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Full Research Article

Effect of Different Media on Rooting and Survival of Pear (*Pyrus pyrifolia* L.) Cuttings cv. Patharnakh

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Abstract

The present experiment was conducted in the Department of Horticulture, Faculty of Agriculture, BAU, Kanke, Ranchi to study the effect of different media on rooting and survival of pear cuttings during the year 2014–15 under the chhotanagpur plateau region of Jharkand. It consisted of 15 treatments including control. All the treatments were replicated thrice in the experiment which was laid out in randomized block design. The media were soil (control), sand, FYM, leaf mould, vermicompost (each 100%), soil+sand, soil+FYM, soil+leaf mould, soil+vermicompost, sand+FYM, sand+leaf mould, sand+vermicompost, FYM+leaf mould, vermicompost+leaf mould and FYM+vermicompost (1:1) ratio. Basal portion of pear cuttings was dipped into 100 ppm IBA solution for 24 hours and then planted in nursery bed at a spacing of 15×10 cm^2. The overall best performance was recorded in media soil+FYM (1:1) for most of the parameters. Numbers of roots $cutting^{-1}$ (13.56), percentage (%) of rooted cuttings (69.70%), numbers of leaves (29.28), success percentage (92.59%) and survival percentage (78.18%). The media, soil+vermicompost (1:1) performed well for root length (21.90 cm) and shoot length (34.39 cm). Soil, when used alone as a growing medium showed the least response and provided unsatisfactory results for all the parameters.

1. Introduction

Pear is next only to apple in importance, acreage, production and varietal diversity among temperate fruits in India. It belongs to the family "Rosaceae" and originated in the mountainous regions of Western China. Pear can be grown in a wide range of climatic conditions, as it can tolerate as low as-26 °C temperature when dormant and as high as 45 °C during growing period. Pear variety, 'Patharnakh', needs only 150 hr of chilling and can also with stand high temperature and hot winds during summer. Pear grows best in deep, well-drained, fertile, and medium-textured and relatively more clay soil. A soil depth of about 180 cm is ideal for proper root growth and fruit production. A neutral pH range of 6.0–7.5 is desirable because iron deficiency appears on highly alkaline soils. Pear may be commercially propagated by cutting, budding or grafting on seedling rootstock. Plants raised through cuttings have an additional advantage that they do not produce suckers in field, which is the main problem with the budded and grafted plants (Jawanda and Singh, 1979). The type of wood used for propagation and the application of growth regulators have been found to affect the rooting capacity of the sand pear cuttings (Singh et al., 1987). Pear is produced in all the continents of the world in both temperate and sub-tropical regions. In India, the major pear producing states are Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Punjab, Arunachal Pradesh, Manipur, Mizoram, Nagaland and Tamil Nadu. Though, area under Jharkhand state is very small, climate and soil conditions are very favourable for its production. The survival of the plant usually depends upon the favourable environmental factors, Rooting media is one of the most important factors required for the rooting and survival of pear cuttings, because it not only supports the plant but also provides moisture and mineral nutrient to it. Therefore, the present study was undertaken to evaluate the effect of different media on rooting and survival of Pear (*Pyrus pyrifolia* L.) cuttings cv. Patharnakh.

2. Materials and Methods

The present investigation was conducted in the Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi, India during the year 2014–15. It consisted of 15 treatments mentioned below which were laid out in a Randomized Block Design (RBD) with three

Treatments	Media	Percentage
T_1	Soil (Control)	100%
T_2	Sand	100%
T_3	FYM	100%
T_4	Leaf mould	100%
T_5	Vermicompost	100%
T_6	Soil+Sand (1:1)	50%+50%
T_7	Soil+FYM (1:1)	50%+50%
T_8	Soil+Leaf mould (1:1)	50%+50%
T_9	Soil+Vermicompost (1:1)	50%+50%
T_{10}	Sand+FYM (1:1)	50%+50%
T_{11}	Sand+Leaf mould (1:1)	50%+50%
T_{12}	Sand+Vermicompost (1:1)	50%+50%
T_{13}	FYM+Leaf mould (1:1)	50%+50%
T_{14}	Vermicompost+Leaf mould (1:1)	50%+50%
T_{15}	FYM+Vermicompost (1:1)	50%+50%

replications. Each replication has 15 plots and each plot containing 45 plants at a distance of 15×10 cm^2. All cuttings were treated with 100 ppm IBA solution for 24 hrs.

