Effect of saline irrigation water on yield and yield attributing characters of tomato (*Solanum lycopersicum* L.) varieties

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**Abstract**

Salinity is one of the most important factor limiting fruit growth and production of several horticultural crops. A pot experiment was undertaken during *Rabi* 2017-18 at Department of Agricultural Chemistry & Soil Science, JAU, Junagadh in order to investigate the effect of different levels of saline irrigation water on yield and yield attributing characters of tomato (*Solanum lycopersicum* L.) varieties. The experiment consists of four salinity levels *viz.*, < 2.0, 4.0, 6.0 and 8.0 dS m\(^{-1}\) with four different varieties *viz.*, V\(_1\): GT-6, V\(_2\): JT-3, V\(_3\): AT-3 and V\(_4\): DVRT-2 of tomato. Results reported that saline water treatments significantly reduced the vegetative growth parameters and hence total yield of tomato. The yield and yield attributing characters were also significantly influenced by different tested varieties of tomato and recorded highest yield with V\(_1\) (GT-6) variety.

**Keywords:** Salinity levels, varieties, tomato, growth, yield and yield attributes

**Introduction**

Tomato is one of the most important horticultural crops in the world and in terms of human consumption and health, it is a major component of daily meals and constitutes valuable vitamins (A & C), minerals, organic acid, fibres and considered as protective food due to its high nutritive value. Tomato plants require high temperatures and high photosynthetic active radiation for optimum production. As these conditions are typical of arid and semi-arid regions where irrigation water is usually limited and often saline. According to FAO guideline (Ayers and Westcot, 1989) \(^{[2]}\), tomato is moderately salinity tolerant and could act as a model crop for saline water use because it’s already grown in large areas with saline conditions, and also there is wealth of important knowledge of the physiology and genetics of this species (Cuartero and Fernandez-Munoz, 1999) \(^{[4]}\). Unfavourable growing conditions and improper selection of varieties are some of the important constraining factors which limits its production. However, under stress conditions by selecting suitable tomato varieties and regulation of growing environment, it could be possible to harvest better crop yield. The objective of present work was to investigate the effect of saline irrigation water on yield and yield attributing characters of tomato varieties.

**Materials and Method**

A pot experiment conducted in the net house of Department of Agricultural Chemistry and Soil Science, JAU, Junagadh during *Rabi* 2017-18. The soil of experimental area was silty clayey in texture and alkaline in reaction. The experiment undertaken consists of 16 treatments combinations comprising four levels of salinity water *viz.*, < 2.0, 4.0, 6.0 and 8.0 dS m\(^{-1}\) and four levels of varieties *viz.*, V\(_1\): GT-6, V\(_2\): JT-3, V\(_3\): AT-3 and V\(_4\): DVRT-2 laid out in factorial CRD with 3 replications. All forty eight pots were filled with each soil bulk of 15 kg. The required quantity of N @ 37.5 kg ha\(^{-1}\) P\(_2\)O\(_5\) @ 37.5 kg ha\(^{-1}\) and K\(_2\)O @ 62.5 kg ha\(^{-1}\) applied to all the pots as basal dose in the form of Urea, DAP and MOP, respectively. Remaining quantity of 37.5 kg ha\(^{-1}\) applied at 30 DAT in form of urea. Three seedling of tomato were transplanted in each pot and later two healthy seedlings per pot were maintained for recording observations. The pots were uniformly irrigated with saline water as per treatments and with
fresh water as control and as when crop required irrigation throughout the cropping season. While for the preparation of different levels of saline water, sea water of EC 55 dS m⁻¹ was diluted with rain water in order to prepare 4.0, 6.0 and 8.0 dS m⁻¹ levels of salinity. All collected data of various parameters were statistically analysed using F’ test (Panse and Sukhatme, 1985) [1].

