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Effect of different salinity levels on growth, flowering and yield characteristics of brinjal varieties under Marathwada conditions

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Abstract

The experiment was conducted at Department of Horticulture, VNMKV, Parbhani during the year 2020-2021. The pot experiment was laid out in Factorial Randomized Block Design which was replicated twice with two factors, *i.e.*, varieties and salinity levels. In varieties, there were 4 brinjal varieties *i.e.*, Phule Arjun, Phule Harit, Krishna and Manjari Gota and there were 5 salinity levels *i.e.*, 0, 2, 3, 4 and 5 dSm⁻¹ which was imposed with the help of Sodium chloride (NaCl) salt to assess the response of brinjal varieties towards growth, flowering and yield characteristics under various salinity stress conditions. The results revealed that among the varieties, significantly the maximum plant height, stem diameter, leaf area, average fruit length, average fruit diameter, average fruit volume and average fruit weight was observed in Phule Harit whereas, for number of branches, plant spread, number of leaves, early flowering was found in Phule Arjun, in case of number of flowers, number fruits and fruit yield per plant was maximum for Manjari Gota. Phule Harit was proved to be maximum for plant height, stem diameter, leaf area, average fruit length, average fruit diameter, average fruit volume and average fruit weight at 3.00, 4.00 and 5.00 dS m⁻¹. Phule Arjun was proved to be maximum for number of branches per plant, early flowering at 3.00, 4.00 and 5.00 dS m⁻¹ but number of leaves found maximum at 3.00 and 4.00 dS m⁻¹ and plant spread at 3.00 dS m⁻¹. It was Krishna was proved to be maximum for plant spread at 4.00 and 5.00 dS m⁻¹ and number of leaves at 5.00 dS m⁻¹. Manjari Gota was proved to be maximum for number of flowers per plant, number of fruits per plant and fruit yield per plant at 3.00, 4.00 and 5.00 dS m⁻¹.

Keywords: Eggplant, grafting, yield, brinjal, *solanum torvum*, salinity levels, growth

Introduction

Brinjal (*Solanum melongena* L., (2n = 2x = 24)) is one of the widely distributed and cultivated species of Solanaceae family. Native of India and China is its secondary centre of origin. It is known as poor man's vegetable. 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 in India (Anon, 2022) [1]. It is well distributed in Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh. Brinjal is highly productive, nutritious and used as a raw material in pickle making and dehydration industries. Cooked in curry and sambhar, mashed, fried or stuffed with spices and then fried, especially long fruits. Eggplant is a rich source of nutrients containing carbohydrates (6.4%), protein (1.3%), fat (0.3%), calcium (0.02%), phosphorus (0.02%), iron (0.0013%), 34 mg β-carotene, 0.05 mg riboflavin, 0.05 mg thiamine, 0.5 mg niacin and 0.9 mg ascorbic acid per 100 grams of fruit. It is low in calories and fats, contains mostly water, fiber, good source of minerals and vitamins and rich in total water-soluble sugars, free reducing sugars, amide proteins among other nutrients. Brinjal is valued for its medicinal properties, beneficial for diabetic patients. Salinity in soil or water is one of the major abiotic stresses that reduce plant growth and crop productivity worldwide (Arzani, 2008) [2]. More than 800 million hectares of land throughout the world are salt affected due to saline and sodic soils, corresponding to more than 6 per cent of the world total land area of which salinity is detrimental in limiting plant growth and crop productivity. Salinity in soil or water is a serious threat to plant growth that prevents plants in achieving their genetic potential. Its annual damage is about 20 per cent of the world's crops grown under irrigation. Salinity occurs when there is an excessive accumulation of salts (especially high Na⁺, Cl⁻ and SO₄⁻) in the soil (Parida and Das, 2005) [3] or irrigation water (Colla *et al.*, 2010) [4]. Continuous irrigation with saline water could also lead to deterioration of physical properties of the soil and decrease of crop production.

Therefore, it is imperative to have more knowledge on salt stress to develop new technologies. Brinjal is moderately sensitive to salinity, consequently more attention is required in agricultural production of this crop with important varieties.

Salinity inhibits the crop growth and productivity via limiting photosynthesis and energy conservation inhibition (Zhu, 2016)^[5]. An increase in photosystem I activity and a decrease in photosystem II mediated oxygen evolution activity as a result of salt stress can cause some modifications in the thylakoid membrane proteins, leading to a decline in the electron transfer from light harvesting antenna to photosystem II (Sudhir *et al.*, 2005)^[6]. Overall negative effect of soil salinity on chlorophyll related parameters were clearly evident in past findings. The important alternative to overcome the problem of soil salinity is by adopting salt tolerant crops for growing. That was the major objective the present investigation in which different varieties of brinjal were assessed under salinity imposed conditions and identification of relatively efficient cultivars.

