

Effect of Different Salinity Levels on Growth Attributes of Brinjal Varieties Grafted on *Solanum torvum*

Motapalukula Jyothi, T.B. Tambe, V. S. Khandare,
V. N. Shinde, Syed Ismail, G. U. Shinde

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ABSTRACT

The present investigation was carried at Department of Horticulture, VNMKV, Parbhani during the year 2020 and 2021. The pot experiment was laid out in Factorial Randomized Block Design, replicated twice with two factors, i.e., grafts and salinity levels. In grafts, four varieties (Phule Arjun, Phule Harit, Krishna and Manjari Gota) were grafted on *Solanum torvum* using cleft method and five salinity levels (0, 2, 3, 4 and 5 dSm⁻¹) were imposed using Sodium chlo-

ride (NaCl) salt to assess the response of rootstock on growth attributes under different salinity stress conditions. Among the varieties that were grafted on *Solanum torvum*, significantly the maximum height of plant (93.50 cm) was found in Phule Harit. While, maximum plant spread (75.32 cm²) and number of branches per plant (5.75) were recorded in Phule Arjun. Among different salinity levels at 3.00, 4.00, and 5.00 dS m⁻¹ Phule Harit grafted on *Solanum torvum* was proved to be maximum plant height (89.33, 86.18 and 76.75 cm, respectively), however, Phule Arjun has shown the maximum plant spread (75.95, 70.53, and 64.46 cm², respectively) and number of branches (5.44, 5.13 and 4.82, respectively). It is indicated that Phule Harit and Phule Arjun grafted on *Solanum torvum* are response the better growth attributes at 5 dS⁻¹.

Keywords Brinjal, Salinity levels, Grafting, *Solanum torvum*, Growth attributes.

INTRODUCTION

Brinjal (*Solanum melongena* L., (2n = 2x = 24)) belongs to Solanaceae family which is native of India, one of the most popular and widely cultivated vegetable, especially among small scale farmers and low-income consumers due to its wide adaptability and low price. In India, it occupies an area of 0.73 million hectares with production of 12.98 million metric tons and productivity of 19.10 tons per hectare (Anon 2022a). The cultivated states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh,

Motapalukula Jyothi^{1*}, T.B. Tambe²

¹PhD Scholar, ²Head, Department of Horticulture, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402, Maharashtra, India

V. S. Khandare³

³Senior Research Officer, Horticulture Research Scheme (Veg), Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402, Maharashtra, India

V. N. Shinde⁴

⁴Associate Professor, College of Agriculture, Latur, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402, Maharashtra, India

Syed Ismail⁵

⁵Associate Dean and Principal, College of Agriculture, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402, Maharashtra, India

G.U. Shinde⁶

⁶Assistant Professor, Mechanical Engineering and Principal Investigator, NAHEP, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani 431402, Maharashtra, India

Email: jyothimotapalukula554@gmail.com

*Corresponding author

Maharashtra and Uttar Pradesh. West Bengal ranks first in production with production of 3029.02 MT and accounting 23.72% share in production. Brinjal cultivated other countries in the world are Bangladesh, Pakistan, China, Turkey, Japan, Southeast Asia, Egypt, Italy, Indonesia, Thailand, Malaysia, Iraq, Syria, Spain, Philippines, Africa, France, Bulgaria and USA (Swarup 2016). Salinity in soil or water is one of the major abiotic stresses that reduce plant growth by preventing plants genetic potential (Arzani 2008). More than 800 million hectares of land throughout the world are salt affected due to saline and sodic soils, to more than 6% of the world total land area. Arid and semiarid areas, less rain, high evaporation, saline irrigation leads to salinity. Salinity occurs when there is an excessive accumulation of salts (especially high Na^+ , Cl^- and SO_4^{2-}) in the soil or irrigation water (Colla *et al.* 2010). Increasing salinization of agricultural soils is aggravated by an increasing scarcity of fresh water and utilization of more saline water for irrigation. The negative effects of salinity are manifested primarily as osmotic stress, ion toxicity and imbalanced nutrition produced by reduced nutrient uptake. Therefore, it is imperative to develop new technologies against the salinity. Brinjal is moderately sensitive to salinity, consequently more attention need to be required for its production. The joining of two plant parts by different grafting methods produces grafted plants. The performance of grafted plants depends on the rootstock and scion. Best grafted plant stand gives better growth, high photosynthesis, root to shoot ratio, high fruit yield, quality, salt tolerance by exclusion/low accumulation of Na^+ and Cl^- (Keatinge *et al.* 2014). However, the different graft combinations using different species of Solanaceae may influence the production due to interactive effects of scion and rootstocks on assimilate partitioning and nutrient uptake (Kawaguchi *et al.* 2008). The present investigation on different scion varieties of brinjal were grafted on *Solanum torvum* rootstock and studied growth related characters under different levels of salinity.

