

Influence of foliar feeding of NPK (19:19:19) on growth, yield, and quality of Cucumber (*Cucumis sativus* L.) cv. Kalyanpur Green

Abstract

The present experiment entitled "Influence of foliar feeding of NPK (19:19:19) on growth, yield, and quality of Cucumber (*Cucumis sativus* L.) cv. Kalyanpur Green " was conducted during *Zaid* season of 2023-2024 at Department of vegetable science Kalyanpur, Kanpur. The trial was laid down in randomized complete block design (RCBD) with three replications and thirteen treatments *viz.* T₁- Control Plot water spray at 25,40 and 55 DAS, T₂- NPK (19:19:19:) @ 0.5% of foliar spray at 25 DAS, T₃- NPK (19:19:19:) @ 0.5% of foliar spray at 40 DAS, T₄- NPK (19:19:19:) @ 0.5% of foliar spray at 55 DAS, T₅- NPK (19:19:19:) @ 0.5% of foliar spray at 25 & 40 DAS, T₆- NPK (19:19:19:) @ 0.5% of foliar spray at 40 & 55 DAS, T₇- NPK (19:19:19:) @ 0.5% of foliar spray at 25,40 & 55 DAS, T₈- NPK (19:19:19:) @ 1.0% of foliar spray at 25 DAS, T₉- NPK (19:19:19:) @ 1.0% of foliar spray at 40 DAS, T₁₀- NPK (19:19:19:) @ 1.0% of foliar spray at 55 DAS, T₁₁- NPK (19:19:19:) @ 1.0% of foliar spray at 25 & 40 DAS, T₁₂- NPK (19:19:19:) @ 1.0% of foliar spray at 40 & 55 DAS and T₁₃- NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 DAS. **Result of study revealed that maximum vine length in T₁₃ (400.00 cm), first fruit harvest in T₁₃ (53.927 DAS), fruit length in T₁₃ (23.600cm), fruit width in T₁₃ (4.00cm), internode length in T₁₃ (18.900 cm), number of fruits per vine in T₁₃ (14.700), yield per plant in T₁₃ (2.60 kg), yield per plot in T₁₃ (23.900 kg), yield per hectare T₁₃ (98.200 quintal), Vitamin C in T₁₃ (4.043 mg/100gm), TSS in T₁₃ (3.693 %) whereas minimum days to first male flower in T₁₃ (39.497 DAS), days to first female flower in T₁₃ (39.800 DAS) and first fruit harvest in T₁₃ (51.927).** (The sentence is incomplete. please reform it without changing the meaning).

Keywords: Cucumber, NPK, foliar feeding, growth and yield.

Introduction

Cucumber, scientifically known as (*Cucumis sativus* L.,) is a widely popular vegetable from the Cucurbitaceae family, characterized by a chromosome number of 2n=14. Originating in India, cucumber boasts numerous nutritional benefits, including being a good source of iodine and comprising approximately 95% water and 4-6% dry substances, which include about 2% sugars, 1% albuminous substances, 0.7% cellular tissues, and 0.1% fat (Sushmita, S., 2018). This versatile vegetable, ideal for summer cultivation, finds its place in various culinary applications,

such as salads, pickles, desserts, and cooked dishes, owing to its edible tender fruits. It is a widely cultivated vegetable crop known for its crisp texture and refreshing taste. Among the many factors influencing its growth and productivity, nutrient management plays a critical role. Cucumber cultivation in India and specifically in Uttar Pradesh spans approximately 116.62 thousand hectares and 3.99 thousand hectares, respectively, with annual productions of 1,651.92 thousand metric tons (MT) and 100.57 thousand metric tons (MT). (Horticultural Statistics at a Glance 2021).

Traditional soil fertilization methods often face limitations due to nutrient leaching, volatilization, and poor soil nutrient availability. Foliar feeding, which involves applying nutrients directly to plant leaves, has emerged as an effective method to circumvent these issues. This technique ensures the rapid absorption of nutrients and can provide immediate supplementation during critical growth stages (Singh *et al.*, 2020). Foliar feeding, a method of supplying nutrients directly to the leaves, has gained popularity due to its potential to enhance plant growth and yield. This study focuses on the influence of foliar application of a balanced NPK (19:19:19) fertilizer on the growth, yield, and quality of the cucumber cultivar Kalyanpur Green. Among various foliar fertilizers, the balanced NPK (19:19:19) formulation has garnered significant attention. This formulation supplies equal proportions of nitrogen (N), phosphorus (P), and potassium (K), each of which is essential for different physiological processes: Despite its potential, there is a paucity of research on the specific effects of foliar-applied NPK (19:19:19) on the growth, yield, and quality of cucumber cv. Kalyanpur Green. This study aims to fill this gap by systematically investigating these parameters.

