GLOBAL JOURNAL OF AGRICULTURAL AND ALLIED SCIENCES (2024) VOL 5, ISSUE 1, PAGES 15-19

SHORT COMMUNICATION

Effect of Foliar Spray of Calcium on the Growth and Yield of Strawberry (*Fragaria ananassa* Duch. cv. Winter Dawn) in Chitwan, Nepal

Srijana Pandey[1,*], Arjun Kumar Shrestha[1], Shashan Devkota[2], Khusi Ram Tiwari[3]

[1]*Department of Horticulture, Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal*

[2]*Department of Entomology, Faculty of Agriculture, Nepal Polytechnic Institute, Bharatpur, Chitwan, Nepal*

[3]*Bayer Crop Science, USA*

MANUSCRIPT INFO

Article history:
Received: April 27 2024
Revised: December 22 2024
Accepted: December 23 2024

Keywords:
Calcium-EDTA
Flowering
Fruit setting
Number of leaves
Plant height

ABSTRACT

The productivity of strawberries can be severely affected by calcium deficiency. However, appropriate application rate of calcium is still not known well, especially for the production condition of Nepal. The objective of the study was to determine an appropriate rate of calcium for strawberry (*Fragaria ananassa*) production in Chitwan, Nepal. A field experiment was conducted from November 2021 to March 2022 in Chitwan, Nepal, in a randomized complete block design with six treatments and four replications. The strawberry variety Winter Dawn was subjected to five rates of calcium-EDTA (250, 500, 750, 1000, 1250 ppm) and a control without calcium-EDTA (water spray). Foliar sprays of calcium-EDTA were applied three times: 30, 45, and 60 days after transplanting (DAT). Plant height, number of leaves per plant, canopy diameter, and fruit diameter and weight data were collected and analyzed, and yield per hectare was calculated. Plant height (23.14 cm), number of leaves per plant (38.70), and canopy diameter (30.12 cm) were higher for 1000-ppm calcium-EDTA, followed by 750-ppm calcium-EDTA. The 1000-ppm calcium-EDTA application shortened the flowering period (42.55 days), increased fruit setting (78.84%), and increased the number of flowers per plant (29.20), the number of fruits per plant (19.18), and the yield (24.73 t/ha) of strawberries. Thus, a foliar spray of 1000-ppm calcium-EDTA was found to be the most effective in increasing strawberry production by 65% compared to the control. The rate of calcium-EDTA above 1000 ppm was found harmful for strawberries. These results can be useful for the commercial strawberry growers in Chitwan and similar agro-ecological conditions.

Citation:
Pandey, S., Shrestha, A. K., Devkota, S., & Tiwari, K. R. (2024). Effect of foliar spray of calcium on the growth and yield of strawberry (*Fragaria ananassa* Duch. cv. Winter Dawn) in Chitwan, Nepal. *Global Journal of Agricultural and Allied Sciences, 5*(1), 15-19.

1. Introduction

The garden strawberry (*Fragaria ananassa* Duch.) (2n = 8x = 56), belonging to the family *Rosaceae*, is considered a widely distributed and profitable fruit due to its genetic diversity and adaptability. It is rich in vitamin C, folate, and ellagic acid, and reduces cancer risk (Bakshi et al., 2013). Botanically, strawberry is an aggregate fruit, known as an etaerio of achenes, with the edible part being the succulent thalamus, which is primarily propagated through one-year-old runners (Chandrakar et al., 2018). It is a false fruit made up of numerous small individual fruits embedded in a fleshy, scarlet receptacle (Wani et al., 2017). Strawberry has an attractive appearance, sweet taste with slight acidity, and its flavor is due to benzyl acetate and methyl butanoate (Hussein and Al-Doori., 2021). Strawberry, a fast-growing crop, is highly responsive to fertilization and requires sufficient nutrient absorption to support its rapid growth. This includes increasing canopy density, enhancing leaf nutrient content, fresh and dry weight, and overall plant health (Hassan, 2016). Foliar fertilization supplies essential nutrients to plants, particularly trace elements, and is crucial when root-based nutrient uptake is insufficient (Lateef et al., 2021).

