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Nikunj V Parakhiya
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Dr. MV Patel
Associate Professor, Department of Horticulture, C. P. College of Agriculture, S. D. Agricultural University, Dantiwada, Gujarat, India

Jay B Gami
Department of Fruit Science, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Harsh S Hathi
Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
Nikunj V Parakhiya
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Effect of media on softwood cuttings of pomegranate (*Punica granatum* L.) cv. Bhagwa

Nikunj V Parakhiya, Dr. MV Patel, Jay B Gami and Harsh S Hathi

Abstract
An investigation was carried out on "Effect of media on soft wood cuttings of pomegranate (*Punica granatum* L.) cv. Bhagwa at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India during during 2020-2021. The experiment was laid out in Completely Randomized Design (CRD) and replicated thrice with twelve treatments and each treatment having 20 cuttings. The treatments were; T_1: Soil + Vermicompost (1:1), T_2: Soil + FYM (1:1), T_3: Soil + Vermiculite (1:1), T_4: Sand + Vermicompost (1:1), T_5: Sand + FYM (1:1), T_6: Sand + Vermiculite (1:1), T_7: Cocopeat + Vermicompost (1:1), T_8: Cocopeat + FYM (1:1), T_9: Cocopeat + Vermiculite (1:1), T_{10}: Soil + Vermicompost + FYM + Vermiculite (1:1:1:1), T_{11}: Sand + Vermicompost + FYM + Vermiculite (1:1:1:1) and T_{12}: Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1). Among different treatments, T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] exhibited minimum days taken for first sprout to appear (7.27 days), number of leaves per cutting at 90 and 120 days after planting of cutting (17.73 and 27.27, respectively), survival percentage of cutting at 120 days after planting (81.67%), shoot length at 120 days after planting (21.42 cm) and number of shoots per cutting at 120 days after planting (7.53). Substantial effect of treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] was detected in root parameters *viz.*, root length at 120 days after planting (19.29 cm), number of primary roots per cutting at 120 days after planting (32.27) and fresh weight of roots at 120 days after planting (4.02 g). The highest gross return (₹1,225.00), net return (₹376.67) and BCR (1.44) were recorded with treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)]. Hence, treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] proved its upper class amongst other treatments in the terms of shoot and root parameters and economics in pomegranate cv. Bhagwa.

Keywords: Cocopeat, FYM, sand, softwood, vermicompost, vermiculite

Introduction
Pomegranate is a hardy shrub. The tree is deciduous in cold climate while, it is evergreen or partially deciduous in tropical and subtropical condition giving an attractive appearance during flowering. Flower terminal, large, deep red colored, solitary or in twos, threes or fives, calyx thick, fleshy red colored petals. Fruit globular fainty 6-sided crowned by the persistant calyx. The pomegranate (*Punica granatum* L.) a member of Punicaceae family is one of the most loved table fruits of the tropical and subtropical regions. The fruit is native of Iran and extensively farmed in countries such as Spain, Morocco, Egypt, Iran, Afghanistan, Balochistan and also to a lesser extent in Burma, China, Japan, USA and India.

The genus *Punica* has two species *viz*., *granatum* and *protopunica*. *Punica protupunica* is found wild in Socotra Island and *Punica granatum* is cultivated in tropical and subtropical parts. *Punica granatum* has been classified into two subspecies: *chlorocarpa* found in *Transcaucasus* region and *porphyrocarpa* in Central Asia. Pomegranate is a sub-tropical fruit and requires hot and dry climate during the period of fruit development and ripening. The quality of fruit is adversely affected in humid climate. The tree is drought resistant and thrives well under semi-arid and desert conditions but bears well only under irrigation (Bose and Mitra, 1990) [4].

Pomegranate is commercially propagated by cuttings. Multiplication of plants through stem cutting is most convenient, hasty and economic method. By this method, stronger plant can be developed considerably in lesser time. The propagation of this crop is of fundamentally important to the orchardist and also to the research workers. Propagation of pomegranate is done by two methods *i.e.* sexual and asexual. In sexual propagation, it is raised through seeds which takes longer period for bearing and plants are not true to type. In order to propagate true to type pomegranate plants, vegetative propagation is critical. Propagation of pomegranate by approach of cuttings are the most practical and cost-effective way to grow fully formed and

stronger trees in a shorter time duration. Cheema *et al*. (1954) [5] argued for asexual techniques of propagation to eliminate the significant amount of diversity observed in seed-propagated plantations.