3. Results and Discussion

The success percentage of pear cuttings can be defined as percentage of number of alive cuttings out of total number of pear cuttings taken during the experiment. It was recorded after one month of planting the cuttings. The maximum success percentage of 92.59% was found in rooting media having a mixture of soil+FYM in 1:1 ratio. This was followed by the mixture of soil+vermicompost (1:1) and sand+leaf mould (1:1) giving 91.11% and 88.96% success, respectively. In contrast to this, soil alone as rooting media resulted in the 72.59% success (Table 1). The better performance of all these media might be attributed to favourable conditions i.e. sufficient nutrients, moisture and aeration available to the cuttings. Whereas, in case of soil alone these favourable conditions were not available as requirement^{-1} of the cuttings. The findings are in close relation with that of Mishra (2014) who noted high success percentage in the media containing peat soil+FYM.

The data showed that different growing media had a significant effect on number of roots cutting^{-1} (Table 1). The medium, soil+FYM in the ratio 1:1 gave maximum number of roots (13.56), followed by soil+vermicompost (12.67) and sand+leaf mould (12). These three media were statistically at par with each other for this parameter. The minimum number of roots was obtained in soil (5.37). The more number of roots were due to the more nutrients, optimum heat, good porosity, aeration and high water holding capacity of the medium containing soil+FYM. The results are matching with the observation of Bhagat and Saraswati (1988) in pomegranate, Sharma (1993) in mulberry cuttings and Irshad et al. (2014) in kiwi fruit, though the media taken by them were different from those used in the present investigation.

Table 1: Effect of different rooting media on success percentage, number of roots cutting^{-1}, Percentage of rooted cutting and root length in cuttings^{-1}

Treatments	Success percentage of cutting (%)	Number of roots cutting^{-1}	Percentage of rooted cutting (%)	Root length (cm)
	30 Days	150 Days	150 Days	150 Days
Soil (Control)	72.59	5.37	31.11	7.33
Sand	85.18	9.63	50.37	14.92
FYM	80.74	7.5	43.78	9.28
Leaf mould	79.26	6.5	40.74	11.56
Vermicompost	77.78	7.2	37.04	13.23
Soil+Sand (1:1)	88.89	10.67	60.74	16.5
Soil+FYM (1:1)	92.59	13.56	69.7	19.73
Soil+Leaf mould (1:1)	86.67	11.67	61.48	18.29
Soil+Vermicompost (1:1)	91.11	12.67	68.78	21.9
Sand+FYM (1:1)	87.41	11	61.48	17.93
Sand+Leaf mould (1:1)	88.96	12	63.7	19.13
Sand+Vermicompost (1:1)	85.92	10.4	60	17
FYM+Leaf mould (1:1)	84.44	9.2	56.3	15.23
Vermicompost+Leaf mould (1:1)	80	8.41	42.22	10.73
FYM+Vermicompost (1:1)	81.48	9	45.19	15.07
SEm±	2.53	0.55	2.86	1.16
CD (p=0.05)	7.34	1.61	8.29	3.37

The addition of vermicompost to soil resulted in improved physical, chemical and biological properties of soil (Arancon et al., 2005). These three factors integrated synergistically to increase the number of roots cutting^{-1} of pear. The results were in agreement with the findings of Bachman and Metzger (2004) in tomato and marigold seedlings and Sardoei et al. (2014) in *Zinnia elegans*. The better performance of sand+leaf mould

might be due to its better aeration, excellent drainage, and high organic matter content and good water holding capacity. All of these factors might be attributed to cell division of callus forming tissues like phloem, pericycle and cambium. These tissues produced the root primordial, which helped in vascular connection with the conducting tissues of cuttings through the cortex and epidermis and as a result roots developed in the selected cuttings which were planted in the given medium. The minimum number of roots was obtained by soil (control). It might be due to more compactness as well as poor nutritional status of soil. The result is supported by the findings of Haider et al. (2015), who reported the maximum number of roots of poplar cuttings in the medium containing organic matter components and minimum in only soil.

