Biological Forum – An International Journal **15(10): 1162-1166(2023)**

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

Effect of Calcium on the Growth and Yield of Tomato (*Solanum lycopersicum* L.)

Shubham Chauhan[1*], Deependra Yadav[2], Sandeep Kumar[2], Ravinder Kumar[3] and Alok Kumar[4]

[1]M.Sc. Scholar, Department of Horticulture,
School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.
[2]Assistant Professor, Department of Horticulture,
School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.
[3]Assistant Professor, Department of Soil Science,
School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.
[4]Assistant Professor, Department of Genetics and Plant Breeding,
School of Agriculture, Abhilashi University, Mandi (Himachal Pradesh), India.

(Corresponding author: Shubham Chauhan)*
(Received: 22 August 2023; Revised: 24 September 2023; Accepted: 05 October 2023; Published: 15 October 2023)
(Published by Research Trend)

ABSTRACT: The present experiment entitled "Effect of calcium on the growth and yield of Tomato (*Solanum lycopersicum* L.)" was conducted at the Research Farm, School of Agriculture, Abhilashi University, Mandi (H.P.) during *kharif*, 2023. The experiment was laid out in Randomized Block Design (RBD) with seven treatments and three replications. The result revealed that the value of Nitrogen (176.57 kg), Phosphorus (22.57 kg) and Potassium (143.69 kg) were recorded highest in T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting). From the result, it has been observed that plant height (92.17 cm and 124.89 cm) at 45 and 60 DAT in T_3 (RDF + Basal dose of calcium @ 10 kg/ha) and T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting), number of leaves (50.66 and 127.33) at 45 and 60 DAT in T_3 (RDF + Basal dose of calcium @ 10 kg/ha) and T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting) and fresh and dry weight of leaves (74.44 g and 17.78) at harvest in T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting) recorded desirable in the respective treatments. The parameters of the yield *viz*., fruits per plant and effective plant population of tomato were studied. Maximum yield per plot (37.83 kg), yield per hectare (70.05 t/ha) and effective plant population at harvest (19.33) were found in T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting). Among the treatments, the maximum cost of cultivation (₹274492), gross return (₹2101500) and net return (₹1835108) were recorded in treatment T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting).

Keywords: Tomato, calcium, growth, yield and treatments.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.), is one of the most popular vegetable crop grown throughout the world because of its wider adaptability. It belongs to family Solanaceae with the chromosome number 2n=2x=24 and has originated from Peru, South America. It is the most popular as salad in the raw state and is made into soups, juice, ketchup, pickles, sauces, conserves, puree, paste, powder and other products. It also has a high medicinal value because of its sweet taste and cooling nature.

India ranks second in the area and production of tomato in the world after China. India is the largest producing tomato and it is grown in an area of 842.75 thousand hectare with the total production of 20694.30 thousand metric tonnes (Anonymous, 2022). In India major Tomato producing states are Karnataka, Madhya Pradesh, Odisha, Kerala, Gujarat, Chhattisgarh, Maharashtra etc. In Himachal Pradesh, it is grown in an area of about 14.00 thousand hectares with a production of 577.00 thousand tonnes (Anonymous, 2022).

Tomato plants can be grown successfully on fertile, well-drained, non-crusting soil. Basically, sandy and red loam soil rich in organic matter suitable for tomato plants. The optimum pH range for tomato cultivation is between 6.0 to 7.0. Tomato plants cannot grow well when soil pH below 6.0, because deficiencies of organic matter. The deficiency of secondary and micro-nutrients in soil may affect the yield and quality of tomato. Tomato is cultivated in summer season in India. The tomato fruits are antiseptic that is used to cures mouth cancer and sore mouth. The red pigment, lycopene is considered as the "world's most powerful natural antioxidant". Hybrid tomato crop requires more of nutrients for higher yield and quality of fruits and this can be achieved by application of recommended quantity of organic and inorganic nutrients. Tomatoes is the excellent source of minerals and vitamins

(Akinfasoye *et al.,* 2011). The tomato fruit contains 3-4 % total sugars, 4-7 % total solids, 15-30 mg $100g^{-1}$ of ascorbic acid and 20-50 mg $100g^{-1}$ of lycopene (Chadha, 2006).

