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Effect of media and its sterilization on seedling vigour for grafting in brinjal (*Solanum melongena* L.)

YB Khedkar, PB Sanap, YR Parulekar, JJ Kadam and NA Meshram

Abstract
The field experiment was carried out at vegetable field, College of Horticulture, Dapoli (M.H), Dr. Balasaheb Sawant Konkon Krishi Vidyapeeth Dapoli, Dist. Ratnagiri during *rabi* season in year 2022-2023. The experiment was laid out in Factorial Randomized Block design comprising of two factors, fourteen treatments and three replications. Factor: A consisted of two sterilization factors S1: Sterilized media and S0: Non-sterilized media and Factor: B consisted of seven media, *i.e.* M1- Cocopeat (100%), M2- Cocopeat (75%) + Vermicompost (25%), M3- Cocopeat (50%) + Vermicompost (50%), M4- Cocopeat (25%) + Vermicompost (75%), M5- Cocopeat (75%) + Saw Dust (25%), M6- Cocopeat (75%) + Rice husk (25%) and M7: Soil (50%) + Cocopeat (25%) + Vermicompost (25%).
In rootstock minimum number of days (7.47) were required for germination were recorded in S1M7 interaction, whereas, maximum height (12.70 cm), maximum diameter (1.92 mm) at collar region, maximum number (7.94) of leaves, highest length (8.16 cm) of tap root, maximum number of adventitious roots (15.31), maximum fresh weight (376.61mg), maximum dry weight (13.81 mg), minimum number of days (42.42) required for rootstock to attain graftable stage and highest number of graftable rootstock (93.14%) were found in S1M4 interaction.
In scion minimum number of days (7.09) required for germination were recorded in S1M7 interaction, whereas, maximum height (7.65 cm), maximum diameter (1.87 mm) at collar region, maximum number of leaves (7.65), highest length (8.20 cm) of tap root, highest number of adventitious roots (14.46), maximum fresh weight (232.83 mg), maximum dry weight (14.56 mg), minimum number of days (36.04) required for scion to reach graftable stage and highest number of graftable scion (95.25%) were recorded in S1M4 interaction.

Keywords: Brinjal, grafting, rootstock, scion, potting media, sterilization, bacterial wilt

Introduction
Brinjal, sometimes referred to as eggplant or aubergine, is widely grown throughout most of the world and is often referred to as the "King of vegetables". It is a native of India and a member of the nightshade family, Solanaceae, where it is cultivated for many centuries. Brinjal is a flexible crop that may be prepared in a number of ways, including as frying, roasting, grilling or baking. China is the largest brinjal producer in the world. It produces a significant amount of brinjal for both internal and international consumption and has a diverse variety. India, on the other hand, is a second-largest producer of brinjal with a production area of 447 thousand hectares and 12982 million tonnes (Anonymous, 2021-22) [2]. In Maharashtra, brinjal is grown using a variety of farming techniques, including irrigated and rain- fed systems, small- and large-scale farming. Pune, Ahmednagar, Satara, Nashik and Solapur are among the key brinjal-growing regions of Maharashtra. Typically, the crop is planted in the *kharif* season (June - July) and harvested in the winter (December - January). However, certain areas also grow brinjal in the summer (March-April) and the *rabi* (October-November) seasons. Brinjal is one of the important solanaceous crop grown under Konkan agro-climatic conditions. Brinjal plants may grow well in the Konkan region's soil because of its high levels of fertility and organic matter. Ratnagiri, Sindhudurg and Raigad are three of the Konkan region's principal brinjal-growing regions. However, bacterial wilt can occur in the laterite soil in the Konkan region, which affects on its yield and quality. In horticultural crops, grafting is a process used to combine the advantageous properties of two separate plant species to create a single plant with enhanced attributes. Grafting has grown in favour in recent years among growers of vegetables. The use of optimised potting material enhances the performance of brinjal seedlings. Potting media are the substances used to grow plants in containers.

They can affect plant growth and development by affecting water retention, aeration and nutrient availability. Grafting onto specific rootstock generally provides resistance to biotic and abiotic stress tolerance, growth, yield and quality of crops, soil borne diseases and nematodes (Maurya *et al*. 2019) [12].

