

Effect of Different Concentrations of Liquid N, P & K on Growth, Yield and Quality of Cucumber (*Cucumis sativus L.*) in Vertical Hydroponics under shade net

Abstract

The experiment was carried out to find out the effect of different concentrations of liquid NPK on growth, yield and quality of cucumber (*Cucumis sativus L.*). The variety was “Ankita”, which is F1 hybrid. The experiment was carried out during September, 2021 to December, 2021 in Shade net, Research Field, Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design (RBD), with eight treatments T₁(16.25ml NPK & micronutrients/Pl in total), T₂(18.75ml NPK & micronutrients/Pl in total), T₃(21.25ml NPK & micronutrients/Pl in total) T₄(23.75ml NPK & micronutrients/Pl in total) T₅(26.25ml NPK & micronutrients/Pl in total) T₆(28.75ml NPK & micronutrients/Pl in total) T₇(31.25ml NPK & micronutrients/Pl in total) with a control (T₀), replicated thrice in vertical hydroponics system. The NPK level increased by 5ml on every 15 days interval. The best result was shown by the treatment T₅(26.25ml NPK & micronutrients/Pl in total). The first fruit setting, picking, vine length, number of leaves, growth of plant, chlorophyll content all parameter were superior in T₅. The plants in control did not show any significant improvement as there were no nutrients given to them. The systems ran four hours daily during their vegetative growth and the timing was increased to six hours during their reproductive phase of development. Fruit formation occurs in almost all plants in each and every treatment except control there was no fruit formation.

Keywords: *Cucumber, Vertical, F1 hybrid, chlorophyll content, RBD and NPK*

Introduction

Cucumber (*Cucumis sativus L.*), belongs to the Cucurbitaceae family, one of the most important plant families in agriculture, The crop is the fourth most important vegetable after tomato, cabbage and onion in Asia (Tatlioglu, 1997), the second most important vegetable crop after tomato in Western Europe (Phu, 1997). Cucumber grown during specific seasons (**zaid and kharif**) in northern India. It is one of the creeping vegetables with large consumer demand worldwide (Petre *et al.*, 2015). Soilless or hydroponics culture is one of the modern techniques. They are considered

as important technologies for better water use efficiency as well as high good quality and quantity products. (Wilkinson *et al.*, 2014). Numbers of organic and inorganic materials such as gravel, sand, peat, sawdust, pumice, tuff, coir, vermiculite, perlite, and rock wool pure or in mixture are used as solid growing media in addition to hydroponics (Water), aeroponics and aquaponics as cropping systems (Johnson *et al.*, 1985; Papadopoulos, 1994; Massa *et al.*, 2011; Hussain *et al.*, 2014 and Putra and Yuliando, 2015). The selection of a particular material as a substrate depends on its availability, cost and local experience on its use (Sahin *et al.*, 2003 and Sorin *et al.*, 2015). In hydroponic systems, the nutrient solution is delivered directly to the plant roots, allowing for precise control over the nutrients, water, and pH levels. This results in healthier and more productive plants that require less space, water, and fertilizers than traditional soil-based farming.

Materials and Methods

An experiment entitled **Effect of different concentrations of Liquid N, P and K on growth, yield and quality of cucumber in vertical hydroponics under Shade net** was conducted at Shade net, Research Field, Department of Horticulture, Naini Agricultural Institute (NAI), Sam Higginbottom University of Agriculture, Technology and Sciences, during, September, 2021 to december,2021.

Statistical analysis was done by using method of analysis of variance (ANOVA) for completely randomized block design (CRBD) by (Panse and Sukhtme,1984). The overall significance of difference among the treatment was tested, using critical difference at 5% level of significance. The result were statistically analyzed with the help of a window based computed package OPSTAT (Sheoran, 2004).

RESULT AND DISCUSSION

Effect of different concentration of liquid NPK and micronutrients on growth parameters at cucumber: The data on vegetative growth at cucumber as influenced by various treatments one given in Table 1. It is clearly evident that maximum attributes observed in T5 such as length of main vine plant was 190.02 cm followed by T4 with 179.74 cm, and minimum in control with 55.50 cm, number of Primary and Secondary branches of cucumber plant with 3.03 and 9.10, followed by T₄(23.75ml/plant) with 2.50 and 6.50. While lowest number of primary and secondary branches per plant was recorded in control with 1.77 and 2.12, Maximum numbers of leaves/plant were recorded in T₅(26.25ml NPK/Pl) with 14.33 followed by T₄ (23.75ml NPK/Pl) with 13.70, whereas minimum 4.10 leaves/plant was recorded in T₀(Control) were significantly affected by the application of different concentrations of liquid NPK with micronutrients. The experimental results revealed that all the growth parameters were significantly improved by using lower to higher concentration of liquid NPK and micronutrients. It's important to note that the optimal nutrient levels for cucumber growth can vary depending on a number of factors, including the specific cultivar, growing conditions, and the growth stage of the plant. However, in general, higher levels of nitrogen,

phosphorus, and potassium can contribute to increase all attributes of growth parameters. The result matches the result of **Çalışkan, B and Caliskan, A.C. (2019), Yan *et al.*, (2012).**