Higher production of tomato depends upon adoption of high yielding varieties, appropriate crop management practices, timely irrigation, balanced fertilization and control of diseases, mulching and insect pests. In India, the tomato holds a prominent place among the country's favourite vegetables.

Calcium is one of the essential nutrients for the growth of a tomato crop. Lack of calcium cause a physiological disorder in tomato called "Blossom-end rot". It occurs when there is lack of calcium in the soil during the dry periods. Its symptoms occur at the blossom end portions as clear or light brown area often said 'water soaked', which eventually becomes dark brown, dry, sunken and leathery. It greatly reduces the quality of fruit and production of crop. It is crucial for the structure of cell walls and cell membranes, fruit growth and development as well as fruit quality in general. Calcium also improves resistance to bacterial and viral diseases (Ustun *et al.,* 2007). The foliar nutrition of calcium is very effective due to the high nutrient absorption directly on leaf surfaces and their efficient utilisation. Calcium increases ammonium, potassium and phosphorus absorption stimulates photosynthesis and increases the size of plant parts. Calcium also increases the yield of tomato when used as a fertilizer (Akhtar *et al*., 2010). The deficiency of calcium proved to be a limiting factor in production and quality. However, Ca requirement of plants must be met continuously to sustain healthy leaf and root development (Amor and Marcelis 2003).

MATERIAL AND METHODS

The present investigation entitled "Effect of calcium on the growth and yield of tomato (*Solanum lycopersicum* L.)" was conducted at Abhilashi University, School of Agriculture, Chachyot, was conducted during *kharif* season of 2023. The experimental site is located at Abhilashi University, School of Agriculture, Mandi, Himachal Pradesh. The experimental farm is situated at 31°33′32″ N and 77°00′53″ E longitudes having an altitude of 1,411 meters above mean sea level.

The experiment was laid out in Randomized Block Design (RBD). Factorial with three replications comprising of seven treatments. The treatment were T_1: Control; (RDF). without calcium, T_2: RDF + Basal dose of calcium @ 10 kg/ha, T_3: RDF + Basal dose of calcium @ 15 kg/ha, T_4: RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting, T_5: RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting, T_6: RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting, T_7: RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting was followed.

The seed of tomato cv. Anshal were dibbied at spacing of 90 x 30 cm. Irrigation immediately after seed sowing and then once in 10-12 days. The proper irrigation helps to maintain the optimum soil moisture in the field. Recommended dose of NPK and soil application of calcium were applied before transplanting. Before the commencement of experiment, soil sample were collected randomly from different plots of experimental field from depth of 0-15 cm. The soil sample after drying was passed through 2.0 mm and was analyzed for soil pH and for available NPK in soil. The result of the analysis and method used are presented in Table 1. The recommended dose of N, P_2O_5 and K_2O were applied through urea, single super phosphate, muriate of potash respectively according to the treatment. Different growth and yield parameters like plant height, number of leaves, number of fruits per plant, yield per hectare. The statical analysis was carried out by using the statistical package OPSTAT.

RESULTS AND DISCUSSION

A. Soil characteristics of experimental field

Data pertaining to soil pH, available NPK (Table 1) showed that foliar spray of calcium did not affect pH in the soil. The treatments were found significant effect on available NPK.

The minimum pH value was recorded in T_1Control; (RDF) without calcium (6.0) and maximum pH was recorded in T_7 (6.2) RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting. Similarly, non-significant effect of foliar application on pH of the soil were also reported by Mahajan (2021). In case of available NPK T_7RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting observed the higher nitrogen (176.57 kg) phosphorus (22.57 kg) potassium (143.69 kg) in the soil and T_1Control; (RDF) without calcium had the lowest nitrogen (170.74 kg) phosphorus (17.92 kg) potassium (138.84 kg). The effects of foliar application of calcium sources and levels on nutrients *viz*., N, P and K content of tomato were found to be statistically significant. The similar results were reported by Kumar *et al.* (2006); Sahin *et al.* (2015); Mahajan (2021); Dhakal *et al.* (2009).