Pomegranate is not specific about its soil pre-requisites and can be grown on varied soil types. The tree gives very good yield in deep loamy or alluvial soil, although it blooms well in comparatively poor soils, where other fruits fail to grow. It can grow in slightly alkaline soils and also in medium or light black soils. The physiological condition of the parent plant, cutting type, cutting season, rooting media and usage of rooting hormones are the factors which influence the rooting of pomegranate cuttings. Rooting media and optimum environmental conditions plays a key role in rooting of cuttings and for further growth and development of cuttings. The medium should be sufficiently firm and dense to hold the cutting in place during propagation. It should be providing moisture and better aeration to the base of cutting.

One of the most crucial components for successful rooting of cutting and plant survival is rooting media. There are different media like soil, sand, vermiculite, *etc*. Which play a chief role in the success of rooting of cutting. Some media have higher moisture holding capacity being lighter weight, allows better root growth in different media.

Materials and Methods

An experiment on pomegranate var. Bhagwa was conducted at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India during 2020-2021. The experiment was laid out in Completely Randomized Design (CRD) with total twelve treatments *viz*., T_1: Soil + Vermicompost (1:1), T_2: Soil + FYM (1:1), T_3: Soil + Vermiculite (1:1), T_4: Sand + Vermicompost (1:1), T_5: Sand + FYM (1:1), T_6: Sand + Vermiculite (1:1), T_7: Cocopeat + Vermicompost (1:1), T_8: Cocopeat + FYM (1:1), T_9: Cocopeat + Vermiculite (1:1), T_{10}: Soil + Vermicompost + FYM + Vermiculite (1:1:1:1), T_{11}: Sand + Vermicompost + FYM + Vermiculite (1:1:1:1) and T_{12}: Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1).

The five growing media *viz.*, soil, sand, FYM, cocopeat, vermicompost and vermiculite were used for the experiment. The media combination was prepared as per treatment which was used as rooting media. Before planting, the media combination was thoroughly drenched with COC (0.2%). It was then filled in the black polythene bags size of 10 cm × 8 cm and leaving 2 cm gap at the top. Softwood cuttings were dipped in the 3000 ppm IBA solution for 1 minute and then prepared cuttings were planted in polythene bags. After planting, COC paste was applied to the topmost wounded region of the cutting and the medium was drenched with carbendazim (0.2%) to check the fungal growth.

Results and Discussion

Data pertaining to the effect of media on soft wood cuttings of pomegranate (*Punica granatum* L.) cv. Bhagwa are presented in Table 1 and 2.

Days taken for first sprout to appear

A persual of data cleary reveals that the minimum days taken for first sprout to appear of cutting was recorded with the treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] which was significantly at par with treatment T_{12} [Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1)] and treatment T_{10} [Soil + Vermicompost + FYM + Vermiculite (1:1:1:1)]. This could be attributed to favourable temperature, humidity, Oxygenand suitable growing media. These mentioned elements are responsible for improved metabolic activities and aeration which up scaled sprouting. This result is supported by Ali (2003) [1] in guava, Kour (2009) [11] in pomegramate and Yeboah *et al*. (2009) [20] in Shea.

Number of leaves per cutting at 90 DAP and 120 DAP

Maximum number of leaves for 90 days (17.73) and 120 days (27.27) were recorded with treatment T_{11}[Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] which was at par with treatment T_{12} [Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1)] at 120 DAP. This might be due to the development of more sprout, more meristematic region for increased number of leaves or it could be due to the activity and better sprouting of cutting under this treatment, as well as vegetative growth, which could have been due to enacted physiological process by stimulating factor in the metabolism and growth of the cutting. Increased in number of leaves might be mainly due to corresponding increase in plant height (Govind and Chandra, 1993 [8] in khasi mandarain), Bhat *et al.* (2004) [3] in pomegramate, Navjot and Kahlon (2007) [14] in pomegramate, Sharma *et al.* (2009) [17] in pomegramate and Rathwa *et al.* (2017) [16] in pomegranate.

