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Effect of Biofertilizers and Growing Media on Survivability of Air Layers of Pomegranate (*Punica granatum* L.)

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ABSTRACT: An experiment entitled effect of biofertilizers and growing media on survivability of air layers of pomegranate (*Punica granatum* L.) was carried out under shade net house at College Farm, College of Horticulture, Jagudan during kharif, 2021 and laid out by FCRD with three repetitions. Finding regarding effect of biofertilizers and media on survivability of air layers is less hence the present experiment was conducted. It consists of two levels of biofertilizers along with five levels of media mixtures by volume basis. With respect to interaction effect treatment combinations B_1G_5 (Bio NPK consortium + Soil + FYM + Vermicompost (1:1:1, v/v/v)) was found significantly superior for fresh weight of shoot and root (14.88 g and 3.95 g, respectively), dry weight of root (0.96 g) and maximum root to shoot ratio (0.27) on fresh weight basis at 75 DAP with survival percentage (100.00 % and 100.00 %) at 60 and 75 DAP, respectively.

Keywords: Pomegranate, Biofertilizers, Growing media, Air layer, Survivability.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is a wonderful deciduous shrub or small tree native to semitropical Asia (Iran). It is belonging to the family Punicaceae. It has long been cultivated as an ornamental and for its edible fruit. It is a high-value crop and its entire tree is of great economic importance.

The propagation of this crop is essential for both orchardists and researchers. Pomegranate is propagated through sexual and asexual means. Air layering is the most common and practical method of propagation among these (Bhambota *et al.,* 1968). However, this method of propagation is limited by the variable success of air layering, the high mortality of layers after separation from the mother plant, and the establishment of the layers' root system in the nursery. It is typically performed during the rainy season, *i.e.* July and August, resulting in more successful rooting. The rooting potential of layers varies by cultivar, location, season, and age of the branch. The percentage of successful pomegranate rooting depends on a variety of factors, including the condition of the mother plant, the portion of the tree from which the air layers are taken, the time of operation, the different media to be used, rainfall, temperature fluctuations, aftercare, etc. In addition, the survival and growth of pomegranate air layers are significantly influenced by varying environmental conditions and growing media.

Rooting media is one of the most important factors for better rooting and survival of the plant. There are different media like soil, sand, vermiculite, FYM, vermicompost, etc. play an important role in the success of rooting or cutting. Some media have a higher moisture-holding capacity with lighter weight, which enhances root formation. So, air layers show the better result in different media. There were reviews that show better shoot and root growth in cuttings of pomegranate (Rathwa *et al*., 2017), air layers of litchi (Gupta *et al*., 2018), air layers of pomegranate (Dawar *et al*., 2020) and stem cutting of dragon fruit (Sudarjat *et al*., 2018; Minz, 2021) using different media combinations.

The plant also suffers to get sufficient nutrition from growing media planted after detachment of air layers. Under such condition, the biofertilizers may able to avail the nutrients easily for newly planted air layered plants by enhancing solubility of different nutrients. Biofertilizers containing beneficial bacteria and fungi enhance soil biological properties, phosphate solubility, and crop yield (El-Habbasha *et al*., 2007). Some bacteria supply plants with growth-promoting substances and play a significant role in phosphate solubilization (Abou-Aly *et al*., 2006). Hence, it is a

matter of great interest to find out best combination of biofertilizers and growing media, which can induce growth and survival of pomegranate air layers. Results were also shown in earlier experiment in air layers of litchi (Sarita *et al.*, 2019) and air layers of guava (Bhandulkar *et al*., 2017; Singh *et al*., 2021). Looking to role of biofertilizers and growing media in survivability of air layers of pomegranate, the present experiment has been planned on effect of biofertilizers and growing media on survivability of air layers of pomegranate (*Punica granatum* L.).

