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Effect of Number of Air Layers Per Shoot and It's Time Of Operation in Pomegranate

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ABSTRACT
The experiment entitled with effect of number of air layers per shoot and it's time of operation in pomegranate was carried out during the year 2015-16 at CFN Unit, College of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with the objectives to study the effect of number of air layers per shoot and it's time of operation in pomegranate and to find out the retention of appropriate number of layers per shoot and it's time of operation for higher success in pomegranate and to find out the cost benefit ratio of number of air layer per shoots in pomegranate for higher profit form pomegranate nursery. The results shows that interaction effects of number of air layer per shoot and it's time of operation in pomegranate shows that better response for pomegranate air layers the treatment combination L_1M_1 i.e. two layers per shoots during July month propagation was found significantly influenced by root initiation, rooting percentage, length of root, fresh weight of root, However, number of roots, root volume and maximum benefit cost ratio (1.78) observed in L_2M_1 i.e. four layer per shoot during July month for pomegranate success and survival for per hectare area.
Keywords: *Sphagnum moss, Air layering, IBA, Pomegranate.*

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INTRODUCTION

Pomegranate (*Punica granatum* L) is an ancient favourite table fruit of tropical regions of the world and it belongs to the family Punicaceae having chromosome no. 2n=18. Plant is deciduous in desert regions, but in coastal areas may lose only a portion of its leaves in winter. Pomegranate comes under the fruit type „Balusta" and its edible part is juicy seed coat i.e. Arils. Pomegranate is a non climacteric fruit and it prefers well drained sandy loam to deep loamy soil types with hot and dry climatic condition during flowering and fruit development. It has been spread to other countries from Iran, its main producer and exporter in the world [1,2]. India ranks first in pomegranate production in the world but it has only 7 % share of total world exports. The total area under cultivation of pomegranate in India is 131 thousand ha and production is around 1346 thousand MT with productivity 10.3 MT ha-1 and in Maharashtra the cultivated area under this crop is 90.00 thousand ha and production is 945.00 thousand MT [4]. Hence, Maharashtra is the leading producer of pomegranate followed by Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. The area under pomegranate is increasing day by day due to its export potential in international market as well as demand in domestic market. Propagation of pomegranate by seed is easy but it takes more time for flowering and fruiting and it brings genetic variability and leads to low yield and poor quality fruits. Propagation through hard wood cuttings is also the best and less expensive method [19] but commercially air-layering is one of the most successful method in pomegranate propagation and has the advantage of being able to reproduce plants with better rooting than cuttings. Air layering can be advantageously useful in pomegranate propagation to minimize the time for fruiting earlier than cutting planting to increase the success percentage [16]. There is a heavy demand for planting materials so there is need to produce large planting material in shortest possible time. The different season and month of layering operation, also affect rooting and survival percentage of pomegranate air layers. Sixty eight per cent of the layers done during rainy season showed callus

development and root initiation within a month compared to 30 to 40 per cent in spring [3]. At present there is no standard period available with pomegranate growers to perform air layering in pomegranate. Therefore present investigation will be undertaken to study the effect of time and air layer per shoot on rooting and survival of air layers in pomegranate and to find out the cost benefit ratio of number of air layer per shoots in pomegranate for higher profit form pomegranate nursery. For correct and precise advice to pomegranate growers of Maharashtra state.

MATERIAL AND METHODS

The present investigation was carried out during the year 2015-16 at CFN unit, College of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola (MS). The experiment was laid out in Factorial Randomized Block Design (FRBD) with two factors, i.e. number of air layers per shoot *viz*., L_1 two layer per shoot, L_2 four layer per shoot, L_3 six layer per shoot and L_4 eight layer per shoot and time of air layering *viz*., M_1 July, M_2 August, M_3 September and M_4 October which were replicated four times with sixteen treatments combinations The materials used and methodologies adopted in the investigation given below:

Treatment Details

Factor A - Number of Layers:

L_1 - Two layers / shoot
L_2 - Four layers / shoot
L_3 - Six layers / shoot
L_4 - Eight layers / shoot

Factor B - Month:

M_1 - 1 July
M_2 - 1 August
M_3 - 1 September
M_4 - 1 October

Table1. Treatment combination of Number of air Layers and months of operation

T_1 - L_1M_1	Two layers /shoot + layering done on 1st July
T_2 - L_1M_2	Two layers /shoot + layering done on 1st August
T_3 - L_1M_3	Two layers /shoot+ layering done on 1st September
T_4 - L_1M_4	Two layers /shoot + layering done on 1st October
T_5 - L_2M_1	Four layers /shoot+ layering done on 1st July
T_6 - L_2M_2	Four layers /shoot + layering done on 1st August
T_7 - L_2M_3	Four layers /shoot + layering done on 1st September
T_8 - L_2M_4	Four layers /shoot + layering done on 1st October
T_9 - L_3M_1	Six layers /shoot + layering done on 1st July
T_{10} - L_3M_2	Six layers /shoot + layering done on 1st August
T_{11} - L_3M_3	Six layers /shoot + layering done on 1st September
T_{12} - L_3M_4	Six layers /shoot + layering done on 1st October
T_{13} - L_4M_1	Eight layers /shoot + layering done on 1st July
T_{14} - L_4M_2	Eight layers /shoot + layering done on 1st August
T_{15} - L_4M_3	Eight layers /shoot + layering done on 1st September
T_{16} - L_4M_4	Eight layers /shoot + layering done on 1st October

A. Selection of Plants and Branches:

The uniformed sized, healthy and vigorous growth of 5 year old trees of *Punica granatum* cv. Bhagwa grown at CFN Unit, were selected. On these plants, well-matured and healthy branches of pencil size shoot thick were selected from one year old mature shoots of pomegranate for air layering.

B. Preparation of Plant Growth Regulators (IBA) in Lanolin Paste:

For preparation of 5000 ppm lanolin paste of IBA 500 mg of IBA was weighed on a chemical balance and was transferred in a beaker. Thereafter, 5 ml of ethyl alcohol (95 %) was added to it and shaked thoroughly to dissolve properly. Then 100 g lanolin was taken in petri dish and heated. The dissolved growth regulator was transferred into the melted lanolin paste and stirred firmly with clean glass rod until evaporation alcohol. In this way, harmonious mixture of growth regulator and lanolin paste was prepared.

C. Preparation of layers:

A strip of bark of 4.0 cm width was completely removed around the stem. The exposed surface was scraped to ensure complete removal of cambium layer to retard healing. Then cut portion was treated with growth regulator paste by brush. Later on slightly moistened sphagnum moss was placed to enclose the cut surfaces. A piece of polythene film was wrapped and tied with string.

RESULTS AND DISCUSSION

The result obtained from the present investigation as well as relevant discussion have been summarized under following sub heads and given in Table. 2 and 3

1. Days required for root initiation:

Data presented in Table 2 indicated that minimum days required for rooting was recorded in treatment combination L_1M_1 (21.75 days) which was at par with L_1M_2 (22.00), L_1M_3 (22.25), L_1M_4 (24.18), L_2M_1 (21.88), L_2M_2 (21.75), L_3M_1 (21.75) and L_4M_1 (22.03) days. Whereas, maximum days required for rooting was recorded in treatment combination L_4M_4 (28.88 days). It is very clear from interaction L_1M_1 i.e. two layers per shoot and July month is best for achieving minimum days required for rooting. It might be due to availability of nutrient in different layers and different months get influence on days for rooting. These results are in accordance with Chandrappa and Gowda [8] in pomegranate.

2. Rooted air layers (%):

Data presented in Table 2 indicated that treatment combinations L_1M_1 recorded higher rooted air layers percentage 76.75% which was at par with L_1M_2, L_2M_1 and L_2M_2 (75.00%, 73.75% and 70.00% respectively). However, minimum rooted air layers percentage was recorded under combinations L_3M_4 (54.00%). It is very clear from treatment combination that two layers per shoot and July month i.e. L_1M_1 is the best for achieving higher rooted layers percentage due to it's favorable effect of number of air layers per shoot and it's time of operation adopted. This might be due to the fact that auxins are known to induce stimulus for regeneration of roots by promotion of hydrolysis, mobilization and utilization of nutritional reserves in the region of root formation at the same time there environmental condition like temperature and relative humidity play significant role for root initiation as specific time. Similar results are reported by Tomar [16] in pomegranate and Baghel [5] in guava.