The percentage of rooted cuttings is defined as percentage of cuttings, which develop roots out of total number of cuttings utilized in the experiment. Maximum rooting percentage (69.70%) was noted in soil+FYM (1:1), in comparison to other media types, but was not significantly different from media with soil+vermicompost, sand+leaf mould, soil+leaf mould and sand+FYM as shown in Table 1. The superiority of soil+FYM (1:1) rooting medium might be due to its unique ability to enhance rooting and root development as compared to other rooting media. FYM plays vital role in maintenance of physical and biological condition of soil and supplies nutrients to crop beside maintenance of humic substances in soil. The rooting media, which were combination of two media proved better than their separate application. This might be due to higher concentration of growth promoting nutrients, proper aeration and moisture retaining capacity in the combination. Similar findings were also observed by Singh and Nair (2003) in ornamental plants, Bashir et al. (2009) in Jojoba cuttings and Mathowa et al. (2014) in African baobab.

The minimum percentage of rooted cuttings (31.11%) was observed in soil. It might be due to low aeration and porosity in soil. The resistance of soil to root penetration might be attributed to water content, bulk density, structure and strength of the soil. Similar result was also reported by Akwatulira et al. (2011) in *Warburgia ugandensis*. The data on root length is depicted in Table 1 which clearly showed that after 150 days of planting maximum root length (21.90 cm) was in soil+vermicompost (1:1), which was at par with soil+FYM and sand+leaf mould with readings 19.73 cm and 19.13 cm, respectively, while minimum root length (7.33 cm) was observed in soil (control).

The soil when treated with vermicompost gains more EC, has better water and nutrient holding capacity, provides good aeration and contains growth regulating substances as well as beneficial micro-organisms (Moradi et al., 2014). All these factors contributed positively towards the root length. This is in confirmation with results of Rasool et al. (2008) in tomato, Venkatesan et al. (2010) in *Gymnema sylvestre* and Choeichit et al. (2013) in stem cuttings of cassava.

The performance of soil (control) in terms of root length was poor. Root length is directly proportional to the penetration, which on the other hand depends upon porosity and friability of the medium. Thus, due to compact nature of soil, it performed poorly as was also shown by Mehmood et al. (2013) in Floral Shower (*Antirrhinum majus* L.).

The parameter under study was significantly affected by the rooting media (Table 2). The maximum shoot length (34.39 cm) was attained by the combination of soil+vermicompost (1:1), followed by soil+FYM (31.46 cm) and soil+leaf mould (30.25 cm). These three media were statistically at par with each other for this parameter. This may be attributed to nutritionally better mixture, high water and nutrient holding capacity, good drainage and high porosity of the media combination, which helped in the development of excellent root system, which in turn supported better shoot system. In addition, such media enhanced apical meristematic activity and also triggered cambial division. Decomposed organic matter improved

Table 2: Effect of different rooting media on shoot length, number of leaves cutting^{-1} and survival percentage at 150 DAP in pear cuttings

