Biological Forum – An International Journal **16(12): 89-92(2024)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Evaluate the Effect of Different Levels of $CaCl_2$ on Growth and Yield of Tomato (*Lycopersicon esculentum*)

Fouzi A. Ibrahim, Suchit A. John and Soni Mourya*
Department Biological Sciences Libyan Center for Studies and Researches in Environmental Science and Technology (SHUATS) Prayagraj (Uttar Pradesh), India.

(Corresponding author: Soni Mourya)*
(Received: 12 September 2024; Revised: 17 October 2024; Accepted: 14 November 2024; Published: 14 December 2024)
(Published by Research Trend)

ABSTRACT: Tomato (*Lycopersicon esculentum* Miller) is one of the most important vegetable crops grown throughout the world under field and greenhouse conditions. Tomato belongs to the family Solanaceae and it is believed to have originated in the coastal strip of western South America, from the equator to latitude of about 300 South. In terms of human health, tomato is a major component in the daily diet in many countries, and constitutes an important source of minerals, vitamins, and antioxidants. The responses of tomato seeds to different seed treatments were interpreted in term of plant height (cm) number of leaves, number of branches and number of flowers per plants. In terms of yield parameters *viz.*, number of fruits per plant, average fruit weigh per plant, fresh weight per plant and dry weight per plant. To raise the tomato yield for the winter (rabi) season, five treatments were seeded. Normal/plain water is the fifth treatment (T0), 600 ppm $CaCl_2$ (600 mg/L), 1200 ppm $CaCl_2$ (1200 mg/L), 1800 ppm $CaCl_2$ (1800 mg/L), and 2400 ppm $CaCl_2$ (2400 mg/L) are the fifth and sixth treatments, respectively. Given the summarized results, it is possible that the tomato plant's growth physiology is significantly impacted by acute calcium chloride stress.

Keywords: Tomato, $CaCl_2$, Growth, *Lycopersicon esculentum* Miller and Yield.

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most important vegetable crop cultivated all over the world for its fleshy fruits. It belongs to the family Solanaceae. The cultivated tomatoes originated as wild forms in the Peru-Ecuador-Bolivia area of South America. Earlier, tomatoes were thought to be poisonous and long before it was considered fit to eat, it was grown only as an ornamental garden plant. Today, it is recognized as one of the important commercial and dietary vegetable crops (Bauer *et al.,* 2004). One of the most popular vegetables in the world is the tomato (*Lycopersicon esculentum*). Because fruits like tomatoes are sensitive, postharvest management is just as important as manufacturing methods. Any point in the handling system, from harvesting to storage and marketing to the ultimate delivery to the customer, might result in post-harvest losses. Particularly in tropical and subtropical regions, tomatoes are extremely perishable due to their climacteric character. After harvest, between 30 and 50 percent of the food is lost due to improper handling and preservation (Mazumder *et al.*, 2021).

Tomatoes are farmed on over 3.9 million hectares of land globally and are members of the Solanaceae family (Hussein *et al.*, 2010). According to the FAO (2022), it is a day-length neutral plant. Along with energy-producing iron, vitamin B1, and phosphorus, tomatoes are also a wonderful source of vitamin E, magnesium, niacin, and bone-healthy copper. Tomatoes are a significant source of phenolics, vitamin C, carotenoids (particularly those that speed up or delay ripening, reduce losses, and improve lycopene), and trace levels of vitamin E, which slows down daily meals and preserves color and quality (Mishra and Prakash 2018). Epidemiological study results indicated that tomatoes and tomato-derived products may offer protection against a variety of pathogens by decreasing shriveling, which eventually forms of cancer, especially cardiovascular diseases (Khachik *et al.*, 2002).

It is well known that calcium ions play a significant role in preserving the quality of fruits and vegetables by participating in a variety of physiological processes. In a number of fruit crops, including tomatoes, elevated Ca^{+2} levels have been demonstrated to lower respiration and ethylene generation rates (Tolasa *et al.*, 2021). From the study, it has been concluded that among the different treatments, T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting) showed significant positive effect on growth and yield parameters as well as soil and economics as recorded maximum values of gross and net returns (Chauhan *et al.*, 2023). Verma *et al.* (2024) concluded that Spray of salicylic acid @ 150 ppm and $CaCl_2$ @ 1.5 % enhance the growth, yield and quality of tomato. The effectiveness of using $CaCl_2$ as a postharvest treatment varies depending on the crop. In this study, a local tomato variety called "Thilina" that was collected at commercial maturity was used to test the effects of various $CaCl_2$ administration methods and concentrations. Fruits treated with $CaCl_2$ had their postharvest quality assessed in typical tropical storage settings. Additionally, a water-soluble dye was used to study the probable calcium routes.

