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

Abstract

The present experiment 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.*T_1- Control Plot water spray at 25,40 and 55 DAS, T_2- NPK (19:19:19:) @ 0.5% of foliar spray at 25 DAS, T_3- NPK (19:19:19:) @ 0.5% of foliar spray at 40 DAS, T_4- NPK (19:19:19:) @ 0.5% of foliar spray at 55 DAS, T_5- NPK (19:19:19:) @ 0.5% of foliar spray at 25 & 40 DAS, T_6- NPK (19:19:19:) @ 0.5% of foliar spray at 40 & 55 DAS, T_7- NPK (19:19:19:) @ 0.5% of foliar spray at 25,40 & 55 DAS, T_8- NPK (19:19:19:) @ 1.0% of foliar spray at 25 DAS, T_9- NPK (19:19:19:) @ 1.0% of foliar spray at 40 DAS, T_{10}- NPK (19:19:19:) @ 1.0% of foliar spray at 55 DAS, T_{11}- NPK (19:19:19:) @ 1.0% of foliar spray at 25 & 40 DAS ,T_{12}- NPK (19:19:9:) @ 1.0% of foliar spray at 40 & 55 DAS and T_{13}- NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 DAS.Result of study revealed that maximum vine length (400.00 cm), first fruit harvest (53.927 DAS), fruit length (23.600cm), fruit width (4.00cm), internode lengthT_{13}(18.900 cm), number of fruits per vine(14.700), yield per plant(2.60 kg), yield per plot(23.900 kg), yield per hectare (98.200 quintal), Vitamin C(4.043 mg/100gm), TSS (3.693 %) and minimum days to first male flower (39.497 DAS), days to first female flower(39.800 DAS) and first fruit harvest(51.927) was found in treatment T_{13} NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 DAS.
Keywords: Cucumber, NPK, foliar feeding, growth, and yield.

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Introduction

Cucumber, scientifically known as (*Cucumissativus* 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 hectaresand 3.99thousand 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.

This study aims to evaluate the effects of foliar feeding with NPK (19:19:19) on vegetative growth parameters of cucumber cv. Kalyanpur Green, assess its impact on yield attributes and total yield, analyze the influence on fruit quality parameters including physical and biochemical characteristics, and determine the optimal concentration and frequency of foliar application for achieving the best growth, yield, and quality outcomes.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 replicationsand consisted of 13 treatments viz. T_1- Control Plot water spray at 25,40 and 55 DAS, T_2- NPK (19:19:19:) @ 0.5% of foliar spray at 25 DAS, T_3- NPK (19:19:19:) @ 0.5% of foliar spray at 40 DAS, T_4- NPK (19:19:19:) @ 0.5% of foliar spray at 55 DAS, T_5- NPK (19:19:19:) @ 0.5% of foliar spray at 25 & 40 DAS, T_6- NPK (19:19:19:) @

0.5% of foliar spray at 40 & 55 DAS, T_7- NPK (19:19:19:) @ 0.5% of foliar spray at 25,40 & 55 DAS, T_8- NPK (19:19:19:) @ 1.0% of foliar spray at 25 DAS, T_9- NPK (19:19:19:) @ 1.0% of foliar spray at 40 DAS, T_{10}- NPK (19:19:19:) @ 1.0% of foliar spray at 55 DAS, T_{11}- NPK (19:19:19:) @ 1.0% of foliar spray at 25 & 40 DAS ,T_{12}- NPK (19:19:19:) @ 1.0% of foliar spray at 40 & 55 DAS, T_{13}- NPK (19:19:19:) @ 1.0% of foliar spray at 25,40 & 55 DAS. [75]The Gross plot size was 4.8 × 4.0 m and the spacing was kept 150× 50 cm between andwithin 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**

RESULTS AND DISCUSSIONS

Vine length(cm)

Among the various treatments T_{13}had maximum vine length (348.100 cm) followed by T_{12} (338.800cm) and T_{11} (334.00) whereas minimum vine length was noticed in control (325.300 cm).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 reported by Patil*et al.*,(1998),(Table 1.)

Days to first male flowering

Among the various treatments T_{13} produced male flower in minimum days (39.800 days after sowing) followed by T_{12} (39.900 days after sowing) and T_{11} (41.100 Days after sowing) whereas maximum days for male flower initiation was noticed in control (41.897 days after sowing 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 reportedby Thriveni*et al.,* (2015); (Table 1.)