B. Plant growth attributes

Plant height. Improvement of growth characters is pre-requisite to increases yield (Table 2). From the result, it has been observed that plant height (92.17 and 124.89 cm) at 45 and 60 DAT resulted in T_3 (RDF + Basal dose of calcium @ 10 kg/ha) and T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting), followed by T_2 (RDF + Basal dose of calcium @ 10 kg/ha) and T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting), whereas minimum plant height was recorded in treatment T_1(Control; (RDF) without calcium) i.e., 74.02 and 110.26 cm at 45 and 60 DAT. Ca is very essential for the meristematic activity. It plays an important role to maintain chromosome structure in mitosis (cell division) and helps to increase height of plant. The similar findings were recorded by Abdur and Ihsan (2012); Tuna *et al.* (2007).

Table 1: Effect of Ca on available soil pH and NPK at harvest.

Treatments	Soil pH	N	P	K
T_1	6.03	170.74	17.92	138.84
T_2	6.09	171.58	19.27	141.94
T_3	6.17	172.93	20.84	142.13
T_4	6.11	173.09	21.61	139.31
T_5	6.13	174.23	21.27	139.12
T_6	6.18	174.38	20.69	141.30
T_7	6.23	176.57	22.57	143.69
S.E. (m) ±	0.26	0.5	0.57	0.38
CD at 5%	NS	1.57	1.79	1.19

** DAT: Days after transplanting. *T_1: Control; (RDF) without Calcium, T_2: RDF + Basal dose of calcium @ 10 kg/ha, T_3: RDF + Basal dose of calcium @ 15 kg/ha, T_4: RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting, T_5: RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting, T_6: RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting. T_7 : RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting

Number of leaves. The highest number of leaves (50.66 and 127.33) at 45 and 60 DAT were recorded in T_3 (RDF + Basal dose of calcium @ 10 kg/ha) and T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting), it was followed by T_2 (RDF + Basal dose of calcium @ 10 kg/ha) and T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting). The minimum number of leaves were recorded in T_4 (RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting) and T_1 (Control; (RDF). without Calcium) i.e.,30.33 and 101.66 at 45 and 60 Days after transplanting, respectively. The Ca is directly involved in improving photosynthesis which results in high leaf number. The same result was obtained by Islam *et al.* (2016), Haleema *et al.* (2018); Ayyub *et al.* (2012).

Fruits per plant. The highest number of fruits per plant (31.66) were recorded in T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting. It was followed by T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting) and T_6 (RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting and the lowest fruit per plant (20.66) was observed in T_1 (Control; (RDF) without calcium). The plant tissue numerous enzyme activity may have been increased by the calcium, Number of fruits per plant depends on the number of flowers and the ability of the plant to provide the nutrients required for growth and development. The same result was obtained by Meena (2015); Ilyas *et al*. (2016); Verma *et al*. (2018).

Fresh and dry weight of leaves. The highest fresh and dry weight of leaves (74.44 g and 17.78) at harvest were recorded in T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting) recorded desirable in the respective treatments. It was followed by T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting) and the minimum fresh and dry weight of leaves (53.93 g) (9.19 g) recorded in T_1 (Control; (RDF) without calcium). Leaf dry weight was determined after drying at 65°C for 2–3 week. Similar results were also reported by Hao and Papadopoulos (2003).

Days to harvest. The minimum days to last fruit harvest was recorded in treatment T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting) (99.33). It was followed by T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting). Whereas, maximum days to last fruit harvest was recorded in treatment, T_1 (Control; (RDF) without calcium) (117.33). These results might be because of the earliness in the flowering and fruiting. The same result was obtained by Saleem *et al.* (2019).

B. Yield attributes

Yield per plot. Maximum yield per plot obtained with the application of (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting) in T_7 registered maximum fruit yield of 37.83 kg plot^{-1} and lowest fruit yield (12.94 kg plot^{-1}) was recorded in T_1 **(**Control; (RDF) without calcium). The higher nutrient availability and their subsequent use of nutrients for improving yield parameters is the reason of the increased yield. Additionally, better nutrient and photosynthesis assimilation results in better plant growth and yield. The same result was obtained by Cardozo *et al*. (2001); Ekinci *et al*. (2015); Saleem *et al*. (2019); Lavanya and Bahadur (2021).

