

# Advances in Biotechnology

## Chapter 1

# Response of Cultivars and Rooting Media on Root Behavior and Bud establishment in Rose (*Rosa Hybrida*) under Cuttage-Buddage System

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## Abstract

An investigation was designed to comprehend and evaluate the vegetative response of rose cuttings to three cultivars and in four different rooting media. Experiment was conducted on three cultivars namely; Happiness, Avon and Kiss of Fire using four rooting media viz; soil (control), vermiculite, perlite and sand:soil:FYM (1:1:1 v/v). It was conducted as a factorial experiment on the basis of Completely Randomized Design with three replications. There were five budded cuttings in each replication. The findings revealed that cuttings of *Rosa indica* var. *odorata* budded with buds of cv. Happiness (V1) recorded maximum bud take percentage for all the four rooting media. Cultivar Happiness performed better than cv. Avon in terms of days for bud sprouting, diameter of primary and secondary branches, while, length of primary and secondary branches was better in cv. Avon. The highest number of roots (33.16) and longest root (13.84 cm) were recorded for Happiness + vermiculite. However, better survival percentage under field condition was recorded in Avon and Kiss of Fire than Happiness. Among the rooting media, vermiculite appeared to be superior due to its positive effect on root growth and development, followed by sand:soil:FYM (1:1:1 v/v), while perlite was least effective. During the investigation period the two factors, cultivars and rooting

media interacted significantly with each other in most of the cases. In general, cv. Happiness and Avon performed better than Kiss of Fire. As far as rooting media is concerned, vermiculite is recommended as an appropriate rooting media for optimum rooting and growth of rose cuttings.

**Key words:** Rose; cultivars; rooting media; bud establishment

## 1. Introduction

Rose is a leading cut flower grown commercially all over the world. It ranks first in global cut flower trade. This flower has a worldwide consumption of more than 40 billion [1]. The major rose growing countries are the Netherlands, USA, Columbia and Israel. In India, commercial cultivation of roses for export market has picked up recently. Roses are mostly cultivated in Maharashtra, Karnataka, Tamil Nadu, Punjab and Delhi. Out of 320 EOU (Export Oriented Units) registered on flowers, rose occupies a major area under protected environment [2]. At present in India, about 8 million new bushes of roses are made each year, mostly for garden display purposes.

Roses are known for their exquisite flowers, bewitching colours and most delightful fragrance. Apart from making garlands, bouquets, buttonholes, preserves, they are also used for worship in temples. Rose water is an important commercial product obtained from rose petals. It has medicinal property and is often used in Ayurvedic system of medicine [3]. A limited quantity of rose oil extracted from flower petals is used in flavouring soft drinks and alcoholic liquors. Rose petals are also used for making *gulkand*, *pankhuri*, *gul-roghan*. Roses are also used for making pot-pouri, conserves, rose vinegar and rose petal wine. It is now a well known fact that rose hips are a very good source of ascorbic acid, the life giving vitamin C [4,3].

“Cutting-graft” was first proposed by McFadden in 1963 by combining cutting and grafting in one action. Dutch persons named this technique as “Stenting” (to stent), which is contraction of Dutch words “*Stekken*” (to strike a cutting) and “*enten*” (to graft). The stented plant is to be called as stenting [5]. The stenting system of grafting of roses, a popular method of propagation of roses in Europe, was developed by Dr. Peter van der Pol of Wageningen Agricultural University, the Netherlands. It requires mature wood in both the root stock and in the selected scion (the variety to be propagated). In the method of stenting, the joining of the root stock with the scion and the rooting of the root stock takes place simultaneously and as a result considerable time is saved. When the plants raised from stenting, are well established with proper shoots and foliage, the thick branches should be pruned to a height of 20-30 cm from the ground and the sprouted shoots may be allowed to develop for production of cut flowers [6].

Budding is the most common method adopted for the multiplication of majority of rose cultivars for obtaining better quality flowers. Generally 16-18 months are taken from rootstock

planting to final budded plant for plantation. This method is labour intensive, time consuming and uneasy to bud. The new method of cuttage- budding is followed to reduce this long period [7]. Therefore, the present investigation was planned with three varieties of rose viz. Happiness, Avon and Kiss of Fire as scion/bud and *Rosa indica* var. *odorata* as rootstock, with the following objectives to assess the influence of cultivars and rooting media on various vegetative characters under shade net, to study the percentage of survival of different cultivars in different rooting media and to screen out the most appropriate treatment/combination for growth parameters.