Calcium is an immobile secondary nutrient, and its redistribution through the phloem from older tissues is limited (Souza et al., 2023). Its absorption mainly occurs at root tips, and uptake depends on the unidirectional transpiration stream, making soil application less effective (Sidhu et al., 2020). It is essential for pollen grain development, germination, pollen tube growth, sugar synthesis and accumulation, and for improving the bloom index and bloom density (Muengkaew et al., 2017). Calcium plays a crucial role in enhancing cell wall integrity, supporting cell growth and division, aiding nitrogen assimilation, and serving as a cofactor for certain enzymes (Sajid et al., 2020). However, the slow movement of Ca in plants affects fruit yield and quality, as it must be transferred to the plant and fruits to reduce damage to physiological processes (Mehraj et al., 2015). The use of chelates like amino acids with Ca penetrate plant tissues, and their slow degradation prevents Ca from binding to the anionic regions of plant cell membranes (Mandour et al., 2019). The decreasing

* *Corresponding author.* E-mail address: srijanapandey6@gmail.com

https://doi.org/10.35251/gjaas.2024.003

transpiration rates during extended periods of cloudy weather can lead to calcium deficiency, resulting in symptoms like burnt leaf tips and margins in horticultural crops (Saeedi et al., 2015).

The reduced use of secondary nutrients impairs strawberry growth, leading to stunted root and leaf development, and lower fruit yield (Ibrahim, 2021). Optimal fertilization and Ca application improve its growth, yield, and quality, while delaying ripening and reducing postharvest decay (Bakshi et al., 2013). However, strawberry fruits treated with higher dose of Ca can lead to higher decay rate causing cell wall disintegration and substrate displacement due to phytotoxicity (Chen et al., 2011). Research related to site-specific nutrient management in strawberries is limited in Nepal as strawberry cultivation is not widely commercialized by farmers. Standardization of Ca rates for commercial production has not yet been well evaluated in Nepal, and farmers are often unaware of nutrient management practices, such as the use of Ca and its effective concentration for higher yields. The objective of this research was to determine an optimal level of calcium to enhance growth and yield of strawberries.

2. Materials and Methods

The research was conducted from November 2021 to March 2022 in the Chitwan district of Nepal (27.39 °N and 84.23 °E) at an elevation of 197 meters above sea level. During the study period, temperatures ranged between 11.64°C to 32.95°C, and relative humidity ranged from 66% to 84.7%. Soil samples were collected before manuring and fertilization by digging a pit 30 cm deep from each plot and made composite to assess the chemical properties of the soil. The soil samples of the experimental site were analyzed at the Agricultural Technology Centre (ATC), Kupandole. The results of soil sample analysis revealed that the soil type of the experimental field was sandy loam with acidic pH (5.3), medium amount of soil organic matter (3.02%) and nitrogen content (0.18%), higher amount of phosphorous (67.4 kg/ha) and potassium (456.8 kg/ha), and an exchangeable calcium level of 10.56 milliequivalent/100 g.

The experiment was laid out in a randomized complete block design with six treatments and four replications. Each plot measured 2.7 m x 0.9 m and 'Winter Dawn' variety of strawberry was planted at a density of 15 plants per plot, with a spacing of 30 cm x 30 cm. Among the 15 plants, five were tagged for data recording. Calcium-EDTA (trade name: "Pusti-Calcium"), containing 10% Ca, was used as the Ca source. The six treatments included: Control (water spray only), 250-ppm calcium-EDTA, 500-ppm calcium-EDTA, 750-ppm calcium-EDTA, 1000-ppm calcium-EDTA, and 1250-ppm calcium-EDTA. To prepare the calcium-EDTA solution, the desired amount of calcium-EDTA was thoroughly dissolved in the required volume of water, and 15 mL of surfactant (trade name: "Hybrid SB") was added as a sticker. Precautions were taken to prevent the addition of nutrients to the soil by using polythene sheets. The desired concentration of calcium-EDTA solution was prepared and sprayed three times at 30, 45 and 60 days after transplanting (DAT) of strawberries.