Materials and Methods

The trial was carried out at the vegetable field, College of Horticulture, Dapoli, Dist. Ratnagiri (M.S.). The media analytical work was done in the research laboratory of the Department of Vegetable Science. The experiment was laid out in Factorial Randomized Block design comprising of two factors, fourteen treatments and three replications. Factor: A consisted of two sterilization factors S1: Sterilized media and S0: Non-sterilized media and Factor: B consisted of seven media, *i.e*. M1- Cocopeat (100%), M2- Cocopeat (75%) + Vermicompost (25%), M3- Cocopeat (50%) + Vermicompost (50%), M4- Cocopeat (25%) + Vermicompost (75%), M5- Cocopeat (75%) + Saw Dust (25%), M6- Cocopeat (75%) + Rice husk (25%) and M7: Soil (50%) + Cocopeat (25%) + Vermicompost (25%). The rootstock of Konkan Prabha and scion of NBH-1214(commercial hybrid) were used. Data was recorded for different growth parameters like days required for germination, height of seedlings (cm), diameter of seedlings at collar region (mm), number of leaves, length of tap root (cm), number of adventitious roots, fresh weight (mg), dry weight (mg), number of days required for rootstock and scion to reach graftable stage, number of graftable rootstock and scion (%). Ten seedlings were randomly selected and tagged in each treatment of all three replications of scion and rootstock to record the periodical observations at weekly interval. The data was analysed as per the method suggested by Panse and Sukhatme (1995) [17]. The critical difference at a 5 per cent level of probability was used for comparing treatments.

Results and Discussion

Days required for germination of rootstock and scion

The minimum number of days (7.22 days) required for germination of rootstock were reported in S1M7, whereas, maximum number of days (9.01) were recorded in S0M5. In scion minimum days (7.09) required for germination were recorded in S1M7, whereas, maximum days (9.16 days) were recorded in S0M5. Similar results were found by Muhammad *et al*. (2016) [13] in tomato, Tupe *et al*. (2021) [22], Mundhe *et al*. (2022) [14] in Brinjal and Uttekar *et al*. (2021) [23] Bhoite *et al*. (2022) [5] in chilli.

Height of rootstock and scion (cm)

Maximum height (12.70 cm) of rootstock (Table 1.) was recorded in S1M4 at 42 DAG. In scion maximum height (7.65 cm) at 35 DAG was found in S1M4 (Table 2.). This might be due to more number of shoots and leaves helped in triggering the process of photosynthesis which resulted in accumulation of more energy. This results were in confirmation with the results obtained by Tupe (2021) [22], Mundhe *et al*. (2022) [14] in brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Diameter at collar region of rootstock and scion (mm)

In rootstock (Table 1.) maximum diameter (1.92 mm) was recorded in S1M4 at 42 DAG and in scion maximum diameter (1.87 mm) was observed in S1M4 at 35 DAG (Table 2.). Seedlings raised on media mixture containing proper aeration, moisture and substantial amount of nutrients to facilitate the uptake which further accelerates the formation of photosynthates. This results were supported by the findings of Tupe (2021) [22], Mundhe *et al*. (2022) [14] in Brinjal, Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli, Surve *et al*. (2019) [20] in Brinjal, Rayker (2020) [19] in brinjal.

Number of leaves on rootstock and scion

Maximum number of leaves (7.94) on rootstock (Table 1.) were recorded in S1M4 at 42 DAG, whereas, in scion (Table 2.) maximum leaves (7.65) were noticed in S1M4 at 35 DAG. Potting media having high organic matter content increased the water and nutrient holding capacity of the media and also high nitrogen content resulting in the more vegetative growth of the plant. It also has high potassium content, which helps in improving the water utilization capacity of the plant. This results were supported by findings of Surve *et al*. (2019) [20], Mundhe *et al*. (2022) [14] in brinjal, Vivek & Duraisamy (2017) [24] in tomato, Mathowa *et al*. (2017) [11] in sweet pepper and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Length of tap root of rootstock and scion (cm)

The tap root length (8.16 cm) of rootstock was highest in S1M4 at 42 DAG (Table 1.). The taproot length (8.20 cm) of scion (Table 2.) was highest in S1M4 at 35 DAG. Increase in physiological activity might have resulted in accumulation of carbohydrates which cause more growth of roots in S1M4. This results were confirmative with results of the Tupe (2021) [22], Mundhe *et al*. (2022) [14] in brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Number of adventitious roots of rootstock and scion

The number of adventitious roots (15.31) were highest in S1M4 at 42 DAG in rootstock (Table 1.) and in scion it were highest in S1M4 at 35 DAG (14.46) (Table 2.). Among various media composition used, the media containing cocopeat with vermicompost resulted in maximum number of adventitious roots. Similar findings were recorded by Tupe (2021) [22], Mundhe *et al*. (2022) [14] in Brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Fresh weight of rootstock and scion (mg)