Treatments	Shoot length (cm)	No. of leaves cutting^{-1}	Survival percentage (%)
Soil (Control)	15.66	10.68	43.02
Sand	24.5	19.91	57.54
FYM	18.13	13.78	54.94
Leaf mould	18.3	13.06	51.4
Vermicompost	16.93	11.06	47.62
Soil+Sand (1:1)	25.89	21.31	68.33
Soil+FYM (1:1)	31.46	29.28	78.18
Soil+Leaf mould (1:1)	30.25	24.28	70.35
Soil+Vermicompost (1:1)	34.39	27.36	75.55
Sand+FYM (1:1)	24.62	23.23	70.95
Sand+Leaf mould (1:1)	28.28	24.14	71.03
Sand+Vermicompost (1:1)	24.5	22.7	69.55
FYM+Leaf mould (1:1)	23.45	20.37	66.72
Vermicompost+Leaf mould (1:1)	21.34	15.64	52.7
FYM+Vermicompost (1:1)	22.34	17.74	55.47
SEm±	1.65	1.31	2.72
CD (p=0.05)	4.79	3.81	7.88

microbial activities, which further contributed towards shoot length. The lowest shoot length (15.66 cm) was attained by soil (control). The findings are in line with that of Bashir et al. (2009) in Jojoba cuttings and Ahmad and Qasim (2003), who noted the maximum stem length in media containing poultry manure, followed by that of with leaf mold and FYM as main source. They also noted the minimum stem length in normal soil for young rooted plants of *Scindapsus aureus*.

The data showed that different rooting media have affected this parameter significantly. The maximum number of leaves cutting^{-1} (29.28) was recorded in soil+FYM (1:1), followed by soil+vermicompost (27.36). These two media were significantly superior to rest of the media utilized in the experiment, while least number of leaves cutting^{-1} (10.68) was recorded in soil (control).

The number of photosynthetically active leaves depends upon better shoot and root growth, which in turn is dependent upon better nutrient content as well as better water and nutrient holding capacity of the medium. This variation in number of leaves with different media, might thus, be attributed to the above mentioned factors. This result is in close conformity with the work reported by Baiyeri (2003) in cashew and breadfruit, Parasana et al. (2013) in mango and Adugna et al. (2015) in Vanilla.

The survival percentage may be defined as the percentage of survived cuttings out of total cuttings after transplanting in the secondary nursery or field. Perusal of the data revealed that the survival percentage was affected significantly by different rooting media. Maximum survival percentage (78.18%) was recorded in soil+FYM and the various media namely, soil+vermicompost (75.55%), sand+leaf mould (71.03%), sand+FYM (70.95%) and soil+leaf mould (70.35%), were all statistically at par with soil+FYM.

The high survival of rooted cuttings in these media might be due to the fact that these combinations provided favourable physical conditions and sufficient nutrients to the cuttings needed for activating enzymatic and biochemical process (Wazir et al., 2003). Field survival of cuttings is mostly dependent on root characters like number, length and quality. The more number of roots cutting^{-1} increased the absorption of food materials and water from soil to the plant, which resulted in the higher survival per cent of the cuttings (Mishra, 2014). These characters certainly increased the potentiality in cuttings to fight against moisture stress and adverse agro-climatic conditions. Similar findings have been previously reported by Sharma (1993) in mulberry, Baiyeri (2003) in African breadfruit, Bashir et al. (2009) in jojoba, Parasana et al. (2013) in mango, Irshad et al. (2014) in kiwi fruit and Mishra (2014) in Kagzilime. However, the media containing soil only performed poorly (43.02%), which was at par with media containing vermicompost only (47.62%). According to Amri et al. (2009), soils not having the required porosity for sufficient gas exchange, can lead to rotting of the cuttings. In addition, these two media also adversely affected the number, length and quality of root formation. Thus, the cuttings did not survive against the adverse climatic stresses.

4. Conclusion

Pear cuttings planted in the medium containing soil+FYM in the ratio of 1:1 showed good result for most of the parameters like number of roots, number of leaves, success percentage of cuttings, percentage of rooted cuttings and survival percentage. The results obtained with soil+vermicompost (1:1) was also appreciable and it was the second best treatment. Since, it was the first year of investigation, it is suggested that the experiment should be continued for another year before making any definite recommendation.

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