## 2. Materials and Methods

The present investigation was conducted during 2009-2010 under shade net at the Model Floriculture Centre of Department of Horticulture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Distt. Udham Singh Nagar. The experiment materials which were used for the study consisted of three Hybrid Tea cultivars namely, Happiness, Avon and Kiss of Fire, a rootstock *Rosa indica* var. *odorata* and for evaluating the effect of different growing media, four types of media were used viz. soil (Control), vermiculite, perlite and sand:soil:FYM (Farm Yard Manure).

The details of treatments and symbols allotted to them in experiment are given in Table 1.

S.No.	Treatment	Symbol
1.	Happiness + Sand:Soil:FYM ( $V_1+M_4$ )	T <sub>1</sub>
2.	Happiness + Vermiculite ( $V_1+M_2$ )	T <sub>2</sub>
3.	Happiness + Perlite ( $V_1+M_3$ )	T <sub>3</sub>
4.	Happiness + Soil ( $V_1+M_1$ )	T <sub>4</sub>
5.	Avon + Sand:Soil:FYM ( $V_2+M_4$ )	T <sub>5</sub>
6.	Avon + Vermiculite ( $V_2+M_2$ )	T <sub>6</sub>
7.	Avon + Perlite ( $V_2+M_3$ )	T <sub>7</sub>
8.	Avon + Soil ( $V_2+M_1$ )	T <sub>8</sub>
9.	Kiss of Fire + Sand:Soil:FYM ( $V_3+M_4$ )	T <sub>9</sub>
10.	Kiss of Fire + Vermiculite ( $V_3+M_2$ )	T <sub>10</sub>
11.	Kiss of Fire + Perlite ( $V_3+M_3$ )	T <sub>11</sub>
12.	Kiss of Fire + Soil ( $V_3+M_1$ )	T <sub>12</sub>

The experiment was laid out in 2 factors Completely Randomized Design. Thus there were 12 treatment combinations which were replicated three times and each treatment consisted of a 5 plants in a replication. The recorded data were statistically analysed using RBD (Randomized Block Design) and 2 factors CRD (Completely Randomized Design). The critical difference (CD) at 5% level of significance was worked out for detecting significant differ-

ences between treatment means.

### 3. Result and Discussion

The treatment combination  $V_1+M_2$  recorded highest bud take percentage (86.66%) whereas,  $V_3+M_3$  recorded lowest per cent bud take (40.00%) among all the treatment combinations. Treatment  $T_2$  (Happiness + vermiculite) recorded minimum days to bud sprouting (20.06 days), the results were statistically at par with other treatments (Table 2). The maximum days (23.26 days) to bud sprouting were taken by treatment  $T_{11}$  (Kiss of Fire + perlite). This may be due to incompatibility between rootstock and cultivars (used as scion). This result is in close conformity with the findings of [8,9,10]. Cultivars and rooting media did not affect percent bud take and days to bud sprouting significantly.

Among the different rooting media tried, vermiculite ( $M_2$ ) was found to be the best rooting media regarding maximum diameter of primary branches (0.68 cm) with cv (Table 2). Happiness ( $V_1$ ) at 120 days after planting, while it was registered minimum (0.59 cm) in Kiss of Fire ( $V_3$ ) with perlite medium. This might be due to optimum conditions of aeration, water holding capacity and nutrient present in vermiculite. Vermiculite is a suitable rooting medium with distinct properties. Similar findings on aforesaid vegetative characters have also been reported by [11]. The effect of cultivar, rooting media and their interaction was found non significant, however, maximum number of secondary branches (1.94) were registered in Happiness ( $V_1$ ) with vermiculite ( $M_2$ ), while it was recorded minimum (1.11 each) in treatment  $T_1$  [Happiness + sand:soil:FYM (1:1:1 v/v)] and  $T_5$  [Avon + sand:soil:FYM (1:1:1 v/v)]. Similar results were also reported by [12,13,14]. The results reveal that diameters of secondary branches were in general better (0.22 cm each) in Happiness + vermiculite ( $T_2$ ), Happiness + soil ( $T_4$ ) and Avon + soil ( $T_8$ ) which was at par statistically. Treatments  $T_3$  (Happiness + perlite),  $T_5$  (Avon + soil) and  $T_7$  (Avon + perlite) exhibited minimum diameter of secondary branches 0.18 cm each at 120 days after planting.