Table 1: Effect of media on shoot parameters of pomegranate (*Punica granatum* L.) cv. Bhagwa

Treatments	Days taken for first sprout to appear	Number of leaves per cutting		Survival percentage of cutting (%)	Shoot length (cm)	Number of shoots per cutting
		90 DAP	120 DAP			
T_1	9.40	14.00	21.67	58.33	16.64	6.00
T_2	11.20	11.07	17.47	43.33	15.19	5.47
T_3	9.73	13.53	21.00	56.67	16.12	5.80
T_4	8.27	15.67	24.20	65.00	18.95	6.73
T_5	10.93	12.33	19.07	48.33	15.54	5.67
T_6	8.67	15.33	23.67	63.33	18.22	6.60
T_7	8.87	14.53	22.53	61.67	17.94	6.67
T_8	10.87	12.67	19.53	53.33	16.08	5.67
T_9	9.07	14.13	21.87	60.00	17.52	6.40
T_{10}	8.00	15.93	24.67	70.00	19.84	6.87
T_{11}	7.27	17.73	27.27	81.67	21.42	7.53
T_{12}	7.80	16.60	25.67	71.67	20.12	7.53
S.Em. ±	0.27	0.38	0.56	2.35	0.59	0.17
C.D. at 5%	0.79	1.13	1.66	6.92	1.74	0.51
C. V. %	5.14	4.61	4.38	6.68	5.78	4.74

Survival percentage (%)

Maximum survival percentage (81.67%) was recorded with treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)]. However, minimum survival percentage (43.33%) was recorded with treatment T_2 [Soil + FYM (1:1)]. This could be because good growing media can save soil moistness, increased nutrient content and further develop soil structure which increased water absorption and maintain the cell turgidity, cell elongation and increased respiration at optimum level, resulting in favourable root initiation in cuttings and lower mortality. Vermicompost granules cause soil aggregation, which may increase organic matter availability as well as phosphorus absorption, permeability and air flow in the rhizosphere. This result is similar with the finding of Singh *et al*. (2013) [18] in pomegranate and Gholap and Polara (2015) [7] in mango.

Shoot length (cm)

The maximum shoot length (21.42 cm) was recorded with treatment T_{11} [Sand + Vermicompost+ FYM + Vermiculite (1:1:1:1)] which was at par with the treatment T_{12} [Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1)] and treatment T_{10} [Soil + Vermicompost + FYM + Vermiculite (1:1:1:1)]. While, minimum shoot length (15.19 cm) was recorded with treatment T_2 [(Soil + FYM (1:1)]. This conductive effect of nutritive media on water holding capacity, porosity, soil aeration and delivering ample amount of nutrient particularly nitrogen and micro nutrient for protein synthesis, cell reproduction, good root and shoot growth over soil alone {Chopde *et al.* (1999)}[6] in custard apple. Metabolism cannot be neglected due to its physiological importance.

Number of shoots per cutting

The maximum number of shoots per cutting (7.53) was noted with treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] which was at par with treatment T_{12} [Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1)] and treatment T_{10} [Soil + Vermicompost + FYM + Vermiculite (1:1:1:1)]. While, minimum number of shoots per cutting (5.47) was recorded with the treatment T_2 [Soil + FYM (1:1)]. This may be because of the well drained media having higher nutrient holding capacity mainly potassium and magnesium which is ideal for better shoot advancement in pomegranate cutting. This result is in consonance with Manila *et al.* (2017) [13] in pomegranate and Rajkumar *et al.* (2017) [15] in pomegranate.

Table 2: Effect of media on root parameters of pomegranate (*Punica granatum* L.) cv. Bhagwa

Treatments	Root length (cm)	Number of primary roots	Fresh weight of roots (g)	Dry weight of roots (g)
T_1	14.55	25.07	3.24	1.03
T_2	13.11	20.93	2.64	0.99
T_3	14.02	23.13	3.04	1.02
T_4	16.84	29.67	3.65	1.06
T_5	13.44	21.60	2.62	1.01
T_6	16.13	28.93	3.61	1.06
T_7	15.84	28.87	3.57	1.05
T_8	13.99	23.13	2.99	1.02
T_9	15.34	25.20	3.29	1.04
T_{10}	17.70	31.33	3.74	1.06
T_{11}	19.29	32.27	4.02	1.07
T_{12}	18.02	31.40	3.90	1.07
S.Em. ±	0.38	0.85	0.07	0.018
C.D. at 5%	1.12	2.50	0.22	NS
C. V. %	4.24	5.51	4.00	2.96