To evaluate the effects of foliar feeding with NPK (19:19:19) on vegetative growth parameters of cucumber cv. Kalyanpur Green, to assess the impact on yield attributes and total yield, to analyze the influence on fruit quality parameters, including physical and biochemical characteristics, to determine the optimal concentration and frequency of foliar application for achieving the best growth, yield, and quality outcomes. (The sentence is incomplete. please reform it without changing the meaning). Foliar applications were initiated at the four-leaf stage and continued at two-week intervals until the onset of fruiting. The nutrient solution was prepared by dissolving the appropriate concentration of NPK (19:19:19) in water and applied using a hand-held sprayer in the early morning to avoid evaporation losses. (Kumar *et al.*, 2018). It is hypothesized that foliar feeding with NPK (19:19:19) will significantly enhance the vegetative growth, yield, and quality of cucumber cv. Kalyanpur Green. The expected outcomes include: Improved plant height, leaf number, and leaf area due to enhanced nutrient availability, increased fruit set and yield as a result of better nutrient absorption and utilization, enhanced fruit quality attributes, leading to higher marketability and consumer acceptance.

2. MATERIALS AND METHODS

The present investigation was conducted during *Zaid* season of 2023-24 at Department of vegetable science, Chandrashekhar Azad University of Agriculture and Technology, Kalyanpur, Kanpur. The experiments were analyzed at Randomized Block Design(RBD). The experiment laid down in 3 replication replications and consisted 13 treatments viz. T₁- Control Plot water

spray at 25,40 and 55 DAS, T₂- NPK (19:19:19:) @ 0.5% of foliar spray at 25 DAS, T₃- NPK (19:19:19:) @ 0.5% of foliar spray at 40 DAS, T₄- NPK (19:19:19:) @ 0.5% of foliar spray at 55 DAS, T₅- NPK (19:19:19:) @ 0.5% of foliar spray at 25 & 40 DAS, T₆- NPK (19:19:19:) @ 0.5% of foliar spray at 40 & 55 DAS, T₇- NPK (19:19:19:) @ 0.5% of foliar spray at 25,40 & 55 DAS, T₈- NPK (19:19:19:) @ 1.0% of foliar spray at 25 DAS, T₉- NPK (19:19:19:) @ 1.0% of foliar spray at 40 DAS, T₁₀- NPK (19:19:19:) @ 1.0% of foliar spray at 55 DAS, T₁₁- NPK (19:19:19:) @ 1.0% of foliar spray at 25 & 40 DAS, T₁₂- NPK (19:19:19:) @ 1.0% of foliar spray at 40 & 55 DAS, T₁₃- NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 DAS. The Gross plot size was 4.8 × 4.0 m and the spacing was kept 150× 50 cm between and within rows. Standard cultural practices recommended were followed uniformly in all experiments.

Biometrical Analysis

Experimental data was subjected to biometrical analysis as per the standard procedure given by Gomez and Gomez (1984).

Table-1 Influence of foliar feeding of N.P.K. (19:19:19) on growth, yield, and quality

