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Effect of media and its sterilization on seedling vigour for grafting in capsicum (*Capsicum annuum* var. *grossum*)

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Abstract
The present experiment entitled, "Production of quality seedlings for grafting and healing of Capsicum (*Capsicum annuum* var. *grossum*) grafts." was conducted at Hi - tech unit, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri. The experiment was laid in Factorial Randomized Block Design with two factors, eight treatments and three replications. In first experiment Factor: A composed two sterilization factors S_0: Non-sterilized potting media and S_1: sterilized potting media while Factor: B composed four different potting media (M_1: 100% Cocopeat, M_2: 75% Cocopeat + 25% Vermicompost, M_3: 75% Cocopeat + 25% sawdust and M_4: 75% Cocopeat + 25% Rice husk). In rootstock (Konkan kirti) minimum days (7.50) required for germination, the maximum height (10.74 cm) maximum diameter (1.75 mm) at the collar region, maximum number (11.33) of leaves, maximum tap root length (8.16 cm), maximum number (12.05) of adventitious roots, maximum fresh weight (116.43 mg) and maximum dry weight (23.66) of rootstock, minimum days required for the rootstock (47.77) to attain the graftable stage, the graftable (%) of rootstock (92.22). In scion (Indra) minimum days (7.17) required for germination, the maximum height (7.50 cm) of the scion, maximum diameter (1.68 mm) at the collar region, maximum number (10.73) of leaves, maximum tap root length (6.67 cm), maximum number (12.33) of adventitious roots, maximum fresh weight (184.13 mg) and maximum dry weight (21.64) of scion, minimum days required for the scion (44.96) to attain the graftable stage, the graftable (%) of scion (94.23).

Keywords: Chilli, capsicum, grafting, rootstock, scion, media

1. Introduction
Capsicum is a major vegetable and spice crop, commonly known as sweet pepper, bell pepper or paprika and cultivated worldwide for fresh, dried and processing products. It belongs to the Solanaceae family and is the most important vegetable in Korea. China being the largest producer, India has the highest production with West Bengal, Karnataka, Haryana and Maharashtra being the leading producers. The pepper also has a great contribution to human health, providing for its great nutritional value, it contains a wide range of nutritional and bio-functional properties related to its phenolic compounds, flavonoids, capsaicinoids, carotenoids, vitamins (C, A, E, B) potassium, magnesium, iron, calcium, phosphorus (Ganguly *et al.*, 2017) [16]. Vegetable grafting is now common in Asia, some parts of Europe and middle East. Seedling production is an important step in graft production system because it influences final result of grafting. Potting media is a major factor that influences seed germination, seedling emergence, seedling growth and quality of seedlings in a nursery (Unal, 2013) [13]. By selecting the appropriate rootstock and with this technology, the morphology of the scion can be manipulated and biotic and abiotic stresses can be managed (Kumar *et al.*, 2017) [3]. Among several grafting methods vegetable grafting is frequently done using the "splice grafting" technique, also called "top grafting," because it is effective, rapid and simple to learn. Awareness regarding vegetable grafting of solanaceous crop is increasing in farmers from Konkan region for avoiding the soilborn diseases and viruses of various vegetables. However, production of quality and quantity of vegetable grafts the protocol for production of vegetables *i.e.*, appropriate media, standard seedlings for grafting in Konkan region.

2. Materials and Methods
The experiment trial was laid out at the High-Tech nursery unit, College of Horticulture, Dapoli, Dist. Ratnagiri (M.S.) during *Rabi* season 2022-23.

The experiment was carried out in a factorial randomized block design with two factors, eight treatments and three replications. Factor A: composed of two sterilization factors S_1: Sterilized media and S_0: Non-sterilized media and Factor: B composed of four media M_1- Cocopeat (100%), M_2- Cocopeat (25%) + Vermicompost (75%), M_3- Cocopeat (75%) + Saw Dust (25%), M_4- Cocopeat (75%) + Rice husk (25%) and three replications. Data was recorded for different growth parameters like days required for germination, height of rootstock and scion (cm), diameter at collar region (mm) of rootstock and scion, number of leaves of rootstock and scion, length of taproot (cm) of rootstock and scion, number of adventitious roots of rootstock and scion, fresh weight (mg) of rootstock and scion, dry weight of rootstock and scion (mg), number of days required for rootstock and scion to attain graftable stage, number of graftable seedlings percentage (%). To record the periodical observations at an interval of 7 days ten seedlings were randomly selected and tagged in each treatment of all three replications of scion (Indra) and rootstock (Konkan kirti).