MATERIAL AND METHODS

The investigation at Department of Biological Science, Sam Higginbottom Institute of Agriculture, Technology and Sciences, (Deemed- to- be- University) Allahabad (U.P.) India.

Details of Experiment. Crop- Tomato (*Lycopersicon esculentum*), Variety- S-22, No. of Treatment -5, No. of Replication -3, Total No. of plots -15

Treatment Combination. T_0=normal /plain water, T_1=600 ppm $CaCl_2$ (600mg /L), T_2=1200ppm $CaCl_2$ (1200mg/L), T_3=1800ppm $CaCl_2$ (1800mg/L), T_4=2400ppm $CaCl_2$ (2400mg/L).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads

Plant height (cm). Plant height (cm) peaked 45 days after the test in T_0 = Normal/plain water (49.00cm), followed by T_2 = 1200ppm $CaCl_2$ (1200mg/L) (49.00cm), and T_3 = 1800ppm $CaCl_2$ (1800mg/L) (46.33cm). T_0 = Normal/plain water had the lowest plant height (cm), followed by T_3 = 1800 ppm $CaCl_2$ (1800 gm/L) (52.00 cm) and T_4 = 2400 ppm $CaCl_2$ (2400 mg/L) (53.00 cm) at 60 DAT. T_1=600 ppm $CaCl_2$ (600 mg/L) (52.66 cm) followed by T_2=1200 ppm $CaCl_2$ (1200 mg/L) (53.00 cm) had the highest plant height (cm) at 75 DAT, whereas T_0 Normal/plain water had the lowest (49.33 cm). Tejwashwani (2018) reported that the application of $CaCl_2$ alone significantly increased the plant height.

Number of Leaves & Branches /plant. In T_1=600 ppm $CaCl_2$ (600 mg/L) (49.33), the highest number of leaves was recorded at 75 DAT, followed by T_0=normal/plain water (42.66) and T_3=1800 ppm $CaCl_2$ (1800 mg/L) (35.00). With T_1=600 ppm $CaCl_2$ (600 mg/L) (54.00), the highest number of leaves was seen 60 DAT, followed by T_2=1200 ppm $CaCl_2$ (1200 mg/L) (50.00), and T_4=2400 ppm $CaCl_2$ (2400 mg/L) (38.66). For T_0=normal/plain water, the highest number of leaves was recorded 45 DAT (64.00), followed by T_2=1200ppm $CaCl_2$ (1200mg/L) (62.66), and T_4=2400ppm $CaCl_2$ (2400mg/L) (51.00). Among T_0=normal/plain water (9.00), T_1=600 ppm $CaCl_2$ (600 mg/L) (7.33), and T_4=2400 ppm $CaCl_2$ (2400 mg/L), T_3=1800 ppm $CaCl_2$ (1800 mg/L), and T_4=2400 ppm $CaCl_2$ (2400 mg/L), the greatest number of branches was recorded 45 DAT. Sixty DAT had the highest number of branches in T_0=Normal/plant water (9.00), followed by T_1=600 ppm $CaCl_2$ (600 mg/L) (8.00), and T_3=1800 ppm $CaCl_2$ (1800 mg/L) (7.33) that had the lowest number. T_2 had the fewest branches (75 DAT) at 1200 ppm $CaCl_2$ (1200 mg/L) (9.00), followed by T_1 at 600 ppm $CaCl_2$ (600 mg/L) (9.33), and T_4 at 2400 ppm $CaCl_2$ (2400 mg/L) (7.33). (Rab and Haq 2012) investigated in tomato plants (*Solanum lycopersicum* L.) at influences plant growth, yield, and quality of tomato were reduced when salt was applied during the development of the first inflorescence.