Results and Discussion
Yield parameters
Data pertained in table 1 shows significant influence of different levels of saline water among different varieties on fruit and stalk yield which found decreasing with increased level of salinity. Significantly higher fruit and stalk yield recorded under S₁ (< 2.0 dS m⁻¹) salinity level. However, variety V₁ (GT-6) registered highest value of fruit yield (133.16 g plant⁻¹), variety V₃ (AT-3) recorded highest stalk yield (176.33 g plant⁻¹). The interaction effect on fruit and stalk yield (Table 2 and 3) was also found statistically significant with treatment combinations V₁S₁ (GT-6 X < 2.0 dS m⁻¹) and V₁S₃ (AT-3 X < 2.0 dS m⁻¹), respectively. Yield reductions caused by salinity may be due to both the osmotic stress and specific toxicity which provokes wide range of physiological and biochemical alterations which in turn inhibit plant growth and yield. These results are in conformity with the findings of Mitchel et al. (1991) [6], Babu and Thirumurugan, (2001), Yurteven et al. (2005) [11] and Turhan et al. (2009) [9].

Table 1: Effect of saline irrigation water and varieties on yield, yield attributing characters of tomato

| Treatments | Yield attributing characters | Salinity (S) | Variety (V) | S x V Interaction | C.V. % |
|------------|------------------------------|--------------|-------------|-------------------|-------|
|            | Fruit yield (g plant⁻¹)     | Stalk yield (g plant⁻¹) | Plant height (cm) | No. of branches/ plant | No. of fruits/ plant | Average fruit weight (g) |
| S₁< 2.0 dS m⁻¹ (tap water) | 153.38 | 159.42 | 71.46 | 6.77 | 7.04 | 23.50 |
| S₂: 4.0 dS m⁻¹ | 134.52 | 146.00 | 62.75 | 5.88 | 6.54 | 21.61 |
| S₃: 6.0 dS m⁻¹ | 101.09 | 128.33 | 57.21 | 5.38 | 5.63 | 17.60 |
| S₄: 8.0 dS m⁻¹ | 84.87 | 107.92 | 44.50 | 4.89 | 4.58 | 15.95 |
| S. Em. ± | 2.21 | 1.97 | 1.15 | 0.10 | 0.11 | 0.36 |
| C.D. (P=0.05) | 6.37 | 5.67 | 3.30 | 0.29 | 0.33 | 1.04 |

Variety (V)

| V₁: GT-6 | 133.16 | 130.83 | 53.25 | 5.47 | 6.29 | 21.28 |
| V₂: JT-3 | 126.87 | 126.67 | 55.58 | 5.73 | 5.25 | 23.25 |
| V₃: AT-3 | 110.03 | 145.00 | 66.42 | 5.92 | 5.67 | 19.02 |
| V₄: DVRT-2 | 103.80 | 139.17 | 60.67 | 5.79 | 6.58 | 15.11 |
| S. Em. ± | 2.21 | 1.97 | 1.15 | 0.10 | 0.11 | 0.36 |
| C.D. (P=0.05) | 6.37 | 5.67 | 3.30 | 0.29 | 0.33 | 1.04 |

S x V Interaction

| S. Em. ± | 4.42 | 3.94 | 2.29 | 0.20 | 0.23 | 0.72 |
| C.D. (P=0.05) | 12.73 | 11.35 | 6.60 | NS | 0.65 | 2.09 |

C.V. %

| 6.46 | 5.04 | 6.73 | 6.09 | 6.59 | 6.38 |

Table 2: Interaction effect of salinity and varieties on fruit yield (g plant⁻¹) of tomato

| S₁< 2.0 dS m⁻¹ | S₂: 4.0 dS m⁻¹ | S₃: 6.0 dS m⁻¹ | S₄: 8.0 dS m⁻¹ | Mean |
|----------------|----------------|----------------|----------------|------|
| V₁: GT-6 | 165.33 | 158.15 | 106.90 | 102.24 | 133.16 |
| V₂: JT-3 | 162.00 | 146.77 | 103.13 | 95.58 | 126.87 |
| V₃: AT-3 | 153.17 | 108.70 | 102.67 | 75.58 | 110.03 |
| V₄: DVRT-2 | 133.00 | 124.47 | 91.67 | 66.07 | 103.80 |
| Mean | 153.38 | 134.52 | 101.09 | 84.87 |
| S. Em. ± | 4.42 | C.D. (P=0.05) | 12.73 |
Table 3: Interaction effect of salinity and varieties on stalk yield (g plant⁻¹) of tomato