Strawberry saplings with 2-3 fully open leaves were transplanted on November 17, 2021, onto raised beds covered with black/silver plastic mulch. Plants were placed at a depth where the crowns were above the surface, but the roots were completely buried. Overhead irrigation was provided for one week after transplanting. To meet the crop's fertilizer needs, NPK (3:5:4) was applied at 4 kg/ha/week up to the vegetative development stage, followed by NPK (2:1:4) at 4 kg/ha/week during the blooming and fruiting stages by fertigation (Shrestha et al., 2023). Weeding was performed periodically as needed. Thiamethoxam (Actara) at 25 g in 50 L of water, with 25 mL of surfactant (Hybrid SB) was sprayed on the strawberry on November 25, 2021. Similarly, the fungicides (Kingmil and Criptan) were applied on December 2, 2021, and January 7, 2022, respectively, for the control of fungal diseases.

The plant height, number of leaves, and canopy diameter of five demarcated plants in each plot were recorded at 35, 50, 65 DAT, and every 15 days thereafter until harvest. Plant height was measured from the crown level to the apex of the primary leaves using a graduated ruler. The number of leaves were counted manually from each treatment. The canopy diameter was measured in the north-south and east-west directions using a graduated ruler. The days to first flower appearance from transplanting and the number of flowers produced were recorded during each flush of the cropping season. All flowers that appeared within the first five weeks of transplantation were removed to ensure proper vegetative growth. After that, the number of flowers per plant were counted manually and the average number of flowers per plant was calculated. The number of fruits per plant was recorded as the average of the cumulative number of fruits from all harvests of the selected plants. Fruit set (%) was calculated as follows:

$$\text{Fruit set \%} = \frac{\text{Total number of fruits per plant}}{\text{Total number of flowers per plant}} \times 100$$

A vernier caliper was used to measure the diameter of five randomly selected fruits from each plot, and their average was computed and represented in millimeters (mm). The total number of fruits harvested per plant was counted and fruit weight was measured. Fruit yield per hectare was determined by calculating fruit yield per plant, multiplied by plant number in a plot, and extrapolating it to yield in kg/ha based on fruit yield per plot. The R-Studio was used for analyzing data after tabulating them in Microsoft Excel. The means were separated using the Duncan's Multiple Range Test (DMRT) to determine the level of probability of interpretation (Gomez and Gomez, 1984).

3. Results

3.1. Plant height

Plant height of strawberry was influenced by different rates of calcium-EDTA at 95 DAT (Table 1). The tallest plants were recorded with 1000 ppm calcium-EDTA followed by 750 ppm calcium-EDTA. However, plant height was reduced at 1250 ppm followed by control (water spray). Strawberry plants attained the maximum height at 95 DAT.

3.2 Number of leaves per plant

Number of leaves per plant was influenced by different rates of calcium-EDTA at 95 DAT (Table 1). The highest number of leaves per plant were recorded with 1000 ppm of calcium-EDTA compared to the control. The lowest number of leaves per plant was recorded with 1250 ppm calcium-EDTA which was statistically at par with the control and calcium-EDTA at 250 ppm.

3.3. Canopy diameter

Canopy diameter was also influenced by different rates of calcium-EDTA at 95 DAT (Table 1). The highest canopy diameter was recorded with 1000 ppm calcium-EDTA compared to the control. The lowest canopy diameter was recorded with 1250 ppm calcium-EDTA followed by the control, which was statistically at par with 250 ppm calcium-EDTA.

Table 1. Plant height, leaves per plant, and canopy diameter at 95 DAT of strawberries as influenced by different rates of foliar-applied calcium-EDTA in Chitwan, Nepal, 2022

Treatments	Plant height (cm)	Leaf number per plant	Canopy diameter (cm)
No Ca-EDTA (control)	18.89^{d}	30.55^{cd}	27.26^{c}
250 ppm Ca-EDTA	20.44^{c}	31.80^{cd}	27.63^{c}
500 ppm Ca-EDTA	20.70^{c}	34.40^{bc}	28.35^{bc}
750 ppm Ca-EDTA	21.99^{b}	37.55^{ab}	29.18^{ab}
1000 ppm Ca-EDTA	23.14^{a}	38.70^{a}	30.12^{a}
1250 ppm Ca-EDTA	17.79^{e}	28.00^{d}	25.79^{d}
F-test	***	***	***
$LSD_{0.05}$	0.84	3.72	1.36
SEM	0.28	1.23	0.44
CV (%)	2.74	7.38	3.14