| Treatment | Vine length (cm) | Days to first male flower | Days to first female flower | First Fruit harvest (DAS) | Fruit length (cm) | Fruit width (cm) | Internode length (cm) | Number of fruits per vine | Yield per plant (Kg) | Yield per plot (Kg) | Yield per hectare (Quintal) | Vitamin C mg/100gm | TSS (°Brix) |
|---|------------------|---------------------------|-----------------------------|---------------------------|-------------------|------------------|-----------------------|---------------------------|----------------------|---------------------|-----------------------------|--------------------|-------------|
| T ₁ - Control Plot (water spray at 25,40 and 55 DAS) | 325.300 | 41.897 | 45.600 | 54.600 | 16.203 | 2.000 | 11.997 | 11.000 | 1.100 | 15.200 | 80.000 | 3.693 | 2.637 |
| T ₂ - NPK (19:19:19:) @ 0.5% of foliar spray at 25 DAS | 350.100 | 41.100 | 45.100 | 52.100 | 16.797 | 2.003 | 12.200 | 11.200 | 1.400 | 15.300 | 80.500 | 3.727 | 2.580 |
| T ₃ - NPK (19:19:19:) @ 0.5% of foliar spray at 40 DAS | 352.800 | 39.900 | 44.700 | 53.007 | 17.200 | 2.000 | 12.300 | 11.300 | 1.400 | 15.700 | 86.000 | 3.673 | 2.717 |
| T ₄ - NPK (19:19:19:) @ 0.5% of foliar spray at 55 DAS | 360.000 | 39.800 | 44.497 | 53.230 | 17.700 | 2.097 | 13.000 | 11.500 | 1.400 | 16.100 | 87.200 | 3.667 | 2.893 |
| T ₅ - NPK (19:19:19:) @ 0.5% of foliar spray at 25 & 40 DAS | 365.200 | 39.100 | 44.403 | 53.877 | 18.200 | 2.300 | 13.503 | 11.800 | 1.400 | 16.200 | 89.700 | 3.780 | 2.917 |
| T ₆ - NPK (19:19:19:) @ 0.5% of foliar spray at 40 & 55 DAS | 370.300 | 39.100 | 44.303 | 53.770 | 18.397 | 2.400 | 13.500 | 11.900 | 1.500 | 16.600 | 89.800 | 3.800 | 3.007 |
| T ₇ - NPK (19:19:19:) @ 0.5% of foliar spray at 25,40 & 55 DAS | 372.200 | 38.200 | 43.297 | 53.590 | 19.903 | 3.003 | 14.100 | 12.500 | 1.900 | 17.700 | 90.300 | 3.907 | 2.993 |
| T ₈ - NPK (19:19:19:) @ 1.0% of foliar spray at 25 DAS | 380.000 | 37.900 | 43.103 | 53.863 | 21.100 | 3.200 | 15.000 | 12.600 | 2.100 | 17.700 | 91.000 | 3.870 | 3.117 |
| T ₉ - NPK (19:19:19:) @ 1.0% of foliar spray at 40 DAS . | 383.300 | 37.403 | 42.100 | 53.943 | 21.500 | 3.000 | 16.200 | 12.900 | 2.200 | 18.200 | 91.300 | 3.933 | 3.200 |
| T ₁₀ - NPK (19:19:19:) @ 1.0% of foliar spray at 55 DAS | 390.100 | 41.903 | 40.400 | 52.930 | 21.700 | 3.400 | 17.097 | 13.100 | 2.300 | 18.700 | 92.800 | 4.003 | 3.300 |
| T ₁₁ - NPK (19:19:19:) @ 1.0% of foliar spray at 25 & 40 DAS | 392.000 | 41.100 | 40.000 | 53.337 | 21.700 | 3.500 | 18.603 | 13.600 | 2.400 | 21.100 | 96.700 | 4.010 | 3.490 |
| T ₁₂ - NPK (19:19:19:) @ 1.0% of foliar spray at 40 & 55 DAS | 395.800 | 39.900 | 39.497 | 53.037 | 23.603 | 4.000 | 18.800 | 13.700 | 2.500 | 22.300 | 97.100 | 4.023 | 3.483 |
| T ₁₃ - NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 | 400.00 | 39.800 | 39.497 | 51.927 | 23.600 | 4.20 | 18.900 | 14.700 | 2.600 | 23.900 | 98.200 | 4.043 | 3.693 |

| | | | | | | | | | | | | | |
|--------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| DAS | | | | | | | | | | | | | |
| C.D. | 14.255 | 1.740 | 2.022 | NS | 0.960 | 0.116 | 0.662 | 0.335 | 0.086 | 0.777 | 2.866 | 0.123 | 0.117 |
| SE(m) | 4.855 | 0.593 | 0.689 | 2.365 | 0.327 | 0.040 | 0.225 | 0.114 | 0.029 | 0.265 | 0.976 | 0.042 | 0.040 |
| SE(d) | 6.866 | 0.838 | 0.974 | 3.345 | 0.462 | 0.056 | 0.319 | 0.161 | 0.042 | 0.374 | 1.380 | 0.059 | 0.056 |

UNDER PEER REVIEW

~~RESEALT AND DISCUSSION~~

RESULTS AND DISCUSSIONS

Vine length (cm)

Among the various treatments T₁₃ had maximum vine length (348.100 cm) followed by T₁₂ (338.800 cm) and T₁₁ (334.00). Whereas minimum vine length was noticed in control (325.300 cm). (The marked part should be in a single sentence). Since, the foliar spray of NPK 19:19:19 can lead to maximum vine growth in cucumbers by ensuring a balanced and readily available supply of essential nutrients, enhancing overall plant health, and promoting efficient and rapid nutrient uptake directly through the leaves. Similar findings were noticed by Patil *et al.*, (1998).; (Table 1.)