Number of flower & Fruit/Plant. In T_0=normal/plain water, the highest number of flowers per plant was recorded at 45 DAT (17.00), followed by T_1=600 ppm $CaCl_2$ (600 mg/L) 14.66, and T_4=2400 ppm $CaCl_2$ (2400 mg/L) (10.00). In T_0=normal/plain water, the highest number of flowers per plant was recorded at 60 DAT (13.33), followed by T_1=600 ppm $CaCl_2$ (600 mg/L) (11.66), and T_4=2400 ppm $CaCl_2$ (2400 mg/L) (7.33). The highest blossom count per plant was recorded 75 DAT in T_0=normal/plain water (1.66), followed by T_1=600 ppm $CaCl_2$ (600 mg/L) (0.66), and T_2=1200 ppm $CaCl_2$ (1200 mg/L) (0.00). After 60 days, the highest number of fruits per plant was recorded in T_0=normal/plain water (4.33), followed by T_2=1200ppm $CaCl_2$ (1200mg/L) (3.00), and T_4=2400ppm $CaCl_2$ (2400mg/L) (2.66). T_0 = normal/plain water (3.66) had the most fruit per plant at 75 DAT, followed by T_1 = 600 ppm $CaCl_2$ (600 mg/L) (3.00), and T_3 = 1800 ppm $CaCl_2$ (1800 mg/L) and T_4 = 2400 ppm $CaCl_2$ (2400 mg/L). Liu *et al.* (2010) studied under simulated drought stress using $CaCl_2$ solution to improve tomato fruit quality.

Average Fruit Weight (g)/Plant. The average fruit weight (g) per plant was maximum in the physiology tomato T_0=normal /plain water (475) followed by T_1=600 ppm $CaCl_2$ (600mg /L) (218) and the minimum was observed in T_4=2400ppm $CaCl_2$ (2400mg/L) (125) average fruit weight (g) per plant. According to (Daundasekera *et al.*, 2015) it was reported that $CaCl_2$ increases the fruit weight and yield of many crops such as the tomato exhibited a significant reduction in fresh weight

Fresh & Dry Weight/ Plant (g). The treatment the fresh weight was observed with T_0=normal /plain water (36.8) followed by in T_1=600ppm $CaCl_2$ (600mg/L) (25.4) and the minimum was observed in T_4=2400ppm $CaCl_2$ (2400mg/L) (13.1). Maximum dry weight in T_0 = normal plant / water (14.7) followed by T_1 = 600ppm/ $CaCl_2$ (600mg/L) (10.5) and the minimum was observed in T_4 = 2400ppm $CaCl_2$ (2400mg/L) (6.3). Abdur and Ihsan-ul Haq (2012b) reported that the application of $CaCl_2$ alone significantly increased the plant height and fruits per plant and decreased the incidence of blossom end rot. Borax alone significantly enhanced the number of branches per plant, number of flowers per cluster, fruits per cluster, fruits per plant, fruit weight, fruit firmness, and total soluble solid content of the fruits.

Table 1a: Effect of calcium chloride stress on growth and yield parameters of tomato.

Treatments		Plant Height (cm)			Number of Leaves/plant			Number of Branches/ plant		
		45DAT	60DAT	75DAT	45DAT	60DAT	75DAT	45DAT	60DAT	75DAT
T_0	Normal /plain water	48.66	49.00	49.33	42.66	46.33	64.00	9	9	9
T_1	600 ppm $CaCl_2$ (600mg /L)	48.00	50.66	52.66	49.33	54.00	59.33	7.33	8	9.33
T_2	1200ppm$CaCl_2$ (1200mg/L)	49.00	52.00	53.00	35.33	50.00	62.66	7	7.66	10
T_3	1800ppm$CaCl_2$ (1800mg/L)	46.33	47.66	51.33	35.00	49.00	52.66	6.33	7	8
T_4	2400ppm$CaCl_2$ (2400mg/L)	47.00	47.33	53.00	38.66	38.66	51.00	6	7	7.33
	SE(m)	5.96	4.26	3.09	3.49	5.30	2.97	0.40	0.32	0.84
	C. D. at 5%	12.43	8.88	6.45	7.28	11.05	6.20	0.83	0.66	1.76

Table 1b: Effect of calcium chloride stress on growth and yield parameters of tomato.