Means with same letter in each column are not different at least p = 0.05. *Significant at 5% (p<0.05), **Significant at 1% (p<0.01), ***highly significant at 0.1% (p<0.001), SEM = Standard error of mean, LSD = Least significant difference, CV = Coefficient of variation, and DAT = Days after transplanting

3.4. Phenological parameters

Phenological differences were found with different rates of calcium-EDTA application as presented in Table 2. Earliest flowering (42.55 days) was observed with calcium-EDTA at 1000 ppm and 750 ppm, while delayed flowering (57.55 days) was recorded with the control. The highest number of flowers per plant (29.20) was recorded with 1000 ppm calcium-EDTA which was statistically similar to calcium-EDTA at 750 ppm. The highest number of fruits per plant (19.18) was also recorded with 1000 ppm of calcium-EDTA which was statistically at par with calcium-EDTA at 750 ppm and 500 ppm. The highest fruit set (78.84%) was recorded with calcium-EDTA at 1000 ppm, 750 ppm and 500 ppm. The lowest numbers of flower and fruit set were recorded at 1250 ppm calcium-EDTA, which was statistically at par with the control and calcium-EDTA at 250 ppm.

Table 2. Phenological variables of strawberry as influenced by different rates of foliar-applied calcium-EDTA in Chitwan, Nepal, 2022

Treatments	Phenological parameters			
	Days to first flowering	Number of flowers per plant	Number of fruits per plant	Fruit set (%)
No Ca-EDTA (control)	57.55^{a}	22.10^{c}	15.11^{b}	67.49^{b}
250 ppm Ca-EDTA	52.70^{b}	22.70^{bc}	16.01^{b}	67.86^{b}
500 ppm Ca-EDTA	51.95^{b}	25.05^{b}	18.16^{a}	77.77^{a}
750 ppm Ca-EDTA	44.35^{c}	28.20^{a}	18.84^{a}	78.38^{a}
1000 ppm Ca-EDTA	42.55^{c}	29.20^{a}	19.18^{a}	78.84^{a}
1250 ppm Ca-EDTA	50.35^{b}	21.65^{c}	14.83^{b}	67.72^{b}
F-test	***	***	***	**
$LSD_{0.05}$	2.86	2.51	1.25	7.08
SEM	0.95	0.83	0.41	2.35
CV (%)	3.83	6.70	4.87	6.43

Means with same letter in each column are not different at least p = 0.05. *Significant at 5% (p<0.05), **Significant at 1% (p<0.01), ***highly significant at 0.1% (p<0.001), SEM = Standard error of mean, LSD = Least significant difference, CV = Coefficient of variation

3.5. Yield attributes of strawberry

Fruit diameter, fruit weight and yield per hectare were found to be influenced by different rates of calcium-EDTA as presented in Table 3. The largest fruit diameter (41.80 mm) was recorded with 1000 ppm of calcium-EDTA followed by calcium-EDTA at 750 ppm, 500 ppm, and 250 ppm. The highest rate of calcium-EDTA (1250 ppm), however, had the lowest fruit diameter (34.97 mm), which was statistically similar with the control treatment. The maximum fruit weight (20.91 g) was recorded with calcium-EDTA at 1000 ppm, which was statistically at par with 750 ppm calcium-EDTA, whereas the minimum fruit weight (16.07 g) was recorded with 1250 ppm Ca followed by no calcium-EDTA, and calcium-EDTA at 250 and 500 ppm. The highest yield (24.73 t/ha) was recorded with 1000 ppm calcium-EDTA, which was statistically at par with the treatment of calcium-EDTA at 750 ppm. The lowest yield per hectare was recorded with 1250 ppm calcium-EDTA, which was statistically at par with the control and calcium-EDTA at 250 ppm. The response of strawberry yield to different rates of calcium-EDTA is illustrated in Fig. 1.