Material and Methods

The present investigation was undertaken at the College of Agriculture, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during the year 2020-21. The experiment was laid out in Factorial Randomized Block Design with two replications and it consisted of two factors, *i.e.* varieties and salinity levels. There were 4 brinjal varieties and 5 levels of salinity. Salinity stress has been imposed by using solution of sodium chloride (NaCl). Salt was applied in four different electrical conductivity (EC) values of 2, 3, 4 and 5 dS m⁻¹ in weekly intervals starting from 20 days after transplanting and non-salt treated plants were kept as control. The brinjal varieties/hybrids adopted and released for Maharashtra region has been selected *viz.*, Phule Arjun (F₁), Phule Harit, Krishna (F₁) and Manjari Gota were obtained from Senior Vegetable Breeder, All India Co-ordinated Research Project (AICRP) on Vegetable Crops, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra.

The popular varieties of brinjal *viz.*, Phule Arjun, Phule Harit, Krishna and Manjari Gota were sown in February. Seeds were sown in trays containing coco peat and vermicompost in 3:1 ratio and watered regularly. Trays were covered with polythene sheets for four days. After emergence of seedlings, trays were kept under a shade net. Foliar sprays of 19:19:19 @ 0.5% were provided weekly once to get quality seedlings. The seedlings were ready for transplanting in 35 days (three to four true leaves). Before the transplanting, seedlings were grown under natural light conditions for two to three days for hardening. The healthy and vigorous seedlings from trays were transplanted to plastic pot in March month. Each of pot size was 28 cm diameter and 30 cm height which is having 20 kg soil capacity filled with 18 kg media containing pot mixture of soil, vermicompost, FYM, digested coir pith, compost and sand at the ratio of 1:1:1:1:1. One seedling was transplanted per pot and irrigation was given immediately after transplanting. The plants after transplanting in pots were supported by bamboo sticks to avoid lodging.

Result and Discussion

The data pertaining to growth, flowering, fruit and yield parameters of brinjal as significantly influenced by different grafts, salinity levels and interactions were furnished in Table 1, Table 3 and Table 3.

Among the varieties, data revealed that under salt stress

conditions Phule Harit found significantly the maximum plant height (85.64 cm), stem diameter (10.47 cm), leaf area (101.97 cm²), average fruit length (11.61 cm), average fruit diameter (8.98 cm), average fruit volume (141.80 ml) and average fruit weight (126.18 g) followed by Krishna for plant height (74.75 cm), stem diameter (9.69 cm), average fruit length (8.60 cm), average fruit diameter (7.36 cm), average fruit volume (102.96 cm) and average fruit weight. While, significantly the minimum plant height (61.98 cm), stem diameter (8.32 cm) and leaf area (37.97 cm²) was observed in Manjari Gota (61.98 cm). Phule Arjun found significantly minimum average fruit length (6.08 cm), average fruit diameter (6.66 cm), average fruit volume (85.11 ml) and average fruit weight (62.28 g). Number of branches per plant (8.99), plant spread, number of leaves per plant (80.77) and early 50% flowering (29.68 days) was reported significantly maximum in Phule Arjun followed by Krishna for number of branches per plant (7.44), plant spread (82.22 cm²), number of leaves (75.82) and early 50% flowering (33.02 days) whereas, significantly minimum number of branches per plant (6.02), number of leaves (64.84) and late 50% flowering (37.78 days) was reported in Phule Harit. Manjari Gota was found significantly maximum for number of flowers per plant (16.89), number of fruits per plant (13.51) and fruit yield per plant (1094.29 g) followed by Phule Arjun for number of flowers per plant (15.10) and number of fruits per plant (12.08) which is even in Krishna (12.08) and the same followed value for fruit yield per plant was recorded in Krishna. Significantly minimum number of leaves (13.26) and number of fruits were reported in Phule Harit and for fruit yield per plant in Phule Arjun (740.28 g). Similar results were also reported in previous findings of Ahire and Nikam (2011)^[7], Petropoulos *et al.* (2012)^[8], Tamilselvi *et al.* (2015)^[9], Sarswat *et al.* (2020)^[10] and Bayoumi *et al.* (2021)^[11].