Root length (cm)

The maximum root length (19.29 cm) was recorded with treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] and minimum root length (13.11 cm) was recorded with treatment T_2 [Soil + FYM (1:1)]. This may be due to the fact that the substrate contains more readily available forms of nutrients for plant absorption, improved water retention and provides favourable physiological conditions for better root development (Khalighi and Padasht-Dehkaee, 2000) [10]. This result is similar to Kumar *et al.* (2015) [12] in lemon and Singh *et al.* (2015) [19] in lemon.

Number of primary roots

The significantly maximum number of primary roots (32.27) were recorded with treatment T_{11} [Sand + VC + FYM + Vermiculite (1:1:1:1)] which was at par with treatment T_{12} [Cocopeat + Vermicompost + FYM +Vermiculite (1:1:1:1)] and treatment T_{10} [Soil + Vermicompost + FYM + Vermiculite (1:1:1:1)]. However, minimum number of primary roots (20.93) were recorded with treatment T_2 [Soil + FYM (1:1)]. This might be due to the gradual release of sufficient quantity of nutrients, more water holding capacity and good aeration in the rhizosphere of cutting (Ansari, 2013 [2] in pomegranate). Similar result was also recorded by (Singh, 2013) [18] in pomegranate and (Manila, 2017) [13] in pomegranate.

Fresh weight of roots (g)

The significantly maximum fresh weight of root (4.02 g) was recorded with treatment T_{11} [Sand + VC + FYM + Vermiculite (1:1:1:1)] which was at par with treatment T_{12} [Cocopeat + Vermicompost + FYM + Vermiculite (1:1:1:1)] and minimum fresh weight of root (2.64 g) was recorded with treatment T_2 [Soil + FYM (1:1)]. The media may be the reason for this because it provides porous and well drained environment with adequate moisture near root zone which enhance the rooting. This observation is corroborated by Gurjar and Patel (2007) [9] in pomegranate and Ansari (2013) [2] in pomegranate.

Dry weight of roots (g)

Various treatments on dry weight of roots (g) produced non

significant effect. Maximum dry weight of roots (1.07 g) was recorded with the treatment T_{11} [Sand + VC + FYM + Vermiculite (1:1:1:1)] and T_{12} T_{12} [Cocopeat + Vermicompost + FYM + Vermiculite (1:1:1:1)]. While, minimum (0.99 g) with the treatment T_2 [Soil + FYM (1:1)].

Table 3: Effect of media on economics and benefit cost ratio in pomegranate cv. Bhagwa cutting

Treatments	Successful cutting at 120 days (Out of 60)	Gross realization (₹)	Total cost (₹)	Net return (₹)	BCR
T_1	35	875.00	711.33	163.67	1.23
T_2	26	650.00	561.33	88.67	1.16
T_3	34	850.00	976.33	-126.33	0.87
T_4	39	975.00	727.33	247.67	1.34
T_5	29	725.00	577.33	147.67	1.26
T_6	38	950.00	992.33	-42.33	0.96
T_7	37	925.00	976.33	-51.33	0.95
T_8	32	800.00	826.33	-26.33	0.97
T_9	36	900.00	1240.33	-340.33	0.73
T_{10}	42	1,050.00	840.33	209.67	1.25
T_{11}	49	1,225.00	848.33	376.67	1.44
T_{12}	43	1,075.00	896.33	178.67	1.20

The calculated data in Table 1.3 showed that the highest gross return (₹ 1, 225.00), net return (₹ 376.67) and cost benefit ratio (1.44) were recorded with treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)]. While, treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] proved its upper class amongst other treatments in the terms of shoot and root parameters, economics and higher BCR in pomegranate cv. Bhagwa.