Yield per hectare. The highest fruit yield per hectare (70.05 t/ha) were recorded in T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting), on the other side, the treatment T_1 (Control; (RDF). without calcium) resulted lowest fruit yield/hectare (23.97 t/ha). Through improved canopy development, the foliar nutrition of calcium may have led to an increase in fruit set and better fruit weight. This would also have increased efficiency of photosynthesis in plants. Additionally, the calcium has increased the activity of several enzymes, including phospholipase, arginine kinase and amylase, which would have improved flowering, fruit set and ultimately crop yield. The same result was obtained by Syahren *et al.* (2012); Verma (2018); Dixit *et al*. (2018); Le and Bui (2019).

Plant population. The maximum plant population (19.33) at harvest were recorded in T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting). It was followed by T_5 (RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting). On the other hand, lowest plant population resulted (14.33) T_1 (Control; (RDF) without calcium).

C. Economics

The data revealed that highest cost of cultivation ₹/hectare (₹ 2,74,492), maximum gross income ₹/hectare amounting to (₹ 2,10,1500), highest net return ₹/hectare (₹ 1,83,5108) was incurred in treatment T_7 (RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting. Whereas lowest cost of cultivation ₹/hectare (₹ 2,61,562), minimum gross income ₹/hectare (₹ 7,19,100), lowest net return ₹/hectare (₹ 4,57,538), was observed in treatment T_1 Control; (RDF) without calcium.

Table 2: Effect of Ca on growth parameters influenced by different treatments.

Treatments	Plant height (cm) at 45 DAT	Plant height (cm) at 60 DAT	Number of leaves at 45 days	Number of leaves at 60 days	Number of fruits per plant	Fresh weight of leaves (g)	Dry weight of leaves (g)	Days to harvest
T_1	74.02	110.26	33.66	101.66	20.66	53.93	9.19	117.33
T_2	87.89	112.80	44.33	104.33	22.00	56.06	10.00	114.66
T_3	92.17	113.08	50.66	108.66	23.33	58.57	10.40	110.66
T_4	77.86	116.54	30.33	114.66	25.66	62.81	12.44	108.00
T_5	79.94	120.38	35.33	127.33	28.33	74.44	17.78	99.33
T_6	75.50	118.20	36.66	118.00	27.33	67.13	12.96	107.33
T_7	81.89	124.89	38.33	122.33	31.66	72.18	16.53	103.66
S.E. (m) ±	1.98	1.99	2.23	1.76	1.90	2.14	1.22	2.27
CD at 5%	6.17	6.21	6.97	5.48	5.93	6.68	3.82	7.07

** DAT: Days after transplanting. *T_1: Control; (RDF) without Calcium, T_2: RDF + Basal dose of calcium @ 10 kg/ha, T_3: RDF + Basal dose of calcium @ 15 kg/ha, T_4: RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting, T_5: RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting, T_6: RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting. T_7: RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting.

Table 3: Effect of Ca on yield parameters influenced by different treatments.

Treatment code	Yield per plot (kg)	Yield per hectare (t)	Plant population
T_1	12.94	23.97	14.33
T_2	15.90	29.44	15.00
T_3	17.81	32.99	15.66
T_4	22.40	41.49	16.33
T_5	30.35	56.20	18.66
T_6	27.13	50.24	17.66
T_7	37.83	70.05	19.33
S.E. (m) ±	2.22	4.11	0.44
CD at 5%	6.92	12.82	1.39

** DAT: Days after transplanting. *T_1: Control; (RDF) without Calcium, T_2: RDF + Basal dose of calcium @ 10 kg/ha, T_3: RDF + Basal dose of calcium @ 15 kg/ha, T_4: RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting, T_5: RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting, T_6: RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting. T_7 : RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting.

Table 4: Economics parameters influenced by different treatments.