3. Results and Discussion

3.1 Days required for germination of rootstock (Konkan kirti) and scion (Indra)

In rootstock the minimum days required for germination of rootstock (Table 1.) was found in S_1M_2 (7.50 days) and maximum days were noted in S_0M_3 (9.67 days). While in scion (Table 2.) minimum days (7.17 days) for germination were recorded in S_1M_2, whereas late germination (9.40 days) was observed in S_0M_3, these results are comparitively with the Mathowa *et al.* (2017) [5] in sweet paper, Radha *et al.* (2018) [7] in chilli.

3.2 Height of rootstock (Konkan kirti) and scion (Indra) (cm)

The data from (Table 1) observed that, in rootstock the maximum height (10.74 cm) was noted in S_1M_2 at 42 DAG. Whereas in scion (Table 2) was recorded highest height (7.50) in S_1M_2. Due to better aeration in vermicompost, water-holding capacity and nutritional content, highest height obtained. The results coincide with those of Demir *et al.* (2010) [1] in pepper, Uttekar *et al.* (2021) [14] in chilli and Tupe *et al.* (2022) [12] in brinjal.

3.3 Diameter at collar region of rootstock (Konkan kirti) and scion (Indra) (mm)

In rootstock (Table 1.) maximum diameter (1.75 mm) was observed in S_1M_2 at 42 DAG and in scion maximum diameter (1.68 mm) was noted in S_1M_2 at 35 DAG (Table 2.). Due to the highest amount of vermicompost and it increased the physical and chemical properties in sterilized potting media, which provides a rich source of nutrients and increased photosynthetic activity and the amount of plant food that was stored. The similar outcomes were given by with Ziest (2017) [15] in tomato, Surve *et al.* (2022) [10] and Rayker (2020) [9].

3.4 Number of leaves of rootstock (Konkan kirti) and scion (Indra)

The maximum number (11.33) of leaves was recorded in treatment S_1M_2 at 42 DAG in (Table 1) for rootstock. While in scion (Table 2) showed that maximum leaves (10.73) were found in S_1M_2 at 35 DAG. The vigour of the seedlings grown in sterilized media might be the reason sterilized potting media have the maximum number of leaves of rootstock as compared to non-sterilized media. Due to highest nutrient content because of maximum vermicompost percentage might be results higher number of leaves on rootstock. The results are similar with those of Khah (2011) [2] and Mundhe *et al.* (2022) [6] in brinjal.

3.5 Tap root length of rootstock (Konkan kirti) and scion (Indra) (cm)

At 42 DAG (Table 1.) the maximum taproot length (8.16 cm) of rootstock was recorded in S_1M_2. In scion data from (Table 2) maximum (6.67) length of taproot of scion was noted in S_1M_2 at 35 DAG. It's possible that an increase in physiological activity led to the buildup of carbohydrates, which accelerated the growth of roots. The results of present study were similar with the Unal (2013) [13] in pepper, Rahimi *et al.* (2013) [8] in sweet pepper,

3.6 Number of adventitious roots of rootstock (Konkan kirti) and scion (Indra)

The number of adventitious roots (12.05) was maximum in S_1M_2 at 42 DAG in rootstock (Table 1.) and in scion it was found that, maximum in S_1M_2 at 35 DAG (12.33) (Table 2.). Due to vermicompost can increased water holding capacity that is favourable for root formation and excellent physical and biological condition. Both Uttekar *et al.* (2021) [14] and Tupe *et al.* (2021) [17] reached the same conclusions with chilli and brinjal, respectively.

3.7 Fresh weight of rootstock (Konkan kirti) and scion (Indra) (mg)

In (Table 1) the maximum fresh weight (116.43 mg) was found in S_1M_2 at 42 DAG of rootstock. Whereas, in scion at 35 DAG the maximum fresh weight (184.13 mg) was observed in S_1M_2 (Table 2). The maximum absorption of nutrients and water due to the increased availability of adventitious roots, might be the cause of the increased fresh weight of the rootstock. The outcomes were similarly comparable to those of Mathowa *et al.* (2017) [5] in sweet pepper Mundhe *et al.* (2022) [6] in brinjal.