MATERIALS AND METHODS

The experiment was laid out in a Factorial Randomized Block Design with two replications. The scion

involved in this study were popular varieties of Maharashtra region viz., Phule Arjun, Phule Harit, Krishna and Manjari Gota and these were grafted on *Solanum torvum* rootstock. Salinity stress was imposed by using Sodium chloride (NaCl) solution in four different electrical conductivity (EC) at 2, 3, 4 and 5 dS m^{-1} in weekly intervals at 20 days after transplanting and control was maintained without applying salt. Seeds were obtained from All India Co-ordinated Research Project (AICRP) on Vegetable Crops, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra. The scion and rootstock seeds were sown in February and January month, respectively in order to get same thickness (2 to 3 mm). Sowing was done in portrays containing cocopeat and vermicompost (3:1) and these were covered with polythene sheets for four days and watered regularly. After emergence of seedlings, trays were kept under a shade net. Foliar spray of 19:19:19 at 0.5 % were given weekly once to get quality seedlings. The rootstock and scion seedlings were taken for grafting at 60-65 days and 30-35 days after sowing, respectively. Cleft grafting method was performed in the morning and evening hours in mist chambers. Height of rootstock seedling was kept 8 to 10 cm from base or surface with no leaves. The cut was made with a sharp razor blade through longitudinal downward with 1.0 to 1.5 cm deep on the rootstock to accommodate the precured scion. The lower stem was cut into a tapered wedge shape with equal faces on both sides to 2.0 mm length to place inside the depth cut of the rootstock. After placing the scion into the split made on the rootstock, graft unions were wrapped with silicon tape. Grafted seedlings were immediately placed in healing chamber for 10 days. Successful healing requires a reduced light intensity, high relative humidity (85-95 %) and moderate temperatures (25-30°C) for five days to allow the graft union to heal, then light was gradually increased and relative humidity was decreased. Finally, the seedlings were transferred to the normal nursery where healing process was allowed for 7 days. Before the transplanting, seedlings were grown under natural light conditions for 2-3 days for hardening. The healthy and vigorous grafts were transplanted into plastic pot [20 kg soil capacity] filled with mixture of soil, vermicompost, FYM, digested coir pith, compost and sand at the ratio of 1:1:1:1:1. Single seedling was transplanted

per pot and irrigation was given immediately after transplanting. After successful grafting, silicon tapes were removed from the graft union. Recommended application of well decomposed farmyard manure was mixed in the soil at a rate of 20 to 25 t/ha at the time of pot filling. Fertilizers at a rate of 150:50:50 kg per ha in the form of urea, P₂O₅ and K₂O were applied. Half dose of nitrogen and potash and full doses of phosphorus fertilizers were applied at the time of

transplanting and other half dose of nitrogen and potash was top dressed in a single dose after 30 days of transplanting. Hand weeding was done to make sure that pots were weed free. The recommended crop protection measures were followed as and when required. The weather data recorded during the period of experiment were, mean daily maximum temperature and minimum temperature (28.7 to 42.1°C, and 9 to 26.5°C, respectively), number of bright sunshine

Table 1. Effect of different salinity levels on plant height (cm) of brinjal varieties grafted on *Solanum torvum*.