Treatment	Cost of cultivation (₹/ha)	Gross Return (₹/ha)	Net Return (₹/ha)
T_1	269664	719100	457538
T_2	270364	883200	620938
T_3	270714	989700	727088
T_4	270454	1244700	982348
T_5	272674	1686000	1421428
T_6	271424	1507200	1243878
T_7	274492	2101500	1835108

** DAT: Days after transplanting. *T_1: Control; (RDF) without Calcium, T_2: RDF + Basal dose of calcium @ 10 kg/ha, T_3: RDF + Basal dose of calcium @ 15 kg/ha, T_4: RDF + Foliar application of calcium @ 0.25% at 45 Days after transplanting, T_5: RDF + Foliar application of calcium @ 0.25% at 45 and 75 Days after transplanting, T_6: RDF + Foliar application of calcium @ 0.5% at 45 Days after transplanting. T_7: RDF + Foliar application of calcium @ 0.5% at 45 and 75 Days after transplanting.

CONCLUSIONS

From the investigation of the study, it may be 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. Hence this treatment can be recommended for the farmers of mid hill zone.

FUTURE SCOPE

The impact of suggested combination of calcium fertilizer nutrients saving, soil fertility improvement, better production and on soil health must be explored in future. Hence study of effect of calcium in present and for bright future is very important.

Acknowledgement. The authors are thankful to Abhilashi University for providing all the necessary facilities to conduct the experiment.
Conflict of Interest. None.

REFERENCES

Abdur, R., & Ihsan, H. (2012). Foliar application of calcium chloride and borax influences plant growth, yield & quality of tomato (*Lycopersicon esculentum* Mill.) fruit. *Turkey Journal of Agriculture*, *36*(6), 695-701.

Akhtar, M. E., Khan, M. Z., Rashis, M. T., Ahsan, Z., & Ahmad, S. (2010). Effect of potash application on yield and quality of tomato (*Lycopersicon esculentum* Mill.). *Pakistan Journal of Botany*, *42*(3), 1695-1702.

Akinfasoye, J., Dotun, A., Ogunniyan, J., & Ajayi, E. O. (2011). Phenotypic relationship among agronomic characters of commercial tomato (*Lycopersicum esculentum* Mill.) hybrids. *American-Eurasian Journal of Agronomy*, *4*(1), 17-22.

Anonymous (2022). National Horticulture Board Database. (www.nhb.gov.in)

Ayyub, C. M., Pervez, M. A., Shaheen, M. R., Ashraf, M. I., Haider, M. W., Hussain, S., & Mahmood, N. (2012). Assessment of various growth and yield attributes of tomato in response to pre-harvest applications of calcium chloride. *Pakistan Journal of Life and Social Science*, *10*(2), 102-105.

Cardozo, V. P., Pizetta, N. V., & Teixeira, N. T. (2001). Manuring of foliate with calcium and boron in the culture of the tomato (*Lycopersicon esculentum* Mill) cv. Debora Max. *Ecossistema*, *26*(1), 39-41.

Chadha, K. L. (2006). Hand Book of Horticulture. ICAR publication, *New Delhi*, 109-114.

Amor, F. D., & Marcelis, L. F. M. (2003). Regulation of nutrient uptake, water uptake and growth under calcium starvation and recovery. *The Journal of Horticultural Science and Biotechnology*, *78*(3), 343-349.

Dhakal, D., Shah, S. C., Gautam, D. M. & Yadav, R. N. (2009). Response of cauliflower (*Brassica oleracea var. botrytis*) to the application of boron and phosphorus in the soils of Rupandehi District. *Nepal Agricultural Research Journal*, *9*, 56-66.

Dixit, A., Sharma, D., Sharma, T. K., & Bairwa, P. L. (2018). Effect of foliar application of some macro and micronutrients on growth and yield of tomato (*Solanum lycopersicum* L.) cv. Arka Rakshak. *International Journal of Current Microbiology and Applied Sciences*, *6*(12), 197-203.

Ekinci, M., Esringü, A., Dursun, A., Yildirim, E., Turan, M., Karaman, M. R., & Arjumend, T. (2015). Growth, yield, and calcium and boron uptake of tomato (*Lycopersicon esculentum* L.) and cucumber (*Cucumis sativus* L.) as affected by calcium and boron humate application in greenhouse conditions. *Turkish Journal of Agriculture and Forestry*, *39*(5), 613-632.

Haleema, B., Rab, A., & Hussain, S. A. (2018). Effect of Calcium, Boron and Zinc Foliar Application on Growth and Fruit Production of Tomato. *Sarhad Journal of Agriculture*, *34*(1), 19-30.