| Variety | S1: 2.0 dS m⁻¹ | S2: 4.0 dS m⁻¹ | S3: 6.0 dS m⁻¹ | S4: 8.0 dS m⁻¹ | Mean |
|---------|----------------|----------------|----------------|----------------|------|
| V1: GT-6 | 147.33          | 139.00          | 129.67          | 107.33          | 130.83 |
| V2: JT-3 | 146.67          | 133.33          | 115.67          | 111.00          | 126.67 |
| V3: AT-3 | 176.33          | 160.00          | 136.00          | 107.67          | 145.00 |
| V4: DVRT-2 | 167.33        | 151.67          | 132.00          | 105.67          | 139.17 |
| Mean     | 159.42          | 146.00          | 128.33          | 107.92          | 139.17 |
| S.Em. ±  | 3.94            |                |                |                | 11.35 |
| C.D. (P=0.05) |            |                |                |                |      |

Conclusion
From the above results, it can be concluded that tomato variety V₁ (GT-6) exhibited its superiority for fruit yield. Tested varieties of tomato exhibited significant variation in terms of growth and yield attributes viz, stalk yield, plant height, no. of branches per plant, no. of fruits per plant and average fruit weight in an inconsistent manner which might be due to their genetic traits. As a successful salt tolerant cultivar should exhibit salt tolerance without compromising its yield potential, variety V₁ (GT-6) was found quite tolerant to salinity as compared to other tested varieties of tomato. Overall, relative tolerance of tested tomato varieties in sequential order as follows: GT-6 > JT-3 > AT-3 > DVRT-2 against saline irrigations upto EC 8.0 dS m⁻¹. Our results are in concordance with the findings of Vadaliya et al. (2019) [10] having similar work with sesame crop.

References
1. Adams P, Ho LC. Effects of constant and fluctuating salinity on the yield, quality and calcium status of tomato. Journal of Horticulture Science. 1989; 64(6):725-732.
2. Ayers RS, Westcot DW. Water quality for agriculture. Irrigation and Drainage. FAO, Rome, Italy, 1989; 29(1).
3. Babu S, Thirumuragan T. Effect of NaCl priming for increased salt tolerance in sesame. Journal of Ecobiology. 2001; 13(4):309-311.
4. Cuartero J, Fernandez Munoz R. Tomato and salinity. Scientia Horticulturalae. 1999; 78:83-125.
5. Garg SK, Kalla A, Bhatnagar A. Evaluation of raw and hydrothermally processed leguminous seeds as supplementary feed for the growth of two Indian major carp species. Aquaculture Research. 2002; 33151-163.
6. Mitchell JP, Shennan C, Grattan SR. Developmental changes in tomato fruit composition in response to water deficit and salinity. Physiology Plantarum. 1991; 83:177-185.
7. Munns R. Genes and salt tolerance: Bringing them together. New Phytologist. 2005; 167:645-663.
8. Panse VG, Sukhatme PV. “Statistical Methods for Agricultural Workers”. Indian Council of Agricultural Research, New Delhi, 1985, 361.
9. Turhan A, Seniz V, Kuscu H. Genotypic variation in the response of tomato to salinity. African Journal of Biotechnology. 2009; 8(6):1062-1068.
10. Vadaliya BM, Parmar KB, Ribadiya TR, Vekaria LC, Davra MA. Effect of salinity on yield, yield attributing characters and quality of sesame (Sesamum indicum L.) varieties. International Journal of Chemical Studies. 2019; 7(1):2278-2281.
11. Yurtseven E, Kesmez GD, Unlukara A. The effects of water salinity and potassium levels on yield, fruit quality and water consumption of a native central anatolian tomato species (Lycopersicon esculantum). Agricultural Water Management. 2005; 78:128-135.