The maximum fresh weight (376.61 mg) of rootstock (Table 1.) was recorded in S1M4 at 42 DAG. The maximum fresh weight (232.83 g) of scion was recorded in S1M4 at 35 DAG (Table 2.). Vermicompost contains organic matter, increased aeration, more nutrient availability, more water holding capacity and it provide better support to the seedlings which might have exhibited in higher fresh weight of rootstock. Similar results were supported by Tupe (2021) [22], Mundhe *et al*. (2022) [14] in Brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Dry weight of rootstock and scion (mg)

The dry weight (13.81 mg) of rootstock (Table 1.) was maximum in S1M4 at 42 DAG, whereas, in scion it was maximum in S1M4 at 35 DAG (14.56 mg) (Table 2.). The maximum dry weight of rootstock was recorded in sterilized potting media might be due to higher fresh weight of the seedlings which in term may be due to the higher growth parameters noticed during present investigation. These results

were in confirmatory with findings reported by Tupe (2021) [22], Mundhe *et al*. (2022) [14] in brinjal, Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli, Markovic *et al*. (1995) [10] in pepper and tomato seedlings, Atiyeh (2000) [3] in tomato, Adediran *et al*. (2005) [1] in tomato and lettuce, Nadia *et al*. (2007) [15] in tomato, Rahimi *et al*. (2013) [18] in sweet pepper, Mathowa *et al*. (2017) [11] in sweet pepper, Dasgan and Abak (2003) [6] in pepper and Bantie *et al*. (2020) [4] in watermelon and squash.

Days required for rootstock and scion to attain graftable stage

The minimum number of days (42.42 days) required for rootstock to attain graftable stage (Table 1. and Fig. 1) was recorded in S1M4 and maximum days (53.54 days) were recorded in S0M5 in rootstock. In scion minimum days (36.04 days) were recorded in S1M4 and the maximum days (48.55 days) required for seedling to reach graftable stage were recorded in S0M5 in scion (Table 2. and Fig.1). These findings were in confirmatory with the results recorded by Johnson (2011) [8] in Brinjal and tomato, Lee *et al*. (2010) [9] in vegetable grafting, Mohamed *et al*. (2016) [13] in tomato, Brinjal and capsicum, Palada (2019) [16] in sweet peppers, Surve *et al*. (2019) [20] in brinjal, Banties (2020) [4] in watermelon and squash seedling, Rayker (2020) [19] in brinjal, Tupe *et al*. (2021) [22], Mundhe *et al*. (2022) [14] in brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Graftable rootstock and scion (%)

The maximum graftable rootstock (93.14%) was found in S1M4 (Table 1. and Fig.2) and maximum graftable scion (95.25%) was found in S1M4, whereas, the minimum graftable rootstock (70.17%) were found in S0M5 in rootstock while minimum scion (80.16%) was noticed in S0M5 (Table 2. and Fig. 2). Similar results were recorded by Tupe *et al*. (2021) [22], Mundhe *et al*. (2022) [14] in Brinjal and Uttekar *et al*. (2021) [23], Bhoite *et al*. (2022) [5] in chilli.

Table 1: Effect of sterilization, composition of potting media and their interaction on various growth parameters of rootstock at 42 DAG**

Treatment	Rootstock							
	Days required for germination							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	8.75	8.58	8.13	7.83	9.01	8.78	7.72	8.40
S_1	8.59	8.55	8.16	7.49	8.80	8.83	7.22	8.23
Mean	8.67	8.56	8.14	7.66	8.91	8.81	7.47	8.32
	RESULT		SEm±		CD at 5%			
S	SIG		0.03		0.09			
M	SIG		0.12		0.36			
S × M	SIG		0.07		0.19			

Treatment	Height of rootstock (cm)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	10.72	11.61	11.98	12.53	9.69	10.57	12.29	11.34
S_1	11.00	11.49	12.09	12.70	10.35	10.87	12.50	11.57
Mean	10.86	11.55	12.04	12.62	10.02	10.72	12.40	11.46
	RESULT		SEm±		CD at 5%			
S	SIG		0.03		0.09			
M	SIG		0.20		0.58			
S × M	SIG		0.08		0.23			