Hao, X., & Papadopoulos, A. P. (2003). Effects of calcium and magnesium on growth, fruit yield and quality in a fall greenhouse tomato crop grown on rockwool. *Canadian Journal of Plant Science*, *83*(4), 903-912.

Ilyas, M., Ahmad, M., Hussain, Z., Saeed, A., Begum, F., Khan, M, I., & Shah, S. (2016). Interactive effect of calcium and magnesium on the growth and yield of tomato (*Lycopersicon esculentum* Mill.). *Pure and Applied Biology*, *5*, 876-882.

Islam, M. Z., Mele, M. A., Baek, J. P., & Kang, H. M. (2016). Cherry tomato qualities affected by foliar spraying with boron and calcium. *Horticulture, Environment, and Biotechnology*, *57*, 46-52.

Kumar, N., Slngh, S., & Singh, V. (2006). Effect of iron and sulphur levels on yield, oil content and their uptake by Indian mustard (*Brassica juncea*). *Indian Journal of Agronomy*, *51*(1), 63-64.

Lavanya, G., & Bahadur, V. (2021) economics of effect of calcium and boron on growth, yield and quality of cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) under shade net condition. *Indian Journal of Pure and Applied Bioscience*, *9*, 232-239

Le, V. T., & Bui, B. T. (2019). Effects of Gibberellic acid, micronutrient fertilizer and Calcium nitrate foliar fertilizer on growth and yield of tomato (*Solanum lycopersicum* L.) cultivated in Vietnam. *RUDN Journal of Agronomy and Animal Industries*, *14*(4), 306-318.

Mahajan (2021). Effect of foliar application of calcium and boron on tomato (*Solanum lycopersicum* L.) productivity and soil health in Kullu valley of Himachal Pradesh. M.sc thesis department of soil science.

Meena, D. C., Maji, S., Meena, J. K., Kumawat, R., Meena, K. R., Kumar, S., & Sodh, K. (2015). Improvement of growth, yield and quality of tomato (*Solanum lycopersicum* L.) cv. Azad T-6 with foliar application of zinc and boron. *International Journal of Bio-resource and Stress Management 6*, 598-601.

Sahin, S., Gebologlu, N., & Karaman, M. R. (2015). Interactive effect of calcium and boron on growth, quality and mineral content of tomato (*Solanum lycopersicon* L.). *Fresenius Environmental Bulletin*, *24*(5), 1624-1628.

Saleem, S., Anayat, R., Mushtaq, F., Mustafa, I., Khan, S. R., Farwah, S., & Hussain, S. M. (2019). Effect of foliar application of calcium and magnesium on growth and yield of tomato (*Solanum lycopersicum* L.) variety Marglobe. *International Journal of Chemical Studies*, *7*(4), 1555-1561.

Syahren, A. M., Wong, N. C., & Mahmud, S. (2012). The efficacy of calcium formulation for treatment of tomato blossom-end rot. *Journal Tropical Agriculture and Foundation of Science*, *40*(1), 89-98.

Tuna, A. L., Kaya, C., Ashraf, M., Altunlu, H., Yokas, I., & Yagmur, B. (2007). The effects of calcium sulphate on growth, membrane stability and nutrient uptake of tomato plants grown under salt stress. *Environmental and Experimental Botany*, *59*(2), 173-178.

Ustun, N., Altunlu, H., Yokaş, I., & Saygili, H. (2007). Influence of potassium and calcium levels on severity of tomato pith necrosis and yield of greenhouse tomatoes. *International Symposium on Tomato Diseases*, *808*, 347-350.

Verma, V. K., Jha, A. K., Verma, B. C., Babu, S., & Patel, R. K. (2018). Response of tomato (*Solanum lycopersicum*) to foliar application of micronutrients under low cost protected structure in acidic soil of Meghalaya. *Indian Journal of Agricultural Sciences*, *88*(7), 998-1003.

How to cite this article: Shubham Chauhan, Deependra Yadav, Sandeep Kumar, Ravinder Kumar and Alok Kumar (2023). Effect of Calcium on the Growth and Yield of Tomato (*Solanum lycopersicum* L.). *Biological Forum – An International Journal*, *15*(10): 1162-1166.