Days to first male flowering

Among the various treatments T₁₃ produced male flower in minimum days (39.800 days after sowing) followed by T₁₂ (39.900 days after sowing) and T₁₁ (41.100 Days after sowing). Whereas maximum days for male flower initiation was noticed in control (41.897 days after sowing). (The marked part should be in a single sentence). Since the foliar application of NPK 19:19:19 helps by balanced nutrient supply, improved nutrient absorption, and enhanced photosynthesis and growth promoting early and healthy development of male flowers. Similar findings were noticed reported by Thriveni *et al.*, (2015).; (Table 1.)

Days to first female flower

Among the various treatments T₁₃ produced female flower in minimum days (39.497 days after sowing) followed by T₁₂ (39.497 days after sowing) and T₁₁ (40.000 Days days after sowing). Whereas maximum days for female flower initiation was noticed in control (45.600 days after sowing). (Merge this sentence with the first sentence). Since the earlier appearance of female flowers in cucumber plants treated with an NPK 19-19-19 foliar spray is due to the balanced and immediate nutrient availability that supports optimal plant growth, flowering, and hormonal balance. (Not creating a meaning, please complete the sentence). Similar findings were noticed reported by Prasad *et al.*, (2016).; (Table 1.)

First Fruit harvest (DAS)

Among the various treatments T₁₃ produced first fruit harvest in minimum days (53.927 days after sowing) followed by T₁₂ (53.037 days after sowing) and T₁₁ (53.337 days after sowing). Whereas maximum days for first fruit harvest was noticed in control (52.600 days after sowing). (The marked part should be in a single sentence). Since the early first fruit harvest in cucumbers following foliar spray with NPK 19:19:19 is likely due to enhanced nutrient availability, improved plant health, and optimized flowering and fruit setting processes facilitated by the balanced nutrient composition of the spray. (Not creating a meaning, please complete the sentence). Similar findings were noticed reported by Akinrinde, A. A., (2006) (Table 1.)

Fruit length (cm)

Among the various treatments T₁₃ fruit length (23.600 cm) followed by T₁₂ (23.603 cm) and T₁₁ (21.700 cm). Whereas minimum fruit length was noticed in control (16.203 cm). Since the foliar application of NPK 19:19:19 it helped by balanced nutrient supply, improved nutrient uptake, enhanced photosynthesis and metabolism and improved flowering and fruit set. Similar findings were noticed by Jagraj Singh *et al.*, (2020). (Table 1.)

**Follow the same pattern as instructed before

Fruit width (cm)

Among the various treatments T₁₃ had highest fruit width (4.20 cm) followed by T₁₂ (4.00 cm) and T₁₁ (3.50 cm). Whereas minimum fruit width was noticed in control (2.00 C.M cm) since the use of NPK 19-19-19 as a foliar spray provides a balanced supply of essential nutrients, leading to better vegetative growth, enhanced photosynthesis, improved metabolic functions, and overall plant health. These factors collectively contribute to an increase in the width of cucumber fruits. Similar findings were noticed by Gao Z, Zhang H, Cao C, *et al.*, (Table 1.)

**Follow the same pattern as instructed before

Internode length (cm)

Among the various treatments T₁₃ internode length (18.900 cm) followed by T₁₂ (18.800 cm) and T₁₁ (18.603 cm). Whereas minimum fruit width was noticed in control (11.997 cm). since the balanced nutrients provided by NPK 19-19-19 foliar spray directly contribute to better

internode length in cucumbers by supporting essential physiological and biochemical processes that promote overall plant growth and health. Similar findings were noticed by Alekar *et al.*, (2015).; (Table 1.)