Factors	Treatment details	Plant height (cm) (Pooled mean)								
		20 DAT	40 DAT	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	160 DAT	180 DAT
Factor A: Grafts										
A ₁	Phule Arjun grafted on <i>Solanum torvum</i>	25.17	29.63	36.27	48.21	55.78	62.54	68.30	71.00	73.16
A ₂	Phule Harit grafted on <i>Solanum torvum</i>	23.69	28.62	44.83	60.81	67.77	73.29	77.00	86.19	93.50
A ₃	Krishna grafted on <i>Solanum torvum</i>	26.42	31.34	38.53	51.85	58.75	64.79	70.85	74.73	77.49
A ₄	Manjari Gota grafted on <i>Solanum torvum</i>	26.33	31.54	38.24	43.60	47.80	52.79	56.08	58.45	60.72
SE (m) ±		0.463	0.384	0.494	0.515	0.449	0.366	0.349	0.491	0.349
CD at 5 %		1.382	1.144	1.474	1.537	1.338	1.090	1.042	1.463	1.039
Factor B: Salinity levels										
B ₁	0 dS m ⁻¹	26.24	32.37	45.08	59.00	66.79	72.82	77.64	84.16	90.11
B ₂	2.00 dS m ⁻¹	24.92	29.88	40.89	53.37	60.48	65.80	70.27	75.49	78.98
B ₃	3.00 dS m ⁻¹	25.74	30.54	39.26	50.22	56.75	62.60	67.31	71.56	75.23
B ₄	4.00 dS m ⁻¹	25.18	29.72	37.04	47.99	53.70	59.72	65.10	68.41	71.67
B ₅	5.00 dS m ⁻¹	24.94	29.06	35.06	45.01	49.90	55.83	59.97	63.33	65.10
SE (m) ±		0.518	0.429	0.553	0.576	0.502	0.409	0.391	0.548	0.390
CD at 5 %		NS	1.279	1.648	1.718	1.496	1.219	1.164	1.635	1.162
A × B: Interactions										
T ₁	A ₁ B ₁	25.07	30.70	39.57	55.07	61.57	66.94	72.94	75.94	78.19
T ₂	A ₁ B ₂	24.48	29.28	35.25	48.88	58.57	64.38	69.25	72.16	74.98
T ₃	A ₁ B ₃	26.21	30.54	36.54	47.57	55.32	61.63	67.82	70.32	72.57
T ₄	A ₁ B ₄	25.03	28.26	35.48	46.26	52.99	60.44	66.32	68.44	70.38
T ₅	A ₁ B ₅	25.07	29.38	34.53	43.30	50.44	59.32	65.18	68.13	69.71
T ₆	A ₂ B ₁	22.19	29.50	50.79	66.07	77.82	84.63	88.25	104.38	120.09
T ₇	A ₂ B ₂	24.13	28.85	48.88	62.23	68.84	75.38	79.67	90.19	95.17
T ₈	A ₂ B ₃	23.97	27.94	46.88	62.57	67.13	71.63	74.94	83.12	89.33
T ₉	A ₂ B ₄	24.38	29.19	39.63	57.87	64.82	69.44	74.13	79.63	86.18
T ₁₀	A ₂ B ₅	23.79	27.63	38.00	55.32	60.27	65.38	68.00	73.63	76.75
T ₁₁	A ₃ B ₁	26.57	31.88	44.07	64.69	72.87	77.88	82.07	85.69	88.94
T ₁₂	A ₃ B ₂	27.35	32.32	40.94	56.44	63.88	66.94	73.44	78.63	82.12
T ₁₃	A ₃ B ₃	25.69	31.38	36.58	48.38	57.75	65.69	71.37	75.94	78.76
T ₁₄	A ₃ B ₄	26.44	30.63	36.13	46.32	52.00	59.52	67.13	70.75	74.07
T ₁₅	A ₃ B ₅	26.07	30.50	34.95	43.44	47.26	53.94	60.25	62.63	63.57
T ₁₆	A ₄ B ₁	31.13	37.42	45.92	50.19	54.92	61.82	67.32	70.62	73.21
T ₁₇	A ₄ B ₂	23.72	29.07	38.50	45.92	50.65	56.52	58.71	60.98	63.67
T ₁₈	A ₄ B ₃	27.10	31.57	37.07	42.38	46.82	51.44	55.13	56.88	60.26
T ₁₉	A ₄ B ₄	24.88	30.91	36.94	41.51	45.00	49.50	52.82	54.82	56.07
T ₂₀	A ₄ B ₅	24.85	28.72	32.76	37.99	41.63	44.69	46.44	48.94	50.38
SE (m) ±		1.036	0.858	1.105	1.153	1.004	0.818	0.781	1.097	0.779
CD at 5 %		3.090	2.559	3.296	3.437	2.993	2.438	2.329	3.271	2.324

DAT- Days after transplanting; NS-Non-Significant.