MATERIALS AND METHOD

The present investigation was carried out at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat during July, 2021. The air layering operation was performed on five years old pomegranate plants. The layers were detached from the mother plants after 50-55 days from the date of operation when the adventitious roots were clearly visible. The experiment was designed using a Randomized Complete Block Design with Factorial Concept (FCRD). There were ten treatment combinations having different biofertilizer and growing media, *viz*., T_1:Bio NPK consortium + Soil + Sand (1:1, v/v), T_2: Bio NPK consortium + Soil + FYM(1:1, v/v), T_3: Bio NPK consortium + Soil + Vermicompost (1:1, v/v), T_4: Bio NPK consortium + Soil + Sand + FYM (1:1:1, v/v/v), T_5: Bio NPK consortium + Soil + FYM + Vermicompost (1:1:1, v/v/v), T_6: Phosphate solubilizing bacteria (PSB) + Soil + Sand (1:1, v/v), T_7: Phosphate solubilizing bacteria (PSB) + Soil + FYM (1:1, v/v), T_8: Phosphate solubilizing bacteria (PSB) + Soil + Vermicompost (1:1, v/v), T_9: Phosphate solubilizing bacteria (PSB) + Soil + Sand + FYM (1:1:1, v/v/v) and T_{10}:Phosphate solubilizing bacteria (PSB) + Soil + FYM + Vermicompost (1:1:1, v/v/v). The prepared mixtures of the various growing media were filled in plastic polybags (10' × 8'). Before planting, half of the bags were filled with mixtures, while the other half were filled after placing air layers in the middle portion and compressed from the side for complete mixture contact and watered immediately using a watering cane. Each treatment was replicated three times with twenty air layers per replication, for a total of sixty air layers per treatment that are grown for seventy-five days. A sufficient number of air layers of uniform size were developed on the mother plants of pomegranate cv. Bhagwa during the second fortnight of July using the standard procedure. During the second week of October, the rooted air layers were separated from the mother plants and transplanted into polybags containing various growing media and biofertilizers. Need based inter-culturing, hoeing and plant protection measures were adopted for raising air layers of pomegranate. Observations such as length of primary root, fresh weight of shoot and root, dry weight of root and root to shoot ratio on fresh weight basis were recorded at 75 DAP as well as survival percentage were recorded at 60 and 75 DAP. They were statistically analyzed.

RESULTS AND DISCUSSION

Effect of biofertilizers on root parameters and survivability. The findings indicate the root parameters of pomegranate air layers such as maximum length of primary root (35.89 cm), fresh weight of shoot(3.01g), fresh and dry weight of root(2.58 g and 0.76g), root to shoot ratio(0.20) on fresh weight basis at 75 days after planting and survival percentage(93.67 % and 92.67 %) at 60 and 75 daysrespectively after planting were recorded in pomegranate layers planted in bio NPK consortium as compared to phosphorus solubilizing bacteria (PSB).

This may be the result of application of biofertilizers increases the availability of phosphorus in the root zone, thereby promoting increased root initiation, nutrient uptake, and root cell elongation. Thus, increased tap root length led to an increase in the fresh and dry weight of the root. Inoculation with biofertilizers may have increased enzyme activities, increased rhizosphere activity, and consequently improved nutrient uptake, which may have positively influenced the fresh and dry weight of root biomass (Simpi, 2016). Similar findings were also observed in acetobactor-treated pomegranate cuttings (Swami, 2007), pummelo seedlings (Fayaz *et al*., 2020), guava air layers (Kashyap, 2019) and in sweet orange (Rana, 2020). The use of biofertilizers may have increased root length and total growth, leading to a larger root surface area. Such condition may have allowed the plant to access more nutrients from the media combinations with improved physical and chemical properties and the rooted layers may have benefited from the improved root development and subsequent increase in water and mineral nutrient uptake, thereby increasing the root to shoot ratio on a fresh weight basis (Dileep *et al*., 1994; Chawla, 2011).

Maximum survival percentage of pomegranate layers might be the fact that bio NPK consortium improved development of microorganisms and increased nutrient availability for layers which resulted in better establishment of root and shoot system. *Azotobacter* sp. can also produce antifungal compounds to fight against many plant pathogens (Chen, 2006).

Effect of growing media on root parameters and survivability. The maximum length of primary root (38.88 cm), fresh weight of shoot (3.55 g), fresh and dry weight of root (3.29 g and 0.93 g), root to shoot ratio(0.24) on fresh weight basis at 75 DAP and survival percentage (95.00 % and 93.33 %) at 60 and 75 DAP, respectively were noted in pomegranate layers planted in medium G_5 consisting Soil + FYM + Vermicompost (1:1:1, v/v/v).

This may be the result of friable nature of rooting media having soil + FYM + vermicompost might have favoured good penetration of roots which have resulted in longest root. The improvement in root dry weight might be due to the vigorous growth of roots, which absorbed more nutrients from the rooting media. High oxygen content of the root zone accelerates the growth of healthy and strong roots (Wiesman and Lavee 1995). Root to shoot ratio attributed to improvement in the

physical and chemical properties of the rooting medium (Dileep *et al*., 1994).

The media having higher nutrient content, porosity and water holding capacity are responsible for the formation of higher number of primary roots which is resulted in survivability of air layers. Similar results were obtained in air layers of Kagzi Lime (Mishra, 2014) and pomegranate cuttings (Singh *et al*., 2013; Rathwa *et al*., 2017; Parakhiya, 2021).