3.8 Dry weight of rootstock (Konkan kirti) and scion (Indra) (mg)

The dry weight (23.66 mg) of rootstock in (Table 1.) was maximum in S_1M_2 at 42 DAG, while in scion it was maximum in S_1M_2 at 35 DAG (21.64 mg) (Table 2.) which might be resulted from the vermicompost enhanced light uptake capacity and seedling growth attributed to the vermicompost and higher light use efficiency and the overall growth, it increased the dry content due to better nutrient intake and enhanced photosynthetic accumulation. Outcomes were similar with those of Mathowa (2017) [5] in sweet pepper

3.9 Number of days required for rootstock (Konkan kirti) and scion to attain Graftable stage

In Table 1 showed that, for rootstock the minimum (47.77 days) required to reach graftable stage was recorded in S_1M_2 and maximum (56.70 days) were recorded in S_0M_3. In scion (Table 2) observed that, minimum (44.96 days) was recorded in S_1M_2 and the maximum (54.15 days) required for seedling to reach graftable stage were recorded in S_0M_3. The availability of favourable conditions, which have an impact on all growth parameters, might be the cause of the early

graftable stage of scion and rootstock in sterilized potting media. Similar results were reported for watermelon, tomato and brinjal by Lee *et al*. (2010) [4].

3.10 Number of Graftable seedlings percentage (%)

In rootstock (Table 1. and Fig.2) the maximum Graftable seedlings percentage (92.22%) was found in S_1M_2 and in scion maximum Graftable seedlings percentage (94.23%) was recorded in S_1M_2, while the minimum Graftable seedling percentage (66.33%) were noted in S_0M_3 in rootstock, while minimum scion seedlings (67.63%) were found in S_0M_3 (Table 2. and Fig. 2). These findings are consistent with those of Uttekar *et al.* (2021) [14] in brinjal, Tupe *et al.* (2021) [17] in chilli and Radha *et al*. (2018) [7] in chilli.

Table 1: Effect of sterilization and composition of potting media on various growth parameters of rootstock (Konkan kirti) at 42 DAG

Rootstock																				
Treatment	**Days required for germination**				**Height of rootstock (cm)**				**Diameter at collar region (mm)**				**Number of leaves**				**Tap root length (cm)**			
	M1	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
S0	9.33	8.67	9.67	9.60	8.55	8.77	8.18	7.76	1.40	1.52	1.21	1.25	10.73	10.97	9.54	10.13	5.65	6.51	5.24	5.39
S1	8.33	7.50	9.50	9.40	9.62	10.74	8.36	8.24	1.61	1.75	1.27	1.33	11.30	11.33	10.47	10.57	6.56	8.16	5.55	5.60
Mean	9.00				8.78				1.42				10.63				6.08			
SEm±	0.19				0.12				0.01				0.10				0.16			
CD @ 5%	0.58				0.37				0.04				0.29				0.48			

Rootstock																				
Treatment	**Number of adventitious roots**				**Fresh weight (mg)**				**Dry weight (mg)**				**Days required for to attain graftable stage**				**Graftable seedling (%)**			
	M1	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
S0	9.43	9.97	8.97	9.37	91.57	94.21	83.60	84.89	17.33	19.83	9.53	11.70	51.00	49.00	56.70	53.33	82.13	84.06	66.33	70.89
S1	10.72	12.05	9.41	9.42	107.06	116.43	87.19	88.01	22.11	23.66	15.37	15.42	48.82	47.77	53.10	52.67	86.61	92.22	71.87	78.91
Mean	9.92				94.12				16.87				51.55				78.98			
SEm±	0.34				1.26				0.38				0.30				0.41			
CD @ 5%	1.04				3.84				1.15				0.91				1.24			

Sterilization of potting media	**Potting media**
S0-Non sterilized media	M1-Cocopeat (100%)
	M2-Cocopeat (75%) +Vermicompost (25%)
S1-Sterilized media	M3-Cocopeat (75%) +Sawdust (25%)
	M4-Cocopeat (75%) + Ricehusk (25%)

Table 2: Effect of sterilization and composition of potting media on scion (Indra) at 35 DAG

Scion																				
Treatment	**Days required for germination**				**Height of scion (cm)**				**Diameter at collar region (mm)**				**Number of leaves**				**Tap root length (cm)**			
	M1	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
S0	8.67	8.17	9.40	9.23	6.60	6.83	6.37	6.04	1.50	1.54	1.23	1.26	10.16	10.24	9.30	9.60	5.70	6.24	4.53	4.61
S1	7.67	7.17	9.17	9.00	7.17	7.50	6.55	6.48	1.61	1.68	1.27	1.47	10.33	10.73	9.70	9.83	6.37	6.67	5.40	5.77
Mean	8.56				6.69				1.45				9.99				5.66			
SEm±	0.16				0.05				0.02				0.05				0.12			
CD @ 5%	0.49				0.15				0.07				0.16				0.36			

