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EFFECT OF PROPAGATION MEDIA ON GROWTH PARAMETERS OF POMEGRANATE AIR LAYERS

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ABSTRACT

The present investigation entitled, "Effect of different propagation media on growth parameters of pomegranate air layers" was conducted during the rainy season 2024-25. Four types of rooting media viz., sphagnum moss, cocopeat, leaf mould and coir pith were used alone and their combinations to perform air layering. The treatment includes T_1 Sphagnum moss (100 %) (Control), T_2 Cocopeat (100 %), T_3 Sphagnum moss + Cocopeat (2:1), T_4 Sphagnum moss + Cocopeat (1:1), T_5 Sphagnum moss + Leaf Mould (1:1), T_6 Cocopeat + Leaf Mould (1:1) and T_7 Sphagnum moss + Coir Pith (1:1). The experimental findings revealed that the use of different propagation media had a significant effect on growth of pomegranate air layers. The treatment combination Sphagnum Moss + Cocopeat (2:1) proved to be the most effective among all treatments. It showed the improved shoot and leaf growth, such as final plant height (29.87 cm), number of shoots per layer (4.53), leaves per shoot (9.67), leaves per layer (43.85) and the highest benefit-cost ratio (2.47). Therefore, it is concluded that the rooting medium used to perform air layering in pomegranate i.e. Sphagnum moss + Cocopeat (2:1) not fully replace the sphagnum moss but up to some extent i.e. 33 % it will helps to reduce the production cost of layers simultaneously gives higher survival percentage with better plant establishment.
Keywords **:** Pomegranate, air layering, propagation media, sphagnum moss, growth, survival rate, benefit-cost ratio.

Introduction

Pomegranate (*Punica granatum* L.) a member of the Punicaceae family (2n=18), is an important fruit crop known for its nutritional, medicinal and economic value. Native to Iran and widely grown in tropical and subtropical regions, it thrives under arid and semi-arid climates due to its drought tolerance and adaptability to diverse soils. India ranks first in global pomegranate production, with Maharashtra being the leading state. In 2023–24, India cultivated pomegranate on 2.27 lakh ha, producing 28.82 lakh MT, with Maharashtra alone contributing 14.36 lakh MT(Anonymous, 2024).

Among propagation techniques, air layering is the most commercially successful for pomegranate, ensuring true-to-type plants with better survival and early fruiting. Sphagnum moss, widely used for air layering due to its high water retention capacity for longer period However, there are some limitations on its commercial use in propagation practices (air layering) because it is forest product and it comes under endangered species. Now a day's forests are decreasing and due to erratic monsoon availability of sphagnum moss is very difficult. Hence, there is a need to explore alternative media like coco peat, leaf mould, and coir pith.

Coco peat is a sustainable coconut by-product with high water-holding capacity and good aeration. Leaf mould, although less used, improves soil texture and moisture retention. Coir pith is an eco-friendly material from coconut husks that supports root development and waste management. These materials may offer cost-effective and sustainable substitutes for sphagnum moss in pomegranate propagation.

Thus, this study was undertaken to find out suitable alternative propagation media for air layering in pomegranate to reduce dependency on sphagnum

moss, minimize production costs and support eco-friendly nursery practices.

Materials and Methods

The present investigation entitled "Effect of different propagation media on rooting in pomegranate air layers cv. Bhagwa" was undertaken with the objective to standardize suitable propagation media for pomegranate air layering. The study was conducted during the rainy season of 2024–2025 at the Instructional-cum-Horticulture Farm, Department of Horticulture, MPKV, Rahuri.

The experiment was laid out in a Randomized Block Design (RBD) comprising seven treatments and three replications. The propagation media used in the treatments were prepared on a volume-to-volume (v/v) basis to perform air layering. The treatment includesT_1: Sphagnum moss (100 %), T_2: Cocopeat (100 %), T_3: Sphagnum moss + Cocopeat (2:1), T_4: Sphagnum moss + Cocopeat (1:1), T_5: Sphagnum moss + Leaf Mould (1:1),T_6: Cocopeat + Leaf Mould (1:1), T_7: Sphagnum moss + Coir Pith (1:1).

Air layering was performed during rainy season on one year old pencil thickness branches. Once root initiation was observed and the roots matured to a brown color, the layers were detached using secateurs below the ringed zone. The rooted layers were transplanted into 4" × 6" polybags filled with clay loam soil, taking care to avoid root damage and ensuring proper establishment.