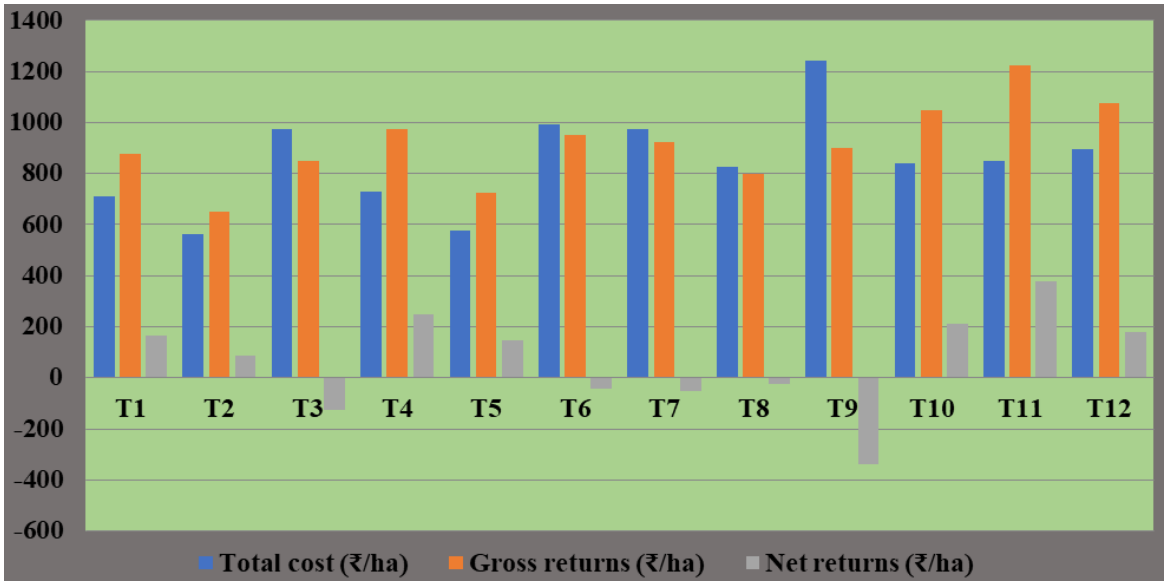

Fig 1: The data graphically depicted

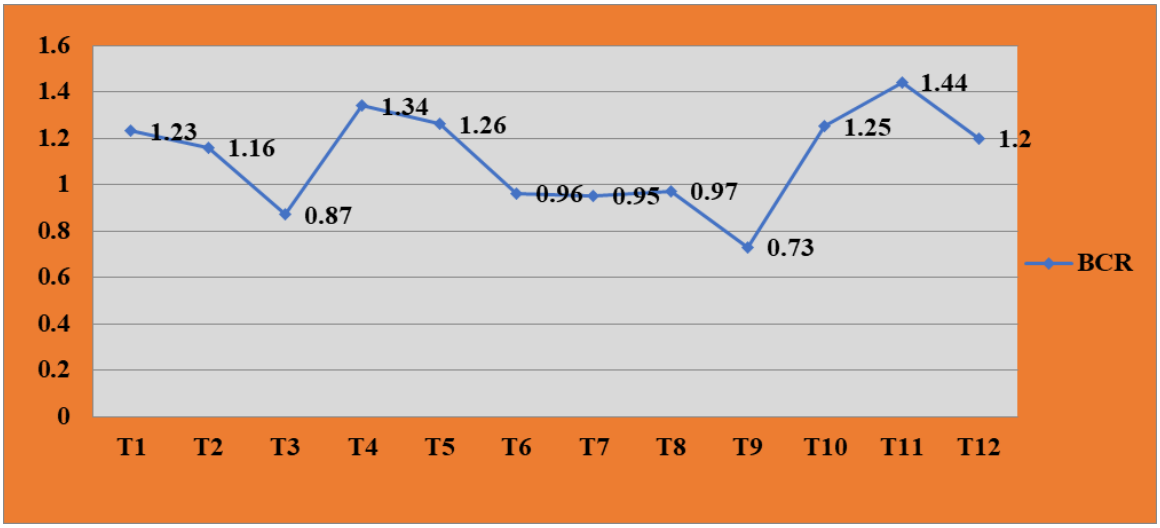

Fig 2: Shows total cost, gross returns and net returns and shows BCR.

Conclusions

On the basis of results obtained from the present investigation, it can be concluded that the treatment T_{11} [Sand + Vermicompost + FYM + Vermiculite (1:1:1:1)] is upper class amongst the other treatments in terms of shoot and root parameters and economics as well in pomegranate cv. Bhagwa.

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