Treatment	Diameter at collar region (mm)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	1.66	1.65	1.68	1.84	1.52	1.78	1.74	1.69
S_1	1.75	1.71	1.86	1.92	1.59	1.67	1.86	1.77
Mean	1.70	1.68	1.77	1.88	1.56	1.73	1.80	1.73
	RESULT		SEm±		CD at 5%			
S	SIG		0.01		0.04			
M	SIG		0.03		0.08			
S × M	SIG		0.05		0.14			

Treatment	Number of leaves							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	6.69	7.62	7.70	7.85	6.46	7.39	7.62	7.33
S_1	7.63	7.69	7.84	7.94	6.77	7.70	7.68	7.61
Mean	7.16	7.66	7.77	7.90	6.62	7.54	7.65	7.47
	RESULT		SEm±		CD at 5%			
S	SIG		0.04		0.12			
M	SIG		0.10		0.30			
S × M	SIG		0.12		0.35			

Treatment	Tap root length(cm)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	7.86	8.01	7.94	8.01	7.67	7.85	7.84	7.88
S_1	7.93	7.93	8.09	8.16	7.72	7.83	8.10	7.99
Mean	7.90	7.97	8.02	8.09	7.81	7.84	7.92	7.93
	RESULT		SEm±		CD at 5%			
S	SIG		0.01		0.04			
M	SIG		0.03		0.08			
S × M	SIG		0.04		0.12			

Treatment	Number of adventitious roots							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	13.54	14.43	14.72	14.91	13.32	13.70	14.60	14.17
S_1	14.29	14.64	15.17	15.31	13.35	13.78	14.81	14.48
Mean	13.91	14.53	14.95	15.11	13.34	13.74	14.70	14.33
	RESULT		SEm±		CD at 5%			
S	SIG		0.02		0.07			
M	SIG		0.14		0.42			
S × M	SIG		0.06		0.17			

Treatment	Fresh weight (mg)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	231.89	324.99	359.78	366.04	211.62	253.55	332.38	298.92
S_1	304.90	342.90	348.04	376.61	213.83	271.99	374.27	317.19
Mean	268.40	333.95	353.91	371.32	212.72	262.77	353.33	308.06
	RESULT		SEm±		CD at 5%			
S	SIG		2.55		7.42			
M	SIG		12.97		37.69			
S × M	SIG		6.76		19.64			

Treatment	Dry weight (mg)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	10.19	11.93	12.94	12.81	9.57	10.56	12.60	11.51
S_1	11.52	12.42	13.57	13.81	9.76	11.00	13.32	12.20
Mean	10.86	12.17	13.26	13.31	9.66	10.78	12.96	11.86
	RESULT		SEm±		CD at 5%			
S	SIG		0.02		0.07			
M	SIG		0.31		0.89			
S × M	SIG		0.08		0.22			

Treatment	Days required to attain graftable stage							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	51.42	48.66	47.39	44.14	53.54	52.62	47.19	49.28
S_1	48.26	44.55	43.46	42.42	50.21	49.19	44.60	46.10
Mean	49.84	46.60	45.42	43.28	51.87	50.90	45.89	47.69
	RESULT		Sem ±		CD at 5%			
S	SIG		0.03		0.09			
M	SIG		0.72		2.13			
S × M	SIG		0.08		0.23			

Treatment	Graftable rootstock							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	74.75	82.36	86.39	92.28	70.17	72.21	79.55	79.65
S_1	78.36	81.64	88.50	93.14	81.66	79.61	81.00	83.42
Mean	76.56	82.00	87.45	92.71	75.82	75.91	80.28	81.54
	RESULT		SEm±		CD at 5%			
S	SIG		0.18		0.54			
M	SIG		0.96		2.88			
S × M	SIG		0.47		1.40			

Table 2: Effect of sterilization, composition of potting media and their interaction on various growth parameters of scion at 35 DAG**