After detachment of layers from the mother plants, they were put in polybags for recording the observations. All the cultural practices involving the control measures were adopted to maintain the layers healthy and disease free. The observations on air layering performance in pomegranate were recorded from five randomly tagged layers per treatment per replication.The observations on air layering performance in pomegranate were recorded from five randomly tagged layers per treatment per replication. The parameters observed included growth attributes such as initial and final plant height (cm) were recorded at the time of detachment and 60 days after transplanting using a scale. The number of shoots per layer, number of leaves per shoot and per layer were recorded at 30 and 60 days after transplanting. Girth of the layered shoot (cm) was measured 30 and 60 days after transplanting. Survival percentage was determined 60 days after transplanting. The benefit: cost ratio was calculated based on media, labour and input costs against the market value of the layered plants. The data were statistically analyzed using Analysis of Variance (ANOVA) under a Randomized Block Design (RBD) as per the method outlined by Panse and Sukhatme (1985) to assess the significance of treatment differences.

Results and Discussion

Height of the Air Layer (cm)

The effect of propagation media on initial and final plant height of pomegranate air layers is shown in Table 1.Air layers were prepared by keeping near about same intermodal distance. The initial height of pomegranate air layers at the time of detachment or transplanting was showed non-significant results among the treatments. The initial height ranged from 9.03 cm to 9.57 cm.

However, the different propagation media showed significant variation in plant height recorded at60 days after transplanting**.** The maximum plant height (31.55 cm) was recorded in T_1 (Control i.e. Sphagnum moss 100%), which was statistically at par with T_3 (Sphagnum moss + Cocopeat 2:1) in which plant height noticed as 29.87 cm. In treatment T_6 (Cocopeat + Leaf mould 1:1) least plant height (13.53 cm) was observed.

It might be due to the higher water holding and aeration capacity of sphagnum moss stimulated early root initiation and faster root growth, primary and secondary roots, longest roots etc. which improved the absorption of water, nutrients and utilization of stored assimilates resulted better shoot growth or plant height. The similar results were also recorded by Kaur and Kaur (2021) and Dubey and Mishra (2024) in pomegranate. Similarly, Maindad*et al.* (2022) also reported that the use of sphagnum moss combined with bio-mix in guava air layers significantly enhanced plant height.

Number of Shoots per Layer

In table 1 different propagation media having significant differences in the number of shoots per layer at 30 days after planting (DAP). The highest number of shoots (4.21) per layer were recorded in T_1 (Sphagnum moss 100%) and it was statistically at par with T_3 (Sphagnum moss + Cocopeat 2:1) (4.12 shoots per layer). Whereas the lowest number of shoots per layer (2.07) was noticed in T_6 (Cocopeat + Leaf Mould 1:1) as compared to rest of rooting media combinations.

At 60 days after planting (DAP), the number of shoots per layer continued to show significant variation due to influence of propagation media. The highest number of shoots (4.57) was recorded in T_1 (Sphagnum moss 100%), which was statistically at par with T_3 (Sphagnum moss + Cocopeat 2:1) having 4.53 shoots.

However, T_6 (Cocopeat + Leaf Mould 1:1) recorded thelowest number of shoots (2.39).

The increase in plant height might be attributed due to the development of a greater number of primary and secondary roots, along with longer root length in sphagnum moss and cocopeat media combination, which likely enhanced the plant's ability to absorb nutrients, moisture and food materials more efficiently, thereby resulting in a higher number of shoots per layer; additionally, the increased shoot formation could be due to the stimulation of adventitious root development, which promotes hormonal activity. These results are in the conformity with the findings of Parmar*et al.* (2018) and Chhabra*et al.* (2022) in guava,who observed that the use of sphagnum moss, cocopeat and vermicompost in combination significantly increased the number of branches in guava air layers.

Number of Leaves per Shoot

It is revealed from the data that, significant differences were observed among different propagation media with respect to the number of leaves per shoot recorded at 30 and 60 days after planting (DAP). The highest number of leaves per shoot (8.22) was recorded in treatment T_3 (Sphagnum moss + Cocopeat 2:1) and it was found statistically at par with T_1 (Sphagnum moss 100%)**,** T_4 (Sphagnum moss + Cocopeat 1:1) and T_2 (Cocopeat 100 %) which were recorded 7.75**,** 7.62 and 7.61 leaves per shoot respectively. In contrast, the lowest number of leaves per shoot (5.69) was observed in T_6 (Cocopeat + Leaf Mould 1:1).