Treatments		Number of Flower/ Plant			Number of Fruit/ Plant		Average Fruit Weight (g)/Plant	Fresh Weight/ Plant (g)	Dry Weight/ Plant (g)
		45DAT	60DAT	75DAT	60DAT	75DAT	75DAT	75DAT	75DAT
T_0	Normal /plain water	17.00	13.33	1.66	4.33	3.66	475	36.8	14.7
T_1	600 ppm $CaCl_2$ (600mg /L)	14.66	11.66	0.66	3.00	3.00	218	25.4	10.5
T_2	1200ppm$CaCl_2$ (1200mg/L)	11.66	8.00	0.00	3.66	2.66	191	19.0	7.9
T_3	1800ppm$CaCl_2$ (1800mg/L)	11.66	8.33	0.33	3.00	2.00	150	15.8	6.6
T_4	2400ppm$CaCl_2$ (2400mg/L)	10.00	7.33	0.33	2.66	2.00	125	13.1	6.3
	SE(m)	0.89	1.54	0.52	0.72	0.39	1.33	0.51	1.55
	C. D. at 5%	1.87	3.20	1.07	1.50	0.81	2.78	1.06	3.22

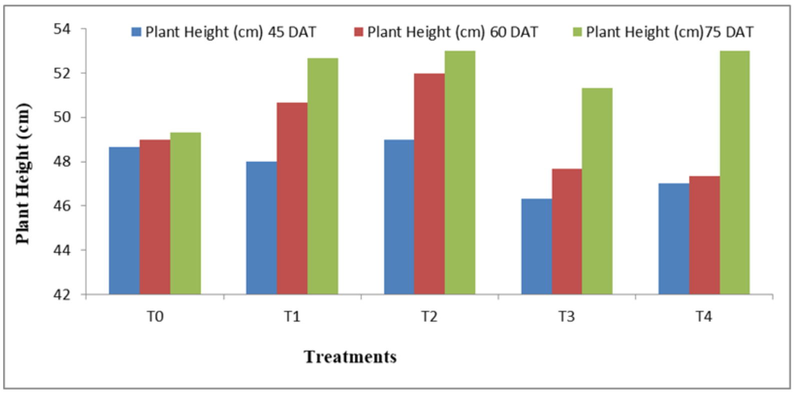

Fig. 1a. Effect of calcium chloride stress on plant height of tomato.

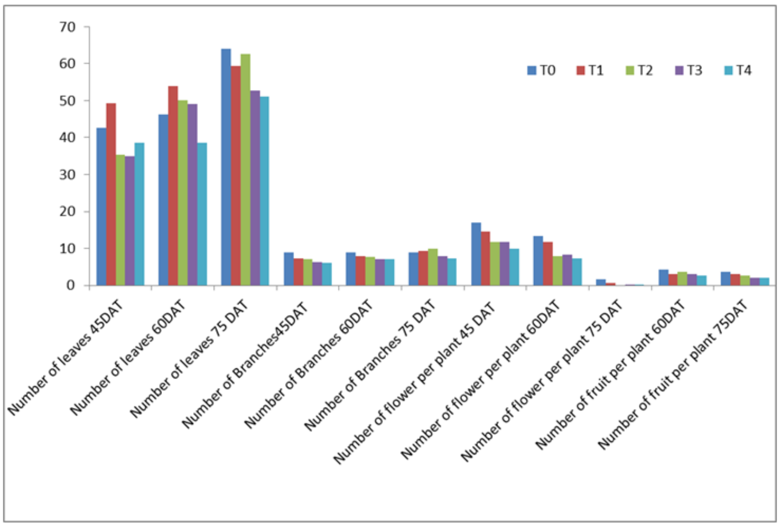

Fig. 1b. Effect of calcium chloride stress on growth & yield parameters of tomato.

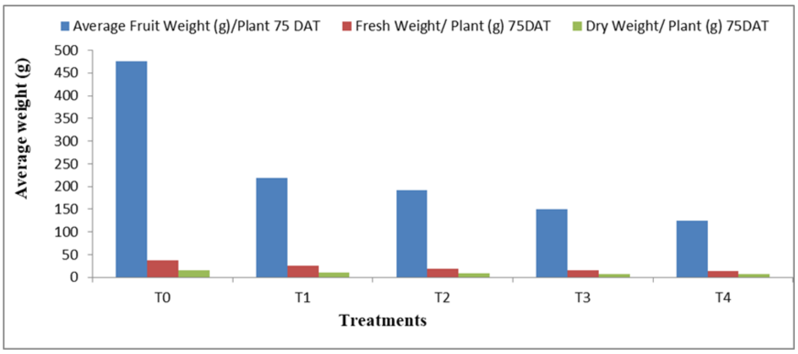

Fig. 1c. Effect of calcium chloride stress on growth & yield parameters of tomato.