3. Number of primary roots:

The data presented in Table 2 indicated that maximum number primary roots per layer was observed in treatment combination L_2M_1 (16.75) which was at par with the combinations L_1M_1, L_1M_2, L_2M_2 and L_2M_3 (16.13, 15.25, 16.00, 13.23 respectively), However, minimum number of primary roots per layer was recorded under the treatment combination L_1M_4 (10.28) at the stage of 60 DAL. This might be due to the, availability of favorable conditions in the month of July and August months registered earlier enhancement of rooting.

4. Number of secondary roots:

The data presented in Table 2 indicated that maximum number of secondary roots per layer was observed in the treatment combination L_2M_2 (42.03) which was at par with combination L_1M_1, L_1M_2, L_2M_1, L_2M_1, L_2M_4 (38.75, 39.75, 38.25, 37.75, 37.50 respectively) and minimum number of secondary roots per layer (32.50) was recorded under the treatment combination L_4M_4 at the stage of 90 DAL. This might be due to secondary hormones are known to play a vital role in the process of restorative regenerations and availability of favorable conditions during July and August months registered earlier enhancement of rooting [10].

5. Length of primary roots (cm):

The data presented in Table 2 indicated that an interaction effect of number of air layers per shoot and it's time of operation were found to be non significant at 60 days after layering for length of primary roots per layer.

6. Length of secondary roots (cm):

The data presented in Table 2 indicated that maximum length of secondary roots per layer was observed in the treatment combination L_1M_1 (3.20 cm) which was at par with combination L_1M_2 (2.50 cm) and minimum length of secondary roots per layer (1.68 cm) was recorded under the treatment combination L_2M_4 at the stage of 90 DAL. This is might be due to auxin are known to be helpful in rooting and auxin to adenine high ratio to promotes the rooting. [10, 9, 15, 17, 18].

7. Root volume (cm^3):

Data presented in Table 2 indicated that treatment combination L_2M_1 i.e. four layers per shoot and July month produced highest root volume (5.25 cm^3), which was at par with combinations L_2M_2, L_1M_1 and L_1M_2 (5.20, 4.83 and 4.00 cm^3 respectively), Whereas minimum root volume was recorded under treatment combination L_3M_4 (2.43 cm^3), It is very clear from interaction that L_2M_1 i.e. four layers per shoot and July month is found to be the best for achieving maximum root volume. This might be due to the fact that auxins are known to induce stimulus for regeneration of roots by promotion of hydrolysis,

mobilization and utilization of nutritional reserves in the region of root formation at the same time there environmental condition like temperature and relative humidity play significant role for root initiation as specific time [16, 9, 6].

6. Heights of rooted air layer (cm):

The data presented in Table 2 indicated that maximum number of height of rooted layer was observed in the treatment combination L_2M_2 (31.25 cm) which was at par with combination L_2M_1, L_1M_2 and L_3M_2 (29.88, 29.85 and 27.50cm respectively), whereas minimum height of rooted layer was recorded under the treatment combination L_4M_3 (23.13 cm) at the stage of 60 days after layering.

7. Survival percentage (%):

Data presented in Table 3 indicated that interaction effects of number of air layers per shoot and it's time of operations has found to be non significant during the survival percentage at final stage of survival.

Table 2. Effect of response of number of air layers per shoot and it's time of operation in pomegranate