Interaction effect of biofertilizers and growing media on growth parameters and survivability. The maximum length of primary root (41.46 cm), fresh weight of shoot (3.89 g), fresh and dry weight of root(3.95 g and 0.96 g), root to shoot ratio(0.27) on fresh weight basis at 75 days after planting and survival percentage (100.00 and 100.00 %) at 60 and 75 days after planting, respectively were recorded in pomegranate layers which have been planted in treatment T_5 [B_1G_5: (Bio NPK consortium) + (Soil + FYM + Vermicompost 1:1:1, v/v/v)].

Table 1: Effect of biofertilizers and growing media on root parameters and survival (%).

Treatment	Length of primary root (cm) at 75 DAP	Fresh weight of root (g) at 75 DAP	Dry weight of root (g) at 75 DAP	Root to shoot ratio at 75 DAP	Survival percentage (%)	
					60 DAP	75 DAP
Biofertilizers (B)						
b_1 : Bio NPK consortium	35.89	2.58	0.76	0.20	93.67	92.67
b_2 :Phosphorus solubilizing bacteria (PSB)	33.93	1.96	0.66	0.17	92.00	89.67
Growing media (G)						
g_1: Soil + Sand	30.66	1.34	0.39	0.15	90.00	87.50
g_2: Soil + FYM	33.79	1.81	0.60	0.16	91.67	90.83
g_3: Soil + Vermicompost	35.22	2.17	0.78	0.18	93.33	91.67
g_4: Soil + Sand + FYM	35.98	2.77	0.85	0.22	94.17	92.50
g_5: Soil + FYM +Vermicompost	38.88	3.29	0.93	0.24	95.00	93.33
Interaction (B × G)						
S.Em.±	0.80	0.04	0.012	0.005	1.05	1.58
CD @ 5 %	2.36	0.11	0.04	0.014	3.11	4.66
CV %	3.98	3.02	3.05	4.36	1.97	3.01

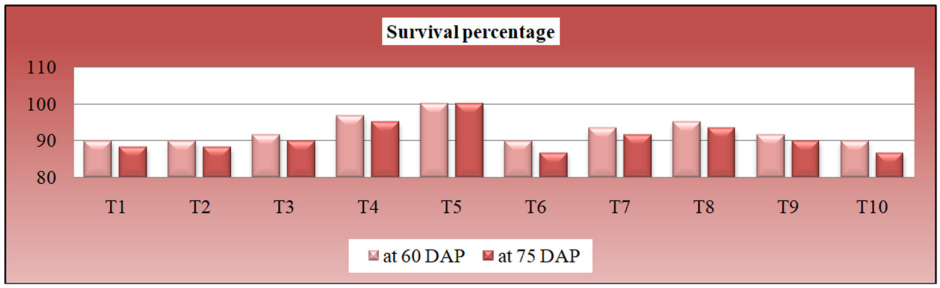

Fig. 1. Effect of biofertilizers and growing media on survival percentage (%) at 60 and 75 DAP.

This may be the result of biofertilizers along with growing media help to provide nutrients to the host plant, or indirectly by positively influencing root growth and morphology or by aiding other beneficial symbiotic relationships (Chawla, 2011). The increased fresh and dry weight of roots may be due to the formation of more roots, higher accumulation of food material as well as longer root length and changes in amino acid metabolism during the regeneration of roots (Pandey and Singh 2009). Root length and total growth increased by rhizobacteria application probably resulted in greater root surface area which may have enabled the plant to access more nutrients from the soil and the rooted layers benefited from the improved root development with subsequent increase in rates of water and mineral nutrient uptake thereby, increased root to shoot ratio on a fresh weight basis (Dileep *et al*., 1994; Chawla, 2011).

Higher survival percentage since the media mixtures enriched biofertilizers provided a head start for the establishment of rooted layers which resulted in higher survivability of layers by accelerating the availability of nutrients at an earlier stage. Combination of biofertilizer and media results in reduced mortality of transplanted air layers hence increased survivability percentage. Similar results were also found in air layers of pomegranate (Dawar *et al*., 2020) and air layers of guava (Singh *et al*., 2021).

CONCLUSIONS

From the present study, it could be concluded that among the different biofertilizers and growing media combinations, bio NPK consortium and soil + FYM + vermicompost (1:1:1, v/v/v) were found to be superior for enhancing the survivability of pomegranate air layers as well as better root parameters along with gross return under net house condition.

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Conflict of Interest. None.

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