Table 3. Effect of rates of foliar-applied calcium-EDTA on different yield attributes of strawberry in Chitwan, Nepal, 2022

Treatments	Yield attributes		
	Fruit diameter (mm)	Fruit weight (g/fruit)	Yield (mt./ha.)
No Ca-EDTA (control)	35.26^{d}	16.14^{b}	14.99^{c}
250 ppm Ca-EDTA	38.07^{c}	16.74^{b}	16.09^{c}
500 ppm Ca-EDTA	39.28^{bc}	16.75^{b}	18.69^{b}
750 ppm Ca-EDTA	40.51^{ab}	20.36^{a}	23.67^{a}
1000 ppm Ca-EDTA	41.80^{a}	20.91^{a}	24.73^{a}
1250 ppm Ca-EDTA	34.97^{d}	16.07^{b}	14.70^{c}
F-test	***	**	***
$LSD_{0.05}$	2.19	2.49	2.03
SEM	0.72	0.83	0.67
CV (%)	3.80	9.28	7.19

Means with same letter in each column are not different at least p = 0.05. *Significant at 5% (p<0.05), **Significant at 1% (p<0.01), ***highly significant at 0.1% (p<0.001), SEM = Standard error of mean, LSD = Least significant difference, CV = Coefficient of variation

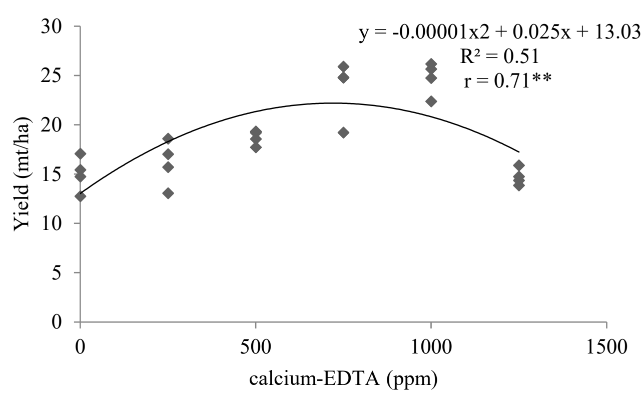

Figure 1. Strawberry yield response to different rates of calcium-EDTA

3.6. Relationship between yield and other parameters

There was a positive correlation (*p*<0.05) between plant height, number of fruits per plant, and yield per plant (Fig. 2). Yield per plant was strongly correlated with plant height (r = 0.77). It was found that 59% (R^2= 0.59) variation in the yield per plant was accounted for the variation in the plant height. Similarly, a positive correlation ($p<0.05$) was found between the number of fruits per plant and yield per plant. Yield per plant was strongly correlated with number of fruits per plant (r = 0.78), with 79 % (R^2= 0.79).

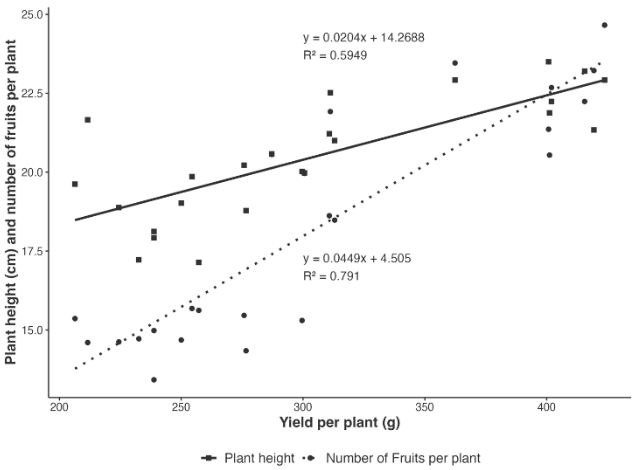

Figure 2. Correlation between plant height and fruit number with yield per plant

4. Discussion

The application of 1000 ppm calcium-EDTA increased the plant height, followed by the 750-ppm calcium-EDTA. This might be because of the role of Ca in cell division, cell elongation, and the permeability of plasma membranes, which results in a rise in plant height. Sajid et al. (2020) mentioned that Ca is essential for the regulation of meristematic growth because it aids in maintenance and regulation of the lamellary system in cell organelles, which encourage vegetative growth. The process of hormone metabolism is accelerated by Ca, which further enhances the production of auxin, and promotes the growth and development promoting compound in strawberry plants (Bakshi et al., 2013). Mandour et al. (2019) also reported that spraying the strawberry plants with increasing dose of Ca chelate increased plant height.