Table 2. Effect of different salinity levels on plant spread (cm²) of brinjal varieties grafted on *Solanum torvum*.

Factors	Treatment details	Plant spread (cm ²) (Pooled mean)								
		20 DAT	40 DAT	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	160 DAT	180 DAT
Factor A: Grafts										
A ₁	Phule Arjun grafted on <i>Solanum torvum</i>	24.09	29.41	40.01	48.05	51.76	61.53	64.87	69.73	75.32
A ₂	Phule Harit grafted on <i>Solanum torvum</i>	20.38	25.70	36.58	42.27	45.02	50.39	56.82	61.52	65.53
A ₃	Krishna grafted on <i>Solanum torvum</i>	21.90	29.49	40.19	46.20	50.52	54.85	61.54	66.43	70.10
A ₄	Manjari Gota grafted on <i>Solanum torvum</i>	21.10	30.94	37.10	41.03	43.02	45.83	49.57	53.08	56.05
SE (m) ±		0.382	0.295	0.368	0.488	0.472	0.405	0.350	0.219	0.235
CD at 5%		1.140	0.880	1.098	1.456	1.407	1.206	1.044	0.652	0.702
Factor B: Salinity levels										
B ₁	0 dS m ⁻¹	22.02	31.96	43.38	51.17	54.72	61.67	67.37	72.77	77.10
B ₂	2.00 dS m ⁻¹	22.81	30.29	39.99	47.17	50.65	57.00	62.02	66.00	71.28
B ₃	3.00 dS m ⁻¹	21.97	28.88	38.01	44.69	48.30	54.01	59.12	63.26	67.57
B ₄	4.00 dS m ⁻¹	21.45	27.18	36.71	41.08	43.73	48.52	53.78	58.89	62.39
B ₅	5.00 dS m ⁻¹	20.08	26.12	34.26	37.83	40.49	44.55	48.70	52.52	55.40
SE (m) ±		0.427	0.330	0.412	0.546	0.528	0.452	0.391	0.245	0.263
CD at 5%		1.275	0.984	1.227	1.628	1.573	1.349	1.167	0.729	0.784
A × B: Interactions										
T ₁	A ₁ B ₁	27.57	33.82	47.38	58.75	61.50	69.75	74.75	81.25	87.36
T ₂	A ₁ B ₂	25.44	30.51	41.38	51.56	55.79	67.88	69.80	72.40	78.33
T ₃	A ₁ B ₃	23.57	28.88	38.87	51.07	54.60	64.75	66.80	69.00	75.95
T ₄	A ₁ B ₄	22.63	27.57	37.54	41.18	43.80	54.15	58.23	65.50	70.53
T ₅	A ₁ B ₅	21.26	26.28	34.88	37.68	41.77	51.13	54.75	60.48	64.46
T ₆	A ₂ B ₁	20.26	28.19	38.06	48.13	51.55	60.43	66.02	70.56	74.53
T ₇	A ₂ B ₂	21.57	26.60	37.19	45.05	47.93	52.33	58.75	63.28	69.34
T ₈	A ₂ B ₃	21.38	25.94	36.57	41.53	44.28	50.38	56.55	61.60	64.98
T ₉	A ₂ B ₄	19.76	24.38	36.14	39.63	42.60	46.50	53.20	59.72	62.69
T ₁₀	A ₂ B ₅	18.93	23.38	34.94	37.03	38.75	42.30	49.57	52.47	56.13
T ₁₁	A ₃ B ₁	22.35	32.17	46.35	51.89	57.75	65.29	70.94	77.75	81.10
T ₁₂	A ₃ B ₂	22.76	31.01	42.86	49.78	54.16	59.69	66.60	70.42	75.10
T ₁₃	A ₃ B ₃	21.88	29.57	40.53	44.72	50.25	53.60	63.10	68.20	72.07
T ₁₄	A ₃ B ₄	22.45	28.16	37.04	43.39	46.65	49.27	57.40	61.22	65.13
T ₁₅	A ₃ B ₅	20.06	26.58	34.18	41.24	45.13	46.41	49.69	54.56	57.10
T ₁₆	A ₄ B ₁	21.91	33.67	41.73	45.90	48.07	51.20	57.79	61.50	65.41
T ₁₇	A ₄ B ₂	21.47	33.03	38.54	42.30	44.73	48.10	52.93	57.92	62.38
T ₁₈	A ₄ B ₃	20.07	31.14	36.07	41.45	44.09	47.30	50.03	54.25	57.28
T ₁₉	A ₄ B ₄	20.97	28.63	36.11	40.13	41.88	44.18	46.32	49.13	51.22
T ₂₀	A ₄ B ₅	20.07	28.26	33.07	35.38	36.33	38.35	40.78	42.60	43.94
SE (m) ±		0.855	0.660	0.823	1.092	1.055	0.905	0.783	0.489	0.526
CD at 5%		NS	NS	2.454	3.256	3.147	2.697	2.335	1.459	1.569