Scion																				
Treatment	**Number of adventitious roots**				**Fresh weight (mg)**				**Dry weight (mg)**				**Days required for to attain graftable stage**				**Graftable seedling (%)**			
	M1	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
S0	8.60	9.73	7.53	7.84	142.53	172.49	117.67	119.14	14.89	16.56	11.48	12.00	47.89	46.17	54.15	50.53	85.28	88.16	67.63	80.41
S1	10.20	12.33	8.49	8.86	181.77	184.13	118.00	121.41	17.95	21.64	12.52	13.89	45.48	44.96	50.30	49.59	89.26	94.23	81.67	83.92
Mean	9.20				144.64				15.12				48.63				83.82			
SEm±	0.19				4.23				0.30				0.51				0.19			
CD @ 5%	0.58				12.84				0.92				1.54				0.58			

Sterilization of potting media	**Potting media**
S0-Non sterilized media	M1-Cocopeat (100%)
	M2-Cocopeat (75%) +Vermicompost (25%)
S1-Sterilized media	M3-Cocopeat (75%) +Sawdust (25%)
	M4-Cocopeat (75%) + Ricehusk (25%)

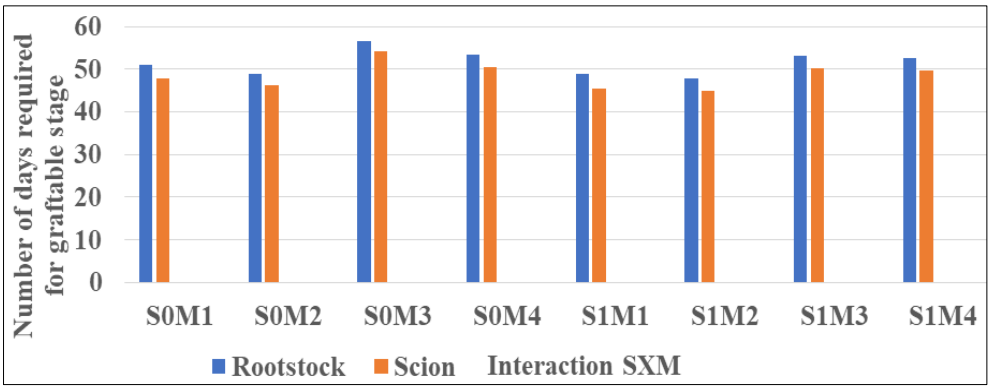

Fig 1: Effect of sterilization and potting media on days required for graftable stage of rootstock and scion

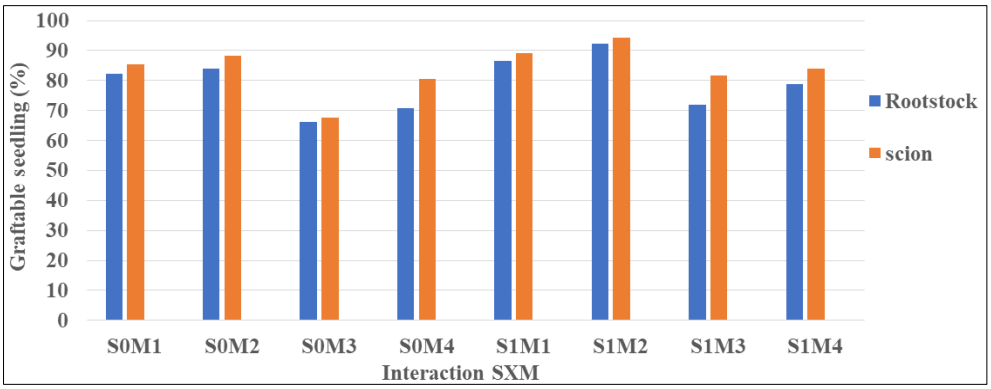

Fig 2: Effect of sterilization and different potting media on graftable seedling percentage of rootstock and scion

4. Conclusion

The overall results concluded that, in both rootstock (Konkan kirti) and scion (Indra) the sterilized potting media (S_1) combination with potting media Cocopeat (75%) and Vermicompost (25%) (M_2) found most superior in terms of various observations taken under study and it required minimum days to attain graftable stage and highest percentage of graftable seedlings.

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