Increased number of leaves with the application of calcium-EDTA at 1000 ppm could be because of the enhancement in nitrogen-use efficiency and photosynthesis, thereby increasing the plant growth and leaf number (Sajid et al., 2020). The above result is in accordance with findings of Ibrahim (2021), such that the combination of Ca (1 g/L) with boron and zinc increased the number of leaves. Bakshi et al. (2013) also reported that the number of leaves increased with the increase in Ca concentration. Calcium-EDTA at 1000 ppm enhanced flowering and increased the number of flowers and fruit set per plant compared to the control. The optimal supply of Ca during the whole crop season, which promotes the vegetative development of the plant, higher photosynthesis, and quicker reproductive growth, may be the cause of the early blooming (Wani et al., 2017). Similar results were obtained by Mehraj et al. (2015) and Chandrakar et al. (2018). The increase in flower and fruit number may be due to optimum Ca absorption by plant tissues and balance of plant physiology, which increased vegetative and reproductive growth, thereby amplifying the number of flowers and fruit per plant (Saeedi et al., 2015).

Calcium-EDTA at 1000 ppm also resulted in the highest fruit set as compared to the control plot in the current study, which is consistent with the finding of Hussein and Al-Doori (2021) that Ca application increased fruit set in strawberry. This may be due to increased photosynthesis. Another factor contributing to increased fruit set may be the role of calcium in hormone metabolism, which encourages auxin production, a process necessary for fruit set and development (Kazemi, 2014). Calcium is crucial for producing viable pollen grains and their development and germination, as well as the growth of pollen tube, which increases fruit set percentage in Mango (Muengkaew et al., 2017). Calcium has a role in cell division and elongation, thereby increasing fruit diameter. As a result, fruit diameter and fruit weight were recorded highest among plants receiving 1000 ppm calcium-EDTA treatment. Mehraj et al. (2015) and Sidhu et al. (2020) also found that optimum dose of Ca produced higher fruit diameter compared to control plot. The increase in fruit weight could be because of the effects of Ca on cell elongation and change in cell turgor pressure, resulting in cell wall enlargement and increasing fruit weight (Souza et al., 2023). This result agrees with the findings of Lateef et al. (2021) and Bakshi et al. (2013).

The highest fruit yield of strawberry was recorded among plants receiving 1000 ppm calcium-EDTA treatment, which may be due to enhanced photosynthetic capability and increased process of hormone metabolism. Hassan (2016) reported that the application of global chelated Ca at 1000 ppm on strawberry plants had higher fruit yield than the untreated plants. Chen et al. (2011) reported that the higher concentration of Ca decreased growth and yield due to phytotoxicity that led cell wall disintegration and substrate delocalization.

5. Conclusion

Based on the results presented and discussed above, it can be concluded that the foliar application of calcium-EDTA at 1000 ppm was found to be the most effective for enhancing vegetative growth and yield components, resulting in 65% increased yield of strawberry. The results also indicated that the application of calcium at the rate above 1000 ppm was not beneficial for strawberry production. These results may be applicable for commercial strawberry production in areas with similar agro-ecologies.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publications of this research article.

References

Bakshi, P., Jasrotia, A., Wali, V. K., Sharma, A., & Bakshi, M. (2013). Influence of pre-harvest application of Ca and micro-nutrients on growth, yield, quality and shelf-life of strawberry cv. Chandler. *Indian Journal of Agricultural Sciences,83* (8), 831-835.

Chandrakar, S., Singh, P., Panigrahi, H. K., Sharma, G. L., & Paikra, S. (2018). Effect of foliar spray of Ca and micro-nutrients on growth parameters, flowering, fruiting and fruit maturity of strawberry (*Fragaria* x *ananassa* Duch.) cv. Nabila under net tunnel. *Journal of Pharmacognosy and Phytochemistry,7* (6), 05-10.

Chen, F., Liu, H., Yang, H., Lai, S., Cheng, X., Xin, Y., et al. (2011). Quality attributes and cell wall properties of strawberries (*Fragaria annanassa* Duch.) under Ca chloride treatment. *Food Chemistry,126* (2), 450-459.

Gomez, K. A., & Gomez, A. A. (1984). *Statistical procedures for agricultural research.* New York: John Wiley & Sons.