DAT- Days after transplanting; NS-Non-Significant.

hours (3.1 to 11.0 per day), wind speed (2.9 to 9.2 km per hour), average relative humidity (41 to 87% in morning hours and 15 to 71% in afternoon). The observations were recorded from all observational plants from each replication and average was worked out for different growth attributes. The readings were

measured periodically at every 20 days interval after transplanting for the year 2020 and 2021. The plant height (cm), plant spread (cm²), number of branches per plant were recorded. The data obtained during experiment were analyzed as per the standard statistical methods prescribed by Panse and Sukhatme (1985).

Table 3. Effect of different salinity levels on number of branches per plant in brinjal varieties grafted on *Solanum torvum*.

Factors	Treatment details	Number of branches per plant (Pooled mean)								
		20 DAT	40 DAT	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	160 DAT	180 DAT
Factor A: Grafts										
A ₁	Phule Arjun grafted on <i>Solanum torvum</i>	1.55	2.34	3.04	3.63	3.95	4.23	4.75	5.50	5.75
A ₂	Phule Harit grafted on <i>Solanum torvum</i>	1.00	1.05	1.93	2.35	2.90	3.47	4.15	4.29	4.49
A ₃	Krishna grafted on <i>Solanum torvum</i>	1.16	1.71	2.47	3.28	3.59	4.34	4.89	5.32	5.44
A ₄	Manjari Gota grafted on <i>Solanum torvum</i>	1.40	2.10	2.81	3.10	3.49	3.96	3.84	4.34	4.43
SE (m) ±		0.078	0.098	0.109	0.133	0.112	0.088	0.052	0.088	0.088
CD at 5 %		0.231	0.293	0.326	0.395	0.332	0.261	0.156	0.262	0.263
Factor B: Salinity levels										
B ₁	0 dS m ⁻¹	1.30	1.97	2.62	3.31	3.71	4.55	5.14	5.73	6.02
B ₂	2.00 dS m ⁻¹	1.38	1.74	2.58	3.08	3.40	4.15	4.71	5.22	5.42
B ₃	3.00 dS m ⁻¹	1.14	1.72	2.44	2.87	3.14	3.84	4.24	4.74	4.91
B ₄	4.00 dS m ⁻¹	1.28	1.80	2.66	3.15	3.65	3.83	4.16	4.49	4.58
B ₅	5.00 dS m ⁻¹	1.30	1.78	2.51	3.04	3.53	3.63	3.80	4.14	4.21
SE (m) ±		0.087	0.110	0.122	0.148	0.125	0.098	0.058	0.098	0.098
CD at 5 %		NS	NS	NS	NS	0.372	0.292	0.174	0.293	0.294
A × B: Interactions										
T ₁	A ₁ B ₁	1.32	2.44	2.94	4.07	4.25	4.75	5.82	7.07	7.44
T ₂	A ₁ B ₂	1.69	2.32	3.26	3.63	3.82	4.44	4.94	5.63	5.94
T ₃	A ₁ B ₃	1.32	2.19	2.69	3.25	3.57	4.13	4.63	5.19	5.44
T ₄	A ₁ B ₄	1.44	2.13	3.01	3.63	4.13	4.07	4.32	5.01	5.13
T ₅	A ₁ B ₅	2.00	2.63	3.32	3.57	4.01	3.76	4.07	4.63	4.82
T ₆	A ₂ B ₁	1.00	1.19	2.26	2.94	3.38	4.04	4.57	4.88	5.19
T ₇	A ₂ B ₂	1.00	1.00	2.00	2.56	2.90	3.36	4.44	4.57	4.94
T ₈	A ₂ B ₃	1.00	1.00	1.86	2.00	2.44	3.50	4.13	4.32	4.51
T ₉	A ₂ B ₄	1.00	1.00	2.02	2.15	3.02	3.19	4.07	4.07	4.19
T ₁₀	A ₂ B ₅	1.00	1.07	1.52	2.11	2.79	3.29	3.57	3.63	3.63
T ₁₁	A ₃ B ₁	1.38	1.94	2.57	3.38	3.88	5.13	5.94	6.38	6.69
T ₁₂	A ₃ B ₂	1.07	1.69	2.13	2.94	3.25	4.63	5.25	5.94	6.07
T ₁₃	A ₃ B ₃	1.07	1.50	2.50	3.32	3.44	4.25	4.69	5.19	5.32
T ₁₄	A ₃ B ₄	1.19	1.88	2.69	3.32	3.75	4.19	4.57	4.82	4.82
T ₁₅	A ₃ B ₅	1.13	1.57	2.46	3.44	3.63	3.53	4.00	4.25	4.32
T ₁₆	A ₄ B ₁	1.50	2.32	2.71	2.84	3.34	4.28	4.23	4.59	4.75
T ₁₇	A ₄ B ₂	1.75	1.94	2.94	3.19	3.63	4.19	4.19	4.73	4.73
T ₁₈	A ₄ B ₃	1.19	2.19	2.71	2.92	3.13	3.50	3.50	4.28	4.40
T ₁₉	A ₄ B ₄	1.50	2.19	2.94	3.50	3.69	3.88	3.69	4.07	4.19
T ₂₀	A ₄ B ₅	1.07	1.88	2.76	3.07	3.69	3.94	3.57	4.07	4.07
SE (m) ±		0.173	0.219	0.244	0.297	0.249	0.196	0.117	0.196	0.197
C.D at 5 %		NS	NS	NS	NS	NS	NS	0.348	0.585	0.587