****Follow the same pattern as instructed before**

Number of fruits per vine

Among the various treatments T₁₃ had highest number fruit per vine (14.700) followed by T₁₂ (13.700) and T₁₄ (13.600). Whereas minimum number of fruit was noticed in control (11.00) since the improved number of fruits per vine in cucumber plants treated with foliar spray NPK 19-19-19 can be attributed to the balanced supply of essential nutrients (N, P, K) supporting overall plant health, reproductive processes, and stress tolerance, ultimately enhancing fruit set and development. Similar findings were noticed by Thriveni *et al.*, (2015).; (Table 1.)

****Follow the same pattern as instructed before**

Yield per plant (Kg)

Among the various treatments T₁₃ yield per plant (2.600 kg) followed by T₁₂ (2.500 kg) and T₁₄ (2.400 kg). Whereas minimum yield per plant (kg) was noticed in control (1.100 kg) since the foliar spray of NPK 19-19-19 provides cucumbers with readily available and balanced nutrition, which supports optimal growth, development, and stress tolerance. This ultimately leads to better yields per plant compared to plants that might rely solely on soil-applied nutrients or those facing nutrient deficiencies. Similar findings were noticed by Mostafa, H. and Mohammad .M.M 2012. (Table 1.)

****Follow the same pattern as instructed before**

Yield per plot (Kg)

Among the various treatments T₁₃ had produced maximum yield per plot (23.900 kg) followed by T₁₂ (22.300 kg) and T₁₄ (21.100 kg). Whereas minimum yield per plot was noticed in control (15.200 kg) since the use of NPK 19-19-19 as a foliar spray on cucumber plants enhances nutrient availability, uptake efficiency, and supports robust growth and productivity, leading to

~~better yields per plot in cucumber cultivation. Similar findings were noticed by Arshad *et al.*, (2014) conducted. ;(Table 1.)~~

~~**Follow the same pattern as instructed before~~

Yield per hectare (q)

~~Among the various treatments T₁₃ yield per hectare (quintal) (98.200 q) followed by T₁₂ (97.100 q) and T₁₁ (96.700 q). Whereas minimum yield per hectare was noticed in control (80.00 q) since the better yield per hectare in cucumbers with NPK 19-19-19 foliar spray is due to its balanced nutrient composition, quick absorption by the plant, and targeted support for essential growth stages and physiological processes. These factors collectively contribute to healthier plants, improved fruit production, and ultimately, higher yields. Similar findings were noticed by Arun and Kumar (2014)., ;(Table 1.)~~

~~**Follow the same pattern as instructed before~~

Vitamin C (mg/100gm)

~~Among the various treatments T₁₃ had highest content vitamin C (4.043mg/100gm) followed by T₁₂ (4.023 mg/100gm) and T₁₁ (4.010 mg/100gm). Whereas minimum vitamin C content was noticed in control (3.693 mg/100gm). Since the foliar application of NPK 19:19:19 it helped the enhances photosynthetic efficiency, stress resistance, overall plant health, and specific biochemical pathways involved in vitamin C synthesis, leading to higher vitamin C content in the fruits. Similar findings were noticed by Sharma, M.K. 2009,;(Table 1.)~~

~~**Follow the same pattern as instructed before~~

Total soluble solid (TSS) of edible fruit (°Brix)

~~Among the various treatments T₁₃ had content highest Total soluble solid (TSS) of edible fruit (3.693%) followed by T₁₂ (3.483%) and T₁₁ (3.490%). Whereas minimum Total soluble solid (TSS) of edible fruit content was noticed in control (2.637 %) it helped the application of a balanced NPK 19-19-19 foliar spray enhances the TSS in cucumbers by providing essential nutrients that improve photosynthesis, carbohydrate synthesis, stress resistance, and overall fruit quality. Similar findings were noticed by Pandey, V., Ahmed, Z, *et al.*, 2005. ;(Table 1.)~~

**Follow the same pattern as instructed before

Conclusion

~~The study on the influence of foliar feeding with NPK (19:19:19) on various growth, yield, and quality parameters of cucumber (*Cucumis sativus* L.) cv. Kalyanpur Green has Overall, the foliar application of NPK 19:19:19 significantly enhances cucumber plant growth, flowering, fruiting, and yield, providing balanced and readily available nutrients, improving photosynthesis, and promoting overall plant health.~~

**Rewrite the conclusion with complete sentences and clear meanings.

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