Treatment	Scion																							
	Days required for germination								Height of scion (cm)								Diameter at collar region (mm)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	8.76	8.69	8.19	7.86	9.16	8.83	7.29	8.40	5.74	6.81	7.10	7.26	5.50	5.75	6.95	6.44	1.37	1.65	1.76	1.84	1.31	1.41	1.75	1.59
S_1	8.64	8.57	8.61	7.50	8.86	8.92	7.09	8.31	5.69	6.64	7.49	7.65	5.70	5.65	7.31	6.59	1.65	1.47	1.83	1.87	1.35	1.46	1.77	1.63
Mean	8.70	8.63	8.40	7.68	9.01	8.88	7.19	8.35	5.71	6.72	7.29	7.46	5.60	5.70	7.13	6.52	1.51	1.56	1.79	1.86	1.33	1.44	1.76	1.61
	RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%			
S	SIG		0.02		0.06				SIG		0.04		0.11				SIG		0.01		0.04			
M	SIG		0.14		0.42				SIG		0.17		0.51				SIG		0.04		0.13			
S × M	SIG		0.04		0.13				SIG		0.13		0.37				SIG		0.04		0.12			
Treatment	Number of leaves								Tap root length(cm)								Number of adventitious roots							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean
S_0	5.74	6.81	7.10	7.26	5.50	5.75	6.95	6.44	7.30	7.34	7.68	7.47	7.34	7.27	7.42	7.40	13.04	13.65	13.72	14.21	11.80	12.39	14.04	13.26
S_1	5.69	6.64	7.49	7.65	5.70	5.65	7.31	6.59	7.37	7.36	8.02	8.20	7.35	7.29	8.03	7.66	13.29	13.75	14.38	14.46	12.04	12.79	14.37	13.58
Mean	5.71	6.72	7.29	7.46	5.60	5.70	7.13	6.52	7.34	7.35	7.80	7.84	7.34	7.28	7.72	7.53	13.16	13.70	14.05	14.34	11.92	12.59	14.20	13.42
	RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%			
S	SIG		0.04		0.11				SIG		0.03		0.09				SIG		0.02		0.06			
M	SIG		0.17		0.51				SIG		0.07		0.21				SIG		0.19		0.57			
S × M	SIG		0.13		0.38				SIG		0.07		0.21				SIG		0.05		0.16			
Treatment	Fresh weight (mg)																Dry weight (mg)							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean								
S_0	216.77	207.08	223.24	221.28	124.00	179.57	211.53	197.64	9.60	11.84	12.72	13.29	7.89	8.90	13.30	11.08								
S_1	201.05	206.87	224.12	232.83	211.94	195.96	226.51	214.18	10.70	12.27	13.95	14.56	8.32	8.97	14.35	11.87								
Mean	208.91	206.98	223.68	227.05	167.97	187.77	219.02	205.91	10.15	12.05	13.34	13.93	8.10	8.94	13.83	11.48								
	RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%											
S	SIG		0.86		2.58				SIG		0.02		0.06											
M	SIG		5.87		17.61				SIG		0.49		1.47											
S × M	SIG		2.28		6.84				SIG		0.07		0.21											
Treatment	Days required to attain graftable stage																Graftable scion							
	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean	M_1	M_2	M_3	M_4	M_5	M_6	M_7	Mean								
S_0	43.50	40.37	39.61	38.42	48.55	44.97	38.72	42.02	80.42	86.51	92.51	94.71	80.16	83.56	84.00	86.27								
S_1	42.19	37.73	36.36	36.04	42.53	41.64	38.71	39.31	83.57	87.42	93.08	95.25	84.52	86.18	86.97	88.14								
Mean	42.85	39.05	37.99	37.23	45.54	43.30	38.72	40.67	82.00	86.97	92.80	94.98	81.34	84.37	85.49	87.20								
	RESULT		SEm±		CD at 5%				RESULT		SEm±		CD at 5%											
S	SIG		0.04		0.13				SIG		0.05		0.14											
M	SIG		0.74		2.16				SIG		1.50		4.50											
S × M	SIG		0.12		0.34				SIG		0.13		0.39											

Sterilization of potting media	Potting Media
S - Non sterilized media S_1^0 - Sterilized media	M - Cocopeat (100%) M^1 - Cocopeat (75%) + Vermicompost (25%) M^2 - Cocopeat (50%) + Vermicompost (50%) M^3 - Cocopeat (25%) + Vermicompost (75%) M^4 - Cocopeat (75%) + Saw Dust (25%) M^5 - Cocopeat (75%) + Rice husk (25%) M^6 - Soil (50%) + Cocopeat (25%) + Vermicompost (25%)