At 60 days after planting, the media combination of Sphagnum moss + Cocopeat (2:1) significantly produced highest number of leaves per shoots(9.67) and it was found statistically at par with T_1 (Sphagnum moss 100%)**,** T_4 (Sphagnum moss + Cocopeat 1:1) and T_2 (Cocopeat 100 %) which were recorded 9.17, 9.14 and 8.88 leaves per shoot respectively. However, the lowest number of leavesper shoot (6.92) was observed in treatment T_6 (Cocopeat + Leaf Mould 1:1).

The increase in number of leaves per shoot could be due to more number of primary and secondary roots, and root length with use of this media combination which might have induced better absorption as well as availability of more mineral nutrients, food material and moisture from the soil and ultimately leading to higher establishment percentage. The current results are in the accordance with the findings reported by Bhosale*et al.* (2009)and Dubey and Mishra (2024) in pomegranate, Maindad*et al.* (2022), Maurya*et al.* (2012) and Parmar*et al.* (2018) in guava.

Number of Leaves per Layer

It is confirmed from the data that, significant variation were observed among different propagation media with respect to the number of leaves per layer recorded at 30 and 60 days after planting (DAP). The maximum number of leaves per layer (33.84) was recorded in treatment T_3 (Sphagnum moss + Cocopeat 2:1) and it was found statistically at par with T_1 (Sphagnum moss 100%) which recorded 32.46 leaves per layer. In contrast, the minimum number of leaves per layer (15.69) was recorded in treatment T_6 (Cocopeat + Leaf Mould 1:1).

At 60 days after planting (DAP), the maximum number of leaves per layer (43.85) was observed in T_3 (Sphagnum moss + Cocopeat 2:1) which were statistically at par with T_1 (Sphagnum moss 100%) (41.95). However, the minimum number of leaves per layer (18.87) was recorded in T_6 (Cocopeat + Leaf Mould 1:1)**.**

The maximum number of leaves might be due to the availability of more mineral nutrients and efficient absorption by the vigorous root system. Use of sphagnum moss significantly enhanced the number of leaves per plant in pomegranate (Bhosale *et al.* 2009, and Dubey and Mishra 2024). The results of this study are inconformity with the findings of Maindad *et al.* (2022) in Guava, who observed that sphagnum moss significantly enhanced rooting and vegetative traits, including leaf formation. Combination of sphagnum moss + cocopeat + vermicompost in guava air layers significantly improved number of leaves per plant reported by Parmar*et al.* (2018).

Girth of Layers (cm)

The girth of air layers was recorded at the time of detachment showing non-significant differences across the treatments, at initial, 30 and 60 days after planting. At the time of layer detachment initial girth of air layers was measured and is ranged from 0.68 to 0.89 cm. At 30 days after planting (DAP) the trend remained similar with girth values ranging from 0.69 to 0.89 cm. likewise, at 60 days after planting (DAP) the girth measurements was varied between 0.69 and 0.90 cm.

Survival Percentage

The data pertaining to thesurvival percentage of pomegranate air layers is influenced by different propagation media. The type of propagation media had a significant influence on the survival percentage of air layers at 60 days after planting. Reflecting considerable variation based on the composition of the rooting medium. The highest survival percentage

(88.00 %) was observed in treatment T_3 (Sphagnum moss + Cocopeat @ 2:1) which was statistically at par with T_1 (Sphagnum moss 100 %) (82.39 %).However, the lowest survival percentage (38.05 %) was noticed in treatment T_6 (Cocopeat + Leaf Mould 1:1).

The superior performance of sphagnum moss and cocopeat combination can be attributed due to its excellent water-holding capacityandaerationwhich create favorable conditions in the rooting zone. These optimal conditions likely promoted the development of a greater number of primary and secondary roots, maximum root lengthmaximum number of leaves and enhanced overall shoot growth. These physiological improvements not only facilitated more efficient uptake of water and nutrients but also contributed to stronger post separation establishment, ultimately resulting in a higher survival percentage of air layers. The results are in the conformity with the findings of Tryambake *et al.* (2004) they reported that sphagnum moss alone or in combination with cocopeat significantly enhanced survival of pomegranate air layers. Highest survival percentage in pomegranate air layers with sphagnum moss and other media combinations (Dubey and Mishra, 2024). Parmar *et al.* (2018) and Meena *et al.* (2024) observed that the combination of sphagnum moss and cocopeat resulted maximum survival percentage in guava.