CONCLUSIONS

There were five treatment which were sown for raising winter (rabi) season Tomato crop. The five treatment T_0=normal /plain water, T_1=600 ppm $CaCl_2$ (600mg /L), T_2=1200ppm $CaCl_2$ (1200mg/L), T_3=1800ppm $CaCl_2$ (1800mg/L) and T_4=2400ppm $CaCl_2$ (2400mg/L). In view of the results summarized above, following conclusion maybe drown calcium chloride stress has significant effect on the growth physiology of the tomato plant.

REFERENCES

Abdur, R. and Haq, I. U. (2012b). Foliar application of calcium chloride and borax influences plant growth, yield, and quality of tomato (*Lycopersicon esculentum* Mill.) fruit. Turkish *Journal of Agriculture and Forestry*, *36*(6), 695-701.

Bauer, R., Lehmann, C., Martini, J., Eckardt, F. and Hoch, M. (2004). Gap junction channel protein in nexin 2 is essential for epithelial morphogenesis in the Drosophila embryo. *Mol. Biol. Cel.*, *15*(6), 2992-3004.

Chauhan, S., Yadav, D., Kumar, S., Kumar, R. and Kumar, A. (2023). Effect of Calcium on the Growth and Yield of Tomato (*Solanum lycopersicum* L.). *Biological Forum – An International Journal*, *15*(10), 1162-1166.

Daundasekera, W. A. M., Liyanage, G. L. S. G., Wijerathne, R. Y. and Pieris, R. (2015). Preharvest calcium chloride application improves postharvest keeping quality of tomato (*Lycopersicon esculentum* Mill.). *Ceylon J. Sci.*, *44*, 55–60.

FAO (2022). Crop Water Information: Tomato http://www.Fao.org/FAO –Water Development and Management Unit –Crop Water Information Maize.Htm.

Hussein, M. M., Balbaa, L. K. and Gaballah, M. S. (2010). Salicylic Acid and Salinity Effects on Growth of Maize. *Plants Research Journal of Agriculture and Biological Sciences*, *3*(1), 321-328.

Liu, M. C., Liu, X. L., Hao, J. and Gao, L. H. (2010). Effect of simulated drought stress on plant growth, yield and fruit properties of tomato. *Acta Horticulturae*, *85*(6), 193-202.

Mishra, S. and Prakash, V. (2018). Biochemical changes in calcium chloride treated Hisar Arun (Local) and Kashi Vishesh (Hybrid) cultivars of Tomato fruit. *Curr. Agric. Res. J.*, *6*, 395.

Mazumder, M. N. N., Misran, A., Ding, P., Wahab, P. E. M. and Mohamad, Preharvest, A. (2021). Foliar Spray of Calcium Chloride on Growth, Yield, Quality, and Shelf Life Extension of different Lowland Tomato Varieties in Malaysia. *Horticulturae*, *7*(1), 466.

Rab, A. and Haq, I. U. (2012). Foliar application of calcium chloride and borax influences plant growth, yield, and quality of tomato (*Lycopersicon esculentum* Mill.) fruit. *Turk. J. Agric.*, *36*, 695–701.

Tejwashwani, A. (2018). Growth and Yield Attributes an influenced by calcium foliar nutrient under poly house condition. Int. J. Pure. *Appl. Biosci*, *6*, 952-957.

Tolasa, M., Gedamu, F. and Woldetsadik, K. (2021). Impacts of harvesting stages and pre-storage treatments on shelf life and quality of tomato (*Solanum lycopersicum* L.). *Cogent Food Agric*, *7*, 1863620.

Verma, M., Kumar, S., Yadav, P.K., Sharma, A.K., Kumawat, A. and Kumari Lata (2024). Effect of Salicylic Acid and $CaCl_2$ on Growth and Yield of Tomato in Arid Environment of Western Rajasthan. *Biological Forum – An International Journal*, *16*(7): 197-199.

How to cite this article: Fouzi A. Ibrahim, Suchit A. John and Soni Mourya (2024). Evaluate the Effect of Different Levels of $CaCl_2$ on Growth and Yield of Tomato (*Lycopersicon esculentum*). *Biological Forum – An International Journal*, *16*(12): 89-92.