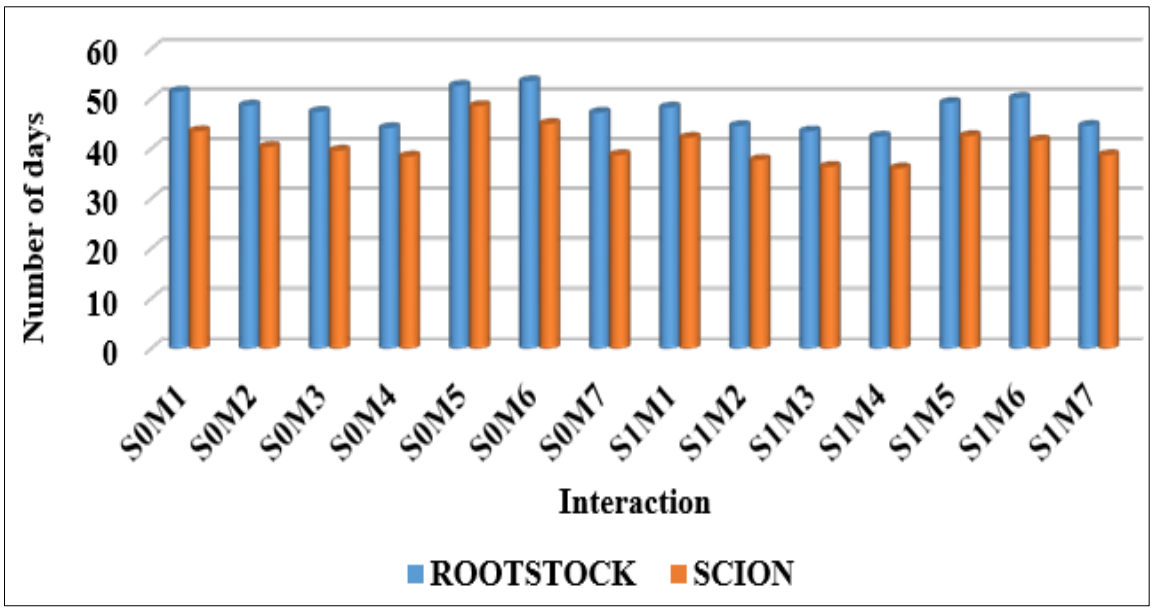

Fig 1: Effect of sterilization and composition of potting media on days required to reach graftable stage of rootstock and scion

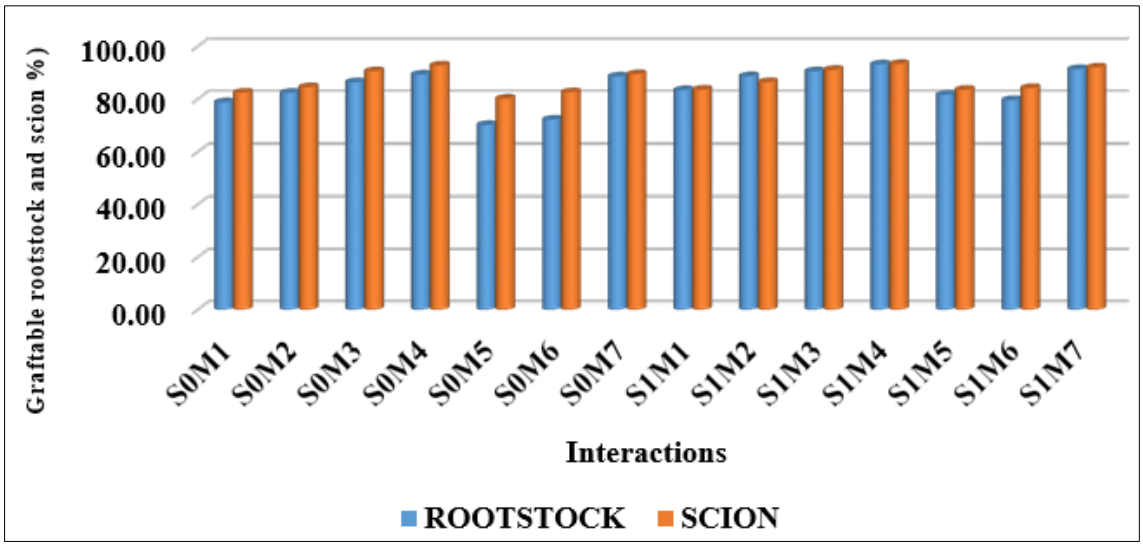

Fig 2: Effect of sterilization and composition of potting media on graftable rootstock and scion (%)

Conclusion

The overall results revealed that, the sterilized potting media (S1) for grafting was found superior with respect to various growth and development parameters than non-sterilized media (S0) in both rootstock and scion, whereas among different potting media M4- Cocopeat @ 25% + Vermicompost @75% was found most superior with respect to various parameters taken under study *viz*. it took minimum days to attain graftable stage as well as maximum graftable rootstock an scion was observed in this media.

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