Avon ( $V_2$ ) performed better (20.33 cm) in sand:soil:FYM (1:1:1 v/v), while Avon + perlite ( $T_7$ ) recorded minimum length of primary branches (11.48 cm) at 120 days after planting. Looking upon the effect of rooting media in general, sand:soil:FYM (1:1:1, v/v) was found best with respect to length of primary branches. The results are in line with those of obtained by [15,16]. Among the three cultivars tested, Avon ( $V_2$ ) recorded the longest secondary branch (15.71 cm), while shortest secondary branch was recorded in cv. Happiness ( $V_1$ ) at 120 days after planting. In case of different rooting media, control (soil) was found superior, very closely followed by vermiculite. Perlite was the least responsive. These results are in collaboration with the findings of [17].

The number of leaves per plant was also significantly affected by cultivar, rooting media and their interaction. Happiness ( $V_1$ ) produced more number of leaves (40.21) when planted

in vermiculite medium ( $M_2$ ). Minimum number of leaves per plant (24.88) were recorded in Happiness ( $V_1$ ) with perlite medium ( $M_3$ ) at 120 days after planting.

Out of the three cultivars and four rooting media, the best performance in terms of maximum number of roots, length of roots, fresh and dry weight of roots was observed in treatment combination of Happiness ( $V_1$ ) + vermiculite ( $M_2$ ) and it was minimum in treatment combination of Kiss of Fire ( $V_3$ ) with perlite medium ( $M_3$ ) in most of the rooting parameters (Table 3). This could be due to difference in medium because vermiculite provides improved aeration, drainage and optimum moisture retention and nutrient availability. The results discussed are in accordance with the earlier findings of [18] who reported that rooting of rose plants was better in vermiculite than in river sand or perlite. Variation in percentage of rooting may be due to genetic factor and low rooting capacity of rootstocks [19].

**Table 2:** Effect of cultivars, rooting media and two factor interaction on vegetative parameters of Rose (*Rosa hybrida*).

Treatment	Per cent bud take	Days for bud sprouting	Dia of primary branches (cm) at 120 DAP.	No. of secondary branches	Dia of secondary branches (cm) at 120 DAP.	Length of primary branches (cm) at 120 DAP.	Length of secondary branches (cm) at 120 DAP.	No. of leaves/plant after 120 days of planting.
<b>Cultivars</b>								
Happiness ( $V_1$ )	68.83	20.84	0.66	1.37	0.21	13.36	12.09	31.19
Avon ( $V_2$ )	58.83	21.87	0.63	1.24	0.19	17.16	12.80	34.85
Kiss of Fire ( $V_3$ )	53.33	22.44	0.61	1.34	0.20	14.72	10.46	30.32
S.Em±	4.1943	0.4170	0.0063	0.1127	0.0030	0.2254	0.2354	0.2652
C.D. at 5%	NS	1.2172	0.0184	NS	0.0089	0.6581	0.6873	0.7741
<b>Rooting media</b>								
Soil (Control) ( $M_1$ )	57.77	21.59	0.64	1.33	0.21	15.47	12.61	30.96
Vermiculite ( $M_2$ )	73.33	21.45	0.65	1.48	0.21	16.11	13.60	38.14
Perlite ( $M_3$ )	46.66	22.41	0.62	1.35	0.18	11.83	9.26	26.25
Sand:Soil:FYM (1:1:1 v/v) ( $M_4$ )	62.22	21.42	0.62	1.12	0.20	16.91	11.67	33.14
S.Em±	4.8432	0.4815	0.0072	0.1302	0.0035	0.2603	0.2719	0.3062
C.D. at 5%	14.1362	NS	0.0212	NS	0.0103	0.7599	0.7936	0.8939
<b>Interaction effects ( cultivars and rooting media)</b>								
$V_1 M_1$	60.00	20.49	0.68	1.27	0.22	13.97	12.23	29.66
$V_1 M_2$	86.66	20.06	0.68	1.94	0.22	14.23	15.05	40.21
$V_1 M_3$	53.33	22.00	0.65	1.16	0.18	12.00	9.16	24.88
$V_1 M_4$	73.33	20.79	0.64	1.11	0.21	13.26	11.93	29.99