DAT- Days after transplanting; NS-Non-significant.

RESULTS AND DISCUSSION

The data in respect to growth attributes viz., plant height, plant spread, and number of branches per plant were significantly influenced by different grafts, salinity levels and interactions. The results were furnished in the Tables 1–3.

Effect of different salinity levels on plant height (cm)

The effect of grafting, salinity levels and interaction effect had significant influence on plant height at 20, 40, 60, 80, 100, 120, 140, 160 and 180 DAT. In pooled mean, among the varieties that were grafted on

Solanum torvum, significantly the maximum height of plant was found in Krishna at 20 DAT (26.42 cm), Manjari Gota at 40 DAT (31.54 cm) and Phule Harit at 60, 80, 100, 120, 140, 160 and 180 DAT (44.83, 60.81, 67.77, 73.29, 77.00, 86.19 and 93.50 cm, respectively). However, it was statistically at par with Manjari Gota (26.33 cm) and Phule Arjun at 20 DAT (25.17 cm) and in Krishna at 40 DAT (31.34 cm). The minimum height of plant was found in Phule Harit at 20 and 40 DAT (23.69 and 28.62 cm, respectively), Phule Arjun at 60 DAT (36.27 cm) and Manjari Gota at 80, 100, 120, 140, 160 and 180 DAT (43.60, 47.80, 52.79, 56.08, 58.45 and 60.72 cm, respectively). At different levels of salinity, maximum plant height was observed in Manjari Gota grafted on *Solanum torvum* with 3.00 dS m⁻¹ at 20 DAT (27.10 cm) and with 3.00 and 4.00 dS m⁻¹ at 40 DAT (31.57 cm and 30.91 cm, respectively). Krishna grafted on *Solanum torvum* with 4.00 and 5.00 dS m⁻¹ (26.44 cm and 26.07 cm, respectively) and 30.50 cm at 40 DAT with 4.00 dS m⁻¹. Whereas in Phule Harit grafted on *Solanum torvum* found maximum for plant height with 3.00 dS m⁻¹ (46.88, 62.57, 67.13, 71.63, 74.94, 83.12 and 89.33 cm, respectively), 4.00 dS m⁻¹ (39.63, 57.87, 64.82, 69.44, 74.13, 79.63 and 86.18 cm, respectively) and 5.00 dS m⁻¹ (38.00, 55.32, 60.27 cm, 65.38, 68.00, 73.63 and 76.75 cm, respectively) at 60, 80, 100, 120, 140, 160 and 180 DAT. Among the varieties that were grafted on *Solanum torvum*, Phule Harit was taller due to its erect growth pattern. Initially slow growth rate was observed in grafted plants, which might be due to slow growth of grafts and slow rate of acclimatization. Subsequently the grafted plants showed maximum plant height, since the *Solanum torvum* Swartz has better root system which ensured maximum plant height and vigours growth, by absorption of more water and nutrients (Bletsos and Olympios 2008). Brinjal plant growth was significantly reduced by salinity. As the salt concentration increased, resulted the decrease the height. Many authors have well documented growth reduction under saline conditions in various plants (Turan and Aydin 2005). These results are in conformity with work by Unlukara *et al.* (2008), evident that the plant height of the egg plant decreased with increasing soil salinity. Shahbaz *et al.* (2013) also reported decline in the shoot length in L-888 and round eggplant cultivars due to salt stress. Al-Zubaidi (2018) found that plant