Benefit-cost (B: C) ratio

The benefit-cost (B:C) ratio of pomegranate air layer production, was significantly influenced by different propagation media, showing considerable variation among treatments due to differences in input costs associated with each media composition. The highest B:C ratio (2.47) was obtained in T_3 (Sphagnum moss + Cocopeat 2:1) reflecting higher economic returns, which can be attributed due to the highest rooting, survival percentage, better plant establishment in polybag and variation in input cost. This was followed by T_1 (Sphagnum moss 100%) (2.20) and T_4 (Sphagnum moss + Cocopeat 1:1) (1.96). On the contrary, the lowest B:C ratio (1.13) was observed in T_6 (Cocopeat + Leaf Mould 1:1) indicating least economic returns due to lowest rooting, survival percentage, poor plant establishment in polybag and variation in input cost.. Higher media cost and lower survival and rooting performance associated with this treatment.

These results are in line with the findings reported by Tryambake*et al.* (2004) they observed that Sphagnum moss + Cocopeat (1:1) may be cost-effective alternate rooting media for better rooting and survival of air layers in pomegranate.

Conclusion

It can be concluded that, the treatment combination Sphagnum Moss + Cocopeat (2:1) proved to be the most effective among all treatments. It showed the improved shoot and leaf growth, such as final plant height (29.87 cm), number of shoots per layer (4.53), leaves per shoot (9.67), leaves per layer (43.85) and the highest benefit-cost ratio (2.47).The control treatment, T_1 (Sphagnum Moss 100 %) showed the final plant height of (31.55 cm) and 4.57 shoots per layer, at 60 DAP.

Therefore, rooting media combination i.e. Sphagnum Moss + Cocopeat (2:1) not fully replace the sphagnum moss but up to some extent i.e. 33 % it will helps to reduce the production cost of layers simultaneously gives higher rooting and survival percentage with better plant establishment.

Table 1: Effect of different propagation media on the vegetative growth of the air layers of pomegranate

Tr. No.	Initial height at transplanting (cm)	Final height (cm) 60 DAP	Number of Shoots per Layer		Number of Leaves per Shoot		Number of Leaves per Layer		Girth of Layers (cm)		
			30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP	Initial	30 DAP	60 DAP
T_1	9.35	31.55	4.21	4.57	7.75	9.17	32.46	41.95	0.89	0.89	0.90
T_2	9.57	18.26	2.37	2.47	7.61	8.88	16.36	21.21	0.80	0.80	0.82
T_3	9.30	29.87	4.12	4.53	8.22	9.67	33.84	43.85	0.77	0.78	0.79
T_4	9.12	24.16	3.07	3.25	7.62	9.14	23.35	29.83	0.68	0.69	0.69
T_5	9.03	15.13	2.92	3.19	7.26	8.68	20.87	27.84	0.86	0.86	0.87
T_6	9.24	13.53	2.07	2.39	5.69	6.92	15.69	18.87	0.87	0.87	0.88
T_7	9.04	16.17	2.87	2.98	6.93	7.62	16.41	20.37	0.78	0.79	0.79
S.Em. ±	0.42	1.05	0.18	0.16	0.33	0.52	1.20	2.17	0.05	0.05	0.05
C. D. at 5%	NS	3.23	0.56	0.49	1.01	1.61	3.70	6.68	NS	NS	NS

Table 2 : Effect of different propagation media on survival percentage of pomegranate air layers at 60 days

Tr. No.	Treatment details	Mean
T_1	Sphagnum moss (100 %) (Control)	82.39
T_2	Cocopeat (100 %)	54.48
T_3	Sphagnum moss + Cocopeat (2:1)	88.00
T_4	Sphagnum moss + Cocopeat (1:1)	67.78
T_5	Sphagnum moss + Leaf mould (1:1)	43.46
T_6	Cocopeat + Leaf mould (1:1)	38.05
T_7	Sphagnum moss + Coir pith (1:1)	50.21
S.Em. ±		2.53
C. D. at 5%		7.80

Table 3 : Effect of different propagation media on the B:C Ratio of production of pomegranate air layers

Tr. No.	Treatment details	Cost (Rs/ layer)	Selling Rate (Rs/ layer)	B:C Ratio
T_1	Sphagnum moss (100 %) (Control)	13.63	30	2.20
T_2	Cocopeat (100 %)	18.30	30	1.64
T_3	Sphagnum moss + Cocopeat (2:1)	12.17	30	2.47
T_4	Sphagnum moss + Cocopeat (1:1)	15.28	30	1.96
T_5	Sphagnum moss + Leaf mould (1:1)	23.00	30	1.30
T_6	Cocopeat + Leaf mould (1:1)	26.53	30	1.13
T_7	Sphagnum moss + Coir pith (1:1)	19.53	30	1.54

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