V <sub>2</sub> M <sub>1</sub>	60.00	22.14	0.64	1.44	0.22	17.88	15.71	35.22
V <sub>2</sub> M <sub>2</sub>	73.33	22.21	0.66	1.27	0.20	18.96	14.23	39.99
V <sub>2</sub> M <sub>3</sub>	46.66	21.98	0.61	1.16	0.18	11.48	9.38	27.22
V <sub>2</sub> M <sub>4</sub>	53.33	21.16	0.61	1.11	0.18	20.33	11.88	36.99
V <sub>3</sub> M <sub>1</sub>	53.33	22.14	0.60	1.27	0.19	14.56	9.88	27.99
V <sub>3</sub> M <sub>2</sub>	60.00	22.09	0.62	1.22	0.21	15.15	11.53	34.21
V <sub>3</sub> M <sub>3</sub>	40.00	23.26	0.59	1.72	0.19	12.01	9.24	26.66
V <sub>3</sub> M <sub>4</sub>	60.00	22.30	0.62	1.16	0.20	17.15	11.21	32.44
S.Em±	8.3887	0.8340	0.0126	0.2255	0.0061	0.4509	0.4709	0.5304
C.D. at 5%	NS	NS	NS	NS	0.0179	1.3163	1.3746	1.5483

**Table 3:** Effect of cultivars, rooting media and their interaction on rooting behaviour of Rose (*Rosa hybrida*).

Treatment	Number of roots per plant	Length of the longest root (cm)	Fresh weight of roots (g)	Dry weight of roots (g)
<b>Cultivars</b>				
Happiness (V <sub>1</sub> )	20.75	10.72	3.83	2.82
Avon (V <sub>2</sub> )	19.62	9.51	4.04	2.98
Kiss of Fire(V <sub>3</sub> )	14.79	7.09	3.78	2.66
S.Em±	0.2678	0.0942	0.0899	0.0904
C.D. at 5%	0.7818	0.2750	0.2625	0.2638
<b>Rooting media</b>				
Soil(Control) (M <sub>1</sub> )	16.22	8.92	3.83	2.67
Vermiculite (M <sub>2</sub> )	24.77	11.44	4.62	3.42
Perlite (M <sub>3</sub> )	13.27	7.24	3.18	2.34
Sand:Soil:FYM (1:1:1 v/v)(M <sub>4</sub> )	19.27	8.83	3.90	2.83
S.Em±	0.3093	0.1087	0.1038	0.1043
C.D. at 5%	0.9028	0.3175	0.3031	0.3046
<b>Interaction effects ( cultivars and rooting media)</b>				
V <sub>1</sub> M <sub>1</sub>	16.83	11.15	3.31	2.29
V <sub>1</sub> M <sub>2</sub>	33.16	13.84	5.45	4.02
V <sub>1</sub> M <sub>3</sub>	17.66	8.65	3.14	2.48
V <sub>1</sub> M <sub>4</sub>	15.33	9.25	3.43	2.48
V <sub>2</sub> M <sub>1</sub>	18.83	8.21	3.79	2.79
V <sub>2</sub> M <sub>2</sub>	19.83	12.81	4.24	3.27
V <sub>2</sub> M <sub>3</sub>	11.50	6.71	3.29	2.26
V <sub>2</sub> M <sub>4</sub>	28.33	10.33	4.86	3.59
V <sub>3</sub> M <sub>1</sub>	13.00	7.40	4.40	2.93

V <sub>3</sub> M <sub>2</sub>	21.33	7.68	4.17	2.99
V <sub>3</sub> M <sub>3</sub>	10.66	6.36	3.12	2.28
V <sub>3</sub> M <sub>4</sub>	14.16	6.92	3.42	2.43
S.Em±	0.5357	0.1884	0.1799	0.1808
C.D. at 5%	1.5637	0.5500	0.5251	0.5277

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