Treatment	Days required for root initiation	Percentage of rooted air layer (%)	No of primary roots 90 DAL	No of secondary roots 90 DAL	Length of primary roots (cm) 90 DAL	Length of secondary roots	Root volume (cm^3) 90 DAL	Height of rooted air layered (cm) 60 DAT	Survival percentage (%)
Factor A									
L_1	22.54	70.44 (57.06)	13.23	36.25	8.75	2.36	3.69	25.84	75.31 (60.21)
L_2	23.83	67.38 (55.17)	14.56	37.79	8.56	2.13	4.04	27.41	77.13 (61.43)
L_3	25.14	63.59 (52.89)	12.23	35.31	7.73	2.06	2.95	25.13	70.13 (56.87)
L_4	26.48	59.88 (50.70)	11.21	34.87	6.81	1.88	2.83	23.84	67.88 (55.48)
F Test	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**
SE (m)±	0.54	1.31	0.71	0.88	0.59	0.14	0.34	0.84	1.20
CD at 5 %	1.33	3.23	1.76	2.17	1.46	0.34	0.84	2.06	2.94
Factor B									
M_1	21.85	71.50 (57.13)	14.24	36.81	9.06	2.37	3.80	25.94	75.06 (60.4)
M_2	24.06	67.09 (55.00)	13.40	37.96	8.28	2.12	3.81	27.43	73.63 (59.10)
M_3	25.38	62.94 (52.50)	12.62	34.13	7.56	2.08	3.06	24.28	71.69 (57.85)
M_4	26.70	59.75 (50.62)	10.96	35.31	6.95	1.86	2.85	24.56	70.06 (56.83)
F Test	**Sig**	**Sig**	**Sig**	Sig	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**
SE (m)±	0.54	1.31	0.71	0.88	0.59	0.14	0.34	0.84	1.20
CD at 5 %	1.33	3.23	1.76	2.17	1.46	0.34	0.84	2.06	2.94
(L x M)									
L_1M_1	21.75	76.75 (61.17)	16.13	38.75	10.25	3.20	4.83	24.00	78.75
L_1M_2	22.00	75.00 (60.00)	15.25	39.75	10.00	2.50	4.00	29.85	76.25
L_1M_3	22.25	65.00 (53.73)	11.25	34.00	7.75	1.75	3.25	25.25	74.25
L_1M_4	24.18	65.00 (53.73)	10.28	32.50	7.00	2.00	2.70	24.25	72.00
L_2M_1	21.88	73.75 (59.18)	16.75	38.25	10.25	2.48	5.25	29.88	79.25
L_2M_2	21.75	70.00 (56.79)	16.00	42.03	8.75	2.23	5.20	31.25	77.50
L_2M_3	25.00	64.50 (53.43)	13.23	34.03	8.00	2.13	2.48	23.75	76.25
L_2M_4	26.70	61.25 (51.50)	12.25	37.75	7.25	1.68	3.25	24.75	75.50
L_3M_1	21.75	69.25 (56.32)	12.63	33.75	8.75	1.80	2.50	23.50	72.75
L_3M_2	26.25	64.38 (53.35)	10.60	36.25	7.25	1.88	3.50	27.50	72.50
L_3M_3	25.50	66.75 (54.79)	15.00	33.75	7.88	2.50	3.38	25.00	68.75
L_3M_4	27.05	54.00 (47.29)	10.70	37.50	7.05	2.05	2.43	24.50	66.50
L_4M_1	22.03	66.25 (54.48)	11.48	36.50	7.00	2.00	2.63	25.00	69.50
L_4M_2	26.25	59.00 (50.18)	11.75	34.98	7.13	1.88	2.53	22.50	68.25
L_4M_3	28.75	55.50 (48.16)	11.00	34.50	6.63	1.95	3.15	23.13	67.50
L_4M_4	28.88	58.75 (50.04)	10.63	32.50	6.50	1.70	3.03	24.75	66.25
F Test	**Sig**	**Sig**	**Sig**	**Sig**	**NS**	**Sig**	**Sig**	**Sig**	**NS**
SE (m)±	1.08	2.63	1.43	1.81	1.18	0.27	0.68	1.67	2.39
CD at 5 %	2.65	6.46	3.51	4.46	-	0.67	1.68	4.12	5.89

Note-Figures in parenthesis denote the arc sign transformations value.

DAL- Days after layering.

DAT- Days after transplanting.

Cost benefit ratio of number of air layers per shoot and it's time of operation in pomegranate:

8. Effect of number of air layers per shoots:

Data presented in Table 3 (a) clearly indicated that treatment L_2 i.e. four layers per shoot has given maximum survival layer (1966) with estimated net return (Rs.37284) and BCR (1.72) on the basis of 3200 layer in survival in nursery bed condition for one hectare area However, treatment L_4 i.e. four layer

per shoot yielded in minimum survival layer (3551) with estimated net profit (Rs.63138) and BCR (1.46) on the basis of 6400 slayer in survival in nursery bed condition for one hectare area.