Hassan, A. H. (2016). Effect of different natural potassium fertilizer rates and microbial inoculants as well as foliar spray of Ca on growth and yield of strawberry plants grown under organic fertilizer systems. *Middle East Journal of Applied Science,6*, 1038-1053.

Hussein, S. A., & Al-Doori, M. F. (2021). The effect of spraying with calcium, boron and benzyl adenine on the quantity and quality of strawberry plants (*Fragaria ananassa* Duch) cv. Rubygem. In *IOP Conference Series: Earth and Environmental Science*.doi: http://dx.doi.org/10.1088/1755-1315/910/1/012066

Ibrahim, H. K. (2021). Effect of foliar application with calcium, boron and zinc on the yield and quality of strawberry fruits and post-harvest diseases. *Journal of Environmental Studies and Researches,11* (2), 300-314.

Kazemi, M. (2014). Influence of foliar application of iron, calcium and zinc sulfate on vegetative growth and reproductive characteristics of strawberry cv.'Pajaro. *Trakia Journal of Sciences,12* (1), 21-26.doi: http://www.uni-sz.bg/

Lateef, M. A., Noori, A. M., Saleh, Y. M., & Al-Taey, D. K. (2021). The effect of foliar spraying with salicylic acid and calcium chloride on the growth, yield, and storage traits of two strawberry cultivars, *Fragaria* x *ananassa* duch. *International Journal of Agriculture Statistics Science,17* (2), 611-615.doi: https://connectjournals.com/03899.2021.17.611

Mandour, M. A., Metwaly, H. A., & Ali, A. M. (2019). Effect of foliar spray with amino acids, citric acid, some calcium compounds and mono-potassium phosphate on productivity, storability and controlling gray mould of strawberry fruits under sandy soil conditions. *Zagazig Journal of Agricultural Research,46* (4), 985-997.

Mehraj, H., Hussain, M. S., Parvin, S., Shiam, I. H., & Jamal Udddin, A. F. (2015). Foliar application of calcium for quality production of strawberry. *Journal of Experimental Biosciences,6*, 73-76.

Muengkaew, R., Chaiprasart, P., & Wongsawad, P. (2017). Calcium-boron addition promotes pollen germination and fruit set of mango. *International Journal of Fruit Science,17* (2), 147-158.doi: https://doi.org/10.1080/15538362.2016.1259085

Saeedi, R., Etemadi, N., Nikbakht, A., Khoshgoftarmanesh, A. H., & Sabzalian, M. R. (2015). Calcium chelated with amino acids improves quality and postharvest life of lisianthus (*Eustoma grandiflorum* cv. Cinderella Lime). *HortScience,50* (9), 1394-1398.

Sajid, M., Ullah, I., Rab, A., Shah, S. T., Basit, A., Bibi, F., et al. (2020). Foliar application of calcium improves growth, yield and quality of tomato cultivars. *Pure and Applied Biology (PAB),9* (1), 10-19.doi: http://dx.doi.org/10.19045/bspab.2020.90002

Shrestha, B., Tripathi, K. M., Shrestha, A. K., & Gautam, R. (2023). Evaluation of Chemical Attributes of Low Chilling Strawberry (*Fragraria ananassa*) Varieties in Chitwan, Nepal. *Nepalese Horticulture, 17*(1), 69-73.

Sidhu, R. S., Singh, N. P., Singh, S., & Sharda, R. (2020). Foliar nutrition with calcium nitrate in strawberries (*Fragaria*× *ananassa* Duch.): Effect on fruit quality and yield. *Indian Journal of Ecology,47* (1), 87-91.

Souza, J. M., Leonel, S., Leonel, M., Garcia, E. L., Ribeiro, L. R., Ferreira, R. B., et al. (2023). Calcium nutrition in fig orchards enhance fruit quality at harvest and storage. *Horticulturae,9* (1), 123.doi: https://doi.org/10.3390/horticulturae9010123

Wani, R. A., Jahangeer, A. B., Hakeem, H. A., Qazi, S. R., Basu, Y. A., Umer, I., et al. (2017). Influence of differential combinations of fertilizer and manure combinations on vegetative growth, yield and quality of strawberry (*Fragaria* x *ananassa* Duch.). *International Journal of Current Microbiology and Applied Sciences,6* (11), 3396-3404.doi: https://doi.org/10.20546/ijcmas.2017.611.398