Days to first female flower

Among the various treatments, T_{13} produced female flowers in the minimum number of days (39.497 days after sowing), followed by T_{12} (39.497 days after sowing) and T_{11} (40.000 days after sowing), whereas the maximum number of days for female flower initiation was noticed in the control (45.600 days after sowing). Since the earlier appearance of female flowers in cucumber plants desirable characteristics and it was gained whenplants treated with NPK 19:19:19 foliar spray it might be due to the balanced and immediate nutrient availability that supports optimal plant growth, flowering, and hormonal balance. Similar findings were reported by Prasad *et al.,* (2016) (Table 1).

First Fruit harvest (DAS)

Among the various treatments, T_{13} produced the first fruit harvest in the minimum number of days (53.927 days after sowing), followed by T_{12} (53.037 days after sowing) and T_{11} (53.337

days after sowing), whereas the maximum number of days for the first fruit harvest was noticed in the control (52.600 days after sowing). Similar findings were reported by Akinrinde, (2006, (Table 1).

Fruit length (cm)

Among the various treatments, T_{13} produced the longest fruit (23.603 cm), followed by T_{12} (23.600 cm) and T_{11} (21.700 cm), whereas the shortest fruit length was noticed in the control (16.203 cm). The foliar application of NPK 19:19:19 helped by providing a balanced nutrient supply, improving nutrient uptake, enhancing photosynthesis and metabolism, and improving flowering and fruit set. Similar findings were reported by Jagraj Singh *et al*., (2020) (Table 1).

Fruit width (cm)

Among the various treatments, T_{13} had the highest fruit width (4.20 cm), followed by T_{12} (4.00 cm) and T_{11} (3.50 cm), whereas the minimum fruit width was noticed in the control (2.00 cm). 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 reported byGao Z.*et al.,* (Table 1).

Internode length (cm)

Among the various treatments, T_{13} had the longest internode length (18.900 cm), followed by T_{12} (18.800 cm) and T_{11} (18.603 cm), whereas the shortest internode length was noticed in the control (11.997 cm). 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 reported by Alekar*et al.,* (2015); (Table 1)

Number of fruits per vine

Among the various treatments, T_{13} had the highest number of fruits per vine (14.700), followed by T_{12} (13.700) and T_{11} (13.600), whereas the minimum number of fruits was noticed in the control (11.00). 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 reported by Thriveni*et al.,* (2015) (Table 1).

Yield per plant (Kg)

Among the various treatments, T_{13} had the highest yield per plant (2.600 kg), followed by T_{12} (2.500 kg) and T_{11} (2.400 kg), whereas the minimum yield per plant was noticed in the control (1.100 kg). 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 soilapplied nutrients or those facing nutrient deficiencies. Similar findings were reported by Mostafa *et al.,* (2012); (Table 1).

Yield per plot (Kg)

Among the various treatments, T_{13} produced the maximum yield per plot (23.900 kg), followed by T_{12} (22.300 kg) and T_{11} (21.100 kg), whereas the minimum yield per plot was noticed in the control (15.200 kg). 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 reported by Arshad *et al.,* (2014) (Table 1)

Yield per hectare (q)

Among the various treatments, T_{13} had the highest yield per hectare (98.200 q), followed by T_{12} (97.100 q) and T_{11} (96.700 q), whereas the minimum yield per hectare was noticed in the control (80.00 q). 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 reported by Arun*et al.,* (2014); (Table 1).

Vitamin C (mg/100gm)

Among the various treatments, T_{13} had the highest vitamin C content (4.043 mg/100gm), followed by T_{12} (4.023 mg/100gm) and T_{11} (4.010 mg/100gm), whereas the minimum vitamin C content was noticed in the control (3.693 mg/100gm). The foliar application of NPK 19:19:19 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 reported by Sharma *et al.,* (2009) (Table 1)

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

Among the various treatments, T_{13} had the highest content of Total Soluble Solids (TSS) in edible fruit (3.693%), followed by T_{12} (3.483%) and T_{11} (3.490%). Whereas the minimum Total Soluble Solids (TSS) content in edible fruit was noticed in the control (2.637%), the application of a balanced NPK 19-19-19 foliar spray enhances TSS in cucumbers by providing essential nutrients that improve photosynthesis, carbohydrate synthesis, stress resistance, and overall fruit quality. Similar findings were reported by Pandey *et al.,* (2005) (Table 1).

Conclusion

The study investigated the influence of foliar feeding with NPK (19:19:19) on various growth, yield, and quality parameters of cucumber (*Cucumissativus* L.) cv. Kalyanpur Green demonstrated that overall, the foliar application of NPK 19:19:19 significantly enhanced cucumber plant growth, flowering, fruiting, and yield. This enhancement is attributed to the provision of balanced and readily available nutrients, which improve photosynthesis and promote overall plant health. Based on the result of this study this treatment can be suggested to the cucumber growing farmers.

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