Table 3(a). Cost benefit ratio of effect of number of air layers per shoot and it's time of operation (ha)

Treatments	Total layer	Cost A	Survival of Layer	Rate of Selling	Gross Income	Net Profit	B:C Ratio
L_1	1600	10848	963	30	28890	18042	1.66
L_2	3200	21696	1966	30	58980	37284	1.72
L_3	4800	32544	2730	30	81900	49356	1.52
L_4	6400	43392	3551	30	106530	63138	1.46
M_1	4000	27120	2401	30	72030	44910	1.66
M_2	4000	27120	2364	30	70920	43800	1.62
M_3	4000	27120	2314	30	69420	42300	1.56
M_4	4000	27120	2273	30	68190	41070	1.51

Price of Material:

1. **Soil + FYM :** 40000
2. **Polythene :** 20000
3. **IBA + Sphganum moss :** 10000
4. **Irrigation &electricity :** 4000
5. **Total cost of production :** 102400
6. **Interest on working capital :** 6144
7. **Total cost of cultivation :** 108544
8. **Cost A of one layer: 6.78 Rupees**

9. Effect of month:

The data recorded are presented in Table 3 (a) clearly indicated that M_1 i. e. July month has given maximum survival layer (2401) with net return (Rs.44910) and BCR (1.66) on the basis of 4000 layer in survival in nursery bed condition for one hectare area. However, treatment M_4 i.e. layering is done in the month of October yielded minimum survival layer (2273) with estimated net profit (Rs.41070) and BCR (1.51) on the basis of 4000 layer in survival in nursery bed condition for one hectare area.

10. Interaction effect:

Data presented in Table 3 (b) Interaction effects of number of air layers per shoot and it's time of operations has found L_2M_1 treatment combination given maximum survival layer (629) with estimated net profit (12090) and BCR (1.78) on the basis of 1000 layer survival in nursery bed condition for one hectare area. However, treatment combination L_4M_4 yielded minimum survival layer (545) with estimated net profit (9570) and BCR (1.41) on the basis of 1000 survival in nursery bed condition for one hectare area.

Table 3 (b). Benefit cost ratio of interaction effect of number of air layers per shoot and it's time of operation (ha)

Treatment combination	Total layer	Cost A	Survival of layer	Rate of selling	Gross income	Net profit	B :C ratio
L_1M_1	1000	6780	625	30	18750	11970	1.77
L_1M_2	1000	6780	608	30	18240	11460	1.69
L_1M_3	1000	6780	595	30	17850	11070	1.63
L_1M_4	1000	6780	580	30	17400	10620	1.57
L_2M_1	1000	6780	629	30	18870	12090	1.78
L_2M_2	1000	6780	618	30	18540	11760	1.73
L_2M_3	1000	6780	608	30	18240	11460	1.69
L_2M_4	1000	6780	608	30	18240	11460	1.69
L_3M_1	1000	6780	585	30	17550	10770	1.59
L_3M_2	1000	6780	583	30	17490	10710	1.58
L_3M_3	1000	6780	560	30	16800	10020	1.48
L_3M_4	1000	6780	546	30	16380	9600	1.42
L_4M_1	1000	6780	564	30	16920	10140	1.50
L_4M_2	1000	6780	557	30	16710	9930	1.46
L_4 M_4	1000	6780	552	30	16560	9780	1.44
L_4M_4	1000	6780	545	30	16350	9570	1.41

CONCLUSIONS

The interaction effects of number of air layer per shoot and it's time of operation in pomegranate shows that better response for pomegranate air layers the treatment combination L_1M_1 i.e. two layers per shoots during July month propagation was found significantly influenced by different observation while number of roots and root volume and maximum benefit cost ratio (1.78) observed in L_2M_1 i.e. four layer per shoot during July month for pomegranate success and survival for per hectare area. These conclusions are based on the findings of only one year study.

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