height has decreased with increasing concentrations of salt irrigation water. The highest reduction in plant height was noticed at 12 dSm⁻¹ compared with the control. However, the different graft combinations may influence the production for interactive effects of scion and rootstocks on assimilate partitioning and nutrient uptake (Kawaguchi *et al.* 2008). The present study gets ample support from the work of Wei *et al.* (2009) who observed more vigours growth of brinjal grafted onto *Solanum torvum* as compared to own root brinjal under NaCl concentrations. Curuk *et al.* (2009) reported that brinjal cultivars 'Pala' grafted on *Solanum torvum* gave 10% increased plant height than non-grafted plants. Sabatino *et al.* (2013) reported that the highest plant height was recorded in brinjal 'ecotype B4' grafted on *Solanum torvum* Swartz and the lowest was recorded in non-grafted plants. Kumar *et al.* (2017b) also reported the maximum plant height in cv Pusa Shyamla when grafted on *Solanum torvum*. Surati Ravaiya Purple and Surati Ravaiya Pink grafted on *Solanum torvum* showed more vigours growth (Kumar *et al.* 2019). Morphologically, plant growth is perceived as an increase in plant size in terms of plant height, while development involves tissue and organ formation. In the current study, a rise in the NaCl concentration of irrigation water resulted in a significant reduction in plant height. But the reduction was significantly lower in the grafted plants which might be due to the vigour of the *Solanum torvum* root stock.

Effect of different salinity levels on plant spread (cm²)

The effect of grafting, salinity levels and interaction effect had significant influence on plant spread at 20, 40, 60, 80, 100, 120, 140, 160 and 180 DAT. In pooled mean, among the varieties that were grafted on *Solanum torvum*, significantly the maximum plant spread was recorded in Phule Arjun at 20, 80, 100, 120, 140, 160 and 180 DAT (24.09, 48.05, 51.76, 61.53, 64.87, 69.73 and 75.32 cm², respectively), Manjari Gota at 40 DAT (30.94 cm²) and Krishna at 60 DAT (40.19 cm²). However, it was statistically at par with Phule Arjun at 60 DAT (40.01 cm²). The significantly minimum plant spread was observed in Phule Harit at 20, 40 and 60 DAT (20.38, 25.70 and 36.58 cm², respectively), Manjari Gota at 80, 100,

120, 140, 160 and 180 DAT (41.03, 43.02, 45.83, 49.57, 53.08 and 56.05 cm², respectively). At different levels of salinity, maximum plant spread was observed in Krishna, Phule Arjun and Phule Harit at 60 DAT with 3.00 (40.53 cm²), 4.00 (37.54 cm²) and 5.00 dS m⁻¹ (34.94 cm²), respectively. At 80 and 100 DAT, the maximum plant spread was observed in Phule Arjun with 3.00 dS m⁻¹ (51.07 and 54.60 cm², respectively) and Krishna with 4.00 dS m⁻¹ (43.39 and 46.65 cm², respectively) and 5.00 dS m⁻¹ (41.24 and 45.13 cm², respectively). Overall, Phule Arjun grafted on *Solanum torvum* was proved to be maximum for plant spread at 120, 140, 160 and 180 DAT with 3.00 dS m⁻¹ (64.75, 66.80, 69.00 and 75.95 cm², respectively) 4.00 dS m⁻¹ (54.15, 58.23, 65.50 and 70.53 cm², respectively) and 5.00 dS m⁻¹, (51.13, 54.75, 60.48 and 64.46 cm², respectively).