Different salt concentrations studied under investigation yielded maximum values for plant height (47.63 cm), stem diameter (10.72 cm), number of branches per plant (9.60), plant spread (94.49 cm²), number of leaves (94.49), leaf area (108.15 cm²), late 50% flowering (37.43 days), number of flowers per plant (19.74), average fruit length (9.44 cm), average fruit diameter (7.77 cm), average fruit volume (118.68 ml), average fruit weight (97.58 g), number of fruits (15.19) and fruit yield per plant (1386.62 g) was reported in the control treatment *i.e.* 0 dS m⁻¹. The minimum values were found at 5.00 dS m⁻¹ for same parameters (61.28 cm, 8.35 cm, 5.81, 64.43 cm², 46.65, 52.47, 30.51 days, 10.29, 7.91 cm, 7.26 cm, 96.20 ml, 81.21 g, 7.95 and 581.79 g). Increased salinity suppressed growth, flowering and yield characters in past findings of Akinci *et al.* (2004)^[12], Uddin *et al.* (2016)^[13] and Quamruzzaman *et al.* (2018)^[14].

Among the treatment combinations, Phule Harit with 0.00 dS m⁻¹ was recorded significantly the maximum plant height (96.79 cm), stem diameter (11.90 cm), leaf area (131.92 cm²), average fruit length (12.54 cm), average fruit diameter (9.32 cm), average fruit volume (160.04 ml) and average fruit weight (138.08 g). It was followed by values were also recorded in Phule Harit with 2.00 dS m⁻¹ and 3.00 dS m⁻¹ for plant height (92.78 cm and 89.94 cm, respectively), average fruit length (11.89 cm and 11.59 cm, respectively), average fruit diameter (9.16 cm and 9.01 cm, respectively), average fruit volume (154.05 ml and 127.08 ml, respectively) and average fruit weight (130.08 g and 127.08 g, respectively) and for stem diameter at 3.00 dS m⁻¹ it was Phule Harit (11.45 cm) Phule Arjun at 0.00 dS m⁻¹ (10.89 cm) for leaf area at 3.00 dS m⁻¹ it was Phule Harit (119.11 cm²) Phule Arjun at 0.00 dS m⁻¹ (126.07 cm²). Whereas, significantly minimum plant height

T ₃	A ₁ B ₃	6.02	6.65	85.94	60.58	12.07	720.29
T ₄	A ₁ B ₄	5.59	6.54	80.22	58.08	10.50	593.11
T ₅	A ₁ B ₅	5.42	6.48	77.96	55.08	7.72	375.85
T ₆	A ₂ B ₁	12.54	9.32	160.04	138.08	10.22	1375.60
T ₇	A ₂ B ₂	11.89	9.16	154.05	130.08	9.22	1160.55
T ₈	A ₂ B ₃	11.59	9.01	135.06	127.08	8.18	990.85
T ₉	A ₂ B ₄	11.27	8.76	130.73	120.08	7.24	843.94
T ₁₀	A ₂ B ₅	10.74	8.66	129.13	115.58	4.93	522.85
T ₁₁	A ₃ B ₁	9.77	7.70	115.12	93.08	17.29	1568.17
T ₁₂	A ₃ B ₂	9.44	7.52	110.77	88.58	14.78	1292.92
T ₁₃	A ₃ B ₃	8.02	7.27	107.17	86.08	11.11	890.75
T ₁₄	A ₃ B ₄	7.94	7.18	92.41	83.58	8.84	732.75
T ₁₅	A ₃ B ₅	7.86	7.14	89.35	77.08	8.39	623.33
T ₁₆	A ₄ B ₁	8.70	7.20	108.22	88.58	16.98	1491.04
T ₁₇	A ₄ B ₂	8.46	7.15	105.24	86.08	14.72	1192.05
T ₁₈	A ₄ B ₃	7.93	7.01	94.74	83.08	13.15	1025.47
T ₁₉	A ₄ B ₄	7.79	6.79	91.44	81.58	11.97	957.76
T ₂₀	A ₄ B ₅	7.62	6.75	88.37	77.08	10.75	805.11
S.E(m) ±		0.098	0.034	0.281	1.274	0.154	10.001
C.D at 5%		0.293	0.102	0.838	3.800	0.459	29.820

Conclusion

Among the varieties, results showed significantly the maximum plant height, stem diameter, leaf area, average fruit length, average fruit diameter, average fruit volume and average fruit weight was observed in Phule Harit whereas, for number of branches, plant spread, number of leaves, early flowering was found in Phule Arjun, in case of number of flowers, number fruits and fruit yield per plant was maximum for Manjri Gota. Phule Harit was proved to be maximum for plant height, stem diameter, leaf area, average fruit length, average fruit diameter, average fruit volume and average fruit weight and Phule Arjun for number of branches per plant, early flowering, whereas, Manjri Gota for number of flowers per plant, number of fruits per plant and fruit yield per plant at 3.00, 4.00 and 5.00 dS m⁻¹ but number of leaves found maximum at 3.00 and 4.00 dS m⁻¹ and plant spread at 3.00 dS m⁻¹. It was Krishna was proved to be maximum for plant spread at 4.00 and 5.00 dS m⁻¹ and number of leaves at 5.00 dS m⁻¹.

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