Effect of different salinity levels on number of branches per plant

The effect of grafting, salinity levels and interaction effect had significant influence on number of branches per plant at 20, 40, 60, 80, 100, 120, 140, 160 and 180 DAT. In pooled mean, among the varieties that were grafted on *Solanum torvum*, significantly the maximum number of branches per plant was found in Phule Arjun at 20, 40, 60, 80, 100 and 160 DAT (1.55, 2.34, 3.04, 3.63, 3.95 and 5.50, respectively) and Krishna at 120, 140 and 180 DAT (4.34, 4.89 and 5.75, respectively). However, it was at par with the Manjari Gota at 20, 40 and 60 DAT (1.40, 2.10 and 2.81, respectively), Krishna at 80, 160 and 180 DAT (3.28, 5.32 and 5.44, respectively) and Phule Arjun at 120 and 140 DAT (4.23 and 4.75, respectively). However, significantly the minimum number of branches per plant was observed in Phule Harit at 20, 40, 60, 80, 100, 120 and 160 DAT (1.00, 1.05, 1.93, 2.35, 2.90, 3.47 and 4.29, respectively) and Manjari Gota at 140 and 180 DAT (3.84 and 4.43, respectively).

At different levels of salinity, number of branches per plant was proved to be maximum in Krishna grafted on *Solanum torvum* with 3.00 and 4.00 dS m⁻¹ (4.69 and 4.57, respectively) and Phule Arjun grafted on *Solanum torvum* with 5.00 dS m⁻¹ (4.07) at 140 DAT. At 160 DAT, Krishna grafted on *Solanum torvum* were proved to be maximum for number of branches per

plant with 3.00 dS m⁻¹ (5.19). Whereas, at 160 DAT and 180 DAT, Phule Arjun grafted on *Solanum torvum* was proved to be maximum for number of branches per plant with 3.00, 4.00 and 5.00 dS m⁻¹ (5.19, 5.01 and 4.63, 5.44, 5.13 and 4.82, respectively). The result of the present investigation was in accordance with the finding of Bekhradi *et al.* (2011), found that cv 'Charleston Gray' when grafted onto *Cucurbita pepo*, Ferro and Lagenaria recorded the highest number of laterals and the lowest number of lateral branches was recorded under control. Mohamed *et al.* (2012), noted that the highest number of watermelon cv 'Aswan F₁' grafted on rootstock '6001 F₁' and on 'Tetsukabuto F₁' recorded more laterals. Tamilselvi *et al.* (2015), who reported that Palee F₁ grafted on to pumpkin rootstock significantly gave the showed the maximum number of primary branches as that of self-rooted Palee plants. Musa *et al.* (2020) showed the significantly higher number of branches was observed in TCV grafted onto TWR and the minimum in non-grafted and self-grafted eggplants. Grafting with vigours rootstocks (MWR, BWR, and TWR) improved scion growth, resulting in more branches at 45 and 90 DAT compared to control. It might be due to influence of strong and deep root system of *Solanum torvum* rootstock which able to absorb water and minerals into aerial plant parts might be ascribed to the root system's physical traits, such as lateral and vertical development. The rootstock's robust root structure encouraged stronger scion growth, which led to grafted plants with more branches. It is a significant characteristic in eggplant that contributes to yield (Cassaniti *et al.* 2011). These findings are consistent with the findings of Gisbert *et al.* (2011).

CONCLUSION

A positive effect of grafting on growth attributes were recorded with *Solanum torvum* Sw. rootstock under varied levels of salinity. The results revealed that among grafted varieties, Phule Harit showed significantly superior performance for plant height. However, maximum plant spread and number of branches were recorded in Phule Arjun. Among the interactions, Phule Harit grafted on *Solanum torvum* was shown maximum for plant height and Phule Arjun grafted on *Solanum torvum* was found sig-

nificantly maximum for plant spread and number of branches per plant at 3.00, 4.00 and 5.00 dS m⁻¹. This study emphasizes the grafting with *Solanum torvum* rootstock would be effective under salt tolerance for better growth of brinjal.

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