Effect of different concentrations of liquid NPK on flowering parameter: Data articulated in Table-1 showed that the flowering behaviour in cucumber were influenced by the different concentrations of liquid NPK and micronutrients. The significant effect was noted in the terms of the total number of female and male flowers per vine differed significantly. Maximum number of female flower per vine in T₅(26.25ml/plant) was 23.67, followed by T₄(23.75ml/plant) was 22.33. Minimum number of female flowers per vine was found in T₀(Control) was 3.67. Similarly Maximum number of male flower in T₅(26.67ml/plant) was 51.67, followed by T₄(23.75ml/plant) was 45. T₀(control) shown less number of male flowers with 6.33. The number of female and male flowers is an important character for earliness or lateness of crop in general. And in terms of sex ratio the results showed that the maximum sex ratio were found in T₅(26.25ml/plant) with 2.23, followed by T₄(23.75ml/plant) with 2.10. The lowest sex ratio was recorded in T₀ with 1.74 male flowers, A careful analysis of the data reveals significant differences among the treatments regarding the Flowering Parameter of Cucumber plant. These findings suggest that the NPK concentrations in the hydroponic solution play a crucial role in determining the number of female and male flowers in Cucumber plants. Further investigation into the optimal NPK levels for number of female and male flower and it could lead to improved production and yield in Cucumber cultivation. The variation in number of female and male flower might also have been due to their genetic nature, environmental factor, hormonal factor and vigour of crop. Similar results have been reported by **Martin M. Maboko *et al.*, (2017), Md. Sabuj Ali *et al.*, (2022).** The narrower sex ratio by the different concentrations of macronutrients (NPK) is possibly due to the fact that these substances are reported to increase functional female organs and compatibility besides reducing the embryo abortion in plants. Similar results were obtained earlier by **Jennifer and Carol (2007) and Gill *et al.* (2012)** in cucumber

Effect of different concentrations of liquid NPK on Yield and yield attributing parameters: Data pertaining from the Table-2 showed that the different concentrations of liquid NPK were gave a significant influence in terms of yield and yield attributing parameters as compared to control during experimentation. The maximum number of fruits plant per plant were found in T₅(26.25 NPK ml/plant) 22.00, followed by T₄(23.75 NPK ml/plants). The lowest number of fruits were recorded in T₇(31.25 NPK ml/plant). The number of fruits per plant is one of the major factors for deciding the yield of the crop. In terms of fruit length. The maximum fruit length was found with T₅(26.25ml/plant) with 10.07 cm, followed by T₄(23.75ml/plant) with 9.6 cm. The minimum fruit length was recorded with T₁(16.25ml/plant) with 7.94 cm. Similarly, the maximum fruit diameter was found in T₅(26.25ml NPK/plant) with 4.63cm, followed by T₄(23.75ml NPK /plant) with

4.53cm. The minimum fruit diameter was found in T₁(16.25ml NPK/plant) with 3.27cm, and the highest fruit weight was recorded in T₅(26.25 NPK ml/plant) with 75.30g, followed by T₄(23.75 NPK ml/plant) with 72.40g. The lowest fruit weight was found in T₁(16.25NPK ml/plant) with 64.90g. The maximum fruit yield per plant(kg) was recorded in T₅ (26.25ml NPK/plant) with 4.79kg followed by T₄(23.75ml NPK/plant) with 4.68. The lowest fruit yield per plant was found in T₁ (16.25ml NPK/plant) with 3.70kg. The maximum yield/structure(kg) was recorded in T₅ with 19.17, followed by T₄ with 18.73kg. The lowest fruit yield/structure(kg) was found in T₁ with 14.80kg. Fruit yield is also depended on fruit length and fruit diameter, increasing fruit length and fruit diameter will increase fruit yield, The variation of fruit yield might have been due to Potassium is the key driver for fruit size and alongside Nitrogen is required in large quantities throughout fruit development and growth but too much nitrogen at a late growth stage can restrict fruit size; therefore, after increasement of NPK concentration from T₆, it shows adverse effect fruit size decreases. Significant differences were recorded with reference to fruit weight amongst, In this experiment it was found that on increasing the NPK concentration the Yield increases up to T₅ and it again decreases in T₆ which had higher concentration than T₅ and minimum yield was obtained in T₁ with minimum NPK concentration. This optimum concentration of nutrients could have provided the plants with sufficient nutrients for their growth and development, resulting in better plant health and higher yields. the higher nutrient concentration may have led to greater nutrient uptake and assimilation by the plants, which would have contributed to increased biomass production and male and female flower formation ; This finding correlates with the findings of **Olubanjo and Adaramola (2022), Janapriya and Palanisamy (2010)**.

Table 1: Effect of different concentrations of liquid NPK on growth and flowering behaviour of cucumber in vertical hydroponics

Vegetative parameters	Flowering parameters
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TREATEMETS	Vine length (cm)	Number of leaves	Number of primary branches	Number of secondary branches	Number of female flower /plant	Number male flower /plant	Sex ratio (male: female)
T ₁ (16.25ml NPK/plant) in total	151.30	11.90	2.30	4.14	19.33	37.67	1.92
T ₂ (18.75ml NPK/plant) in total	160.86	12.30	2.37	4.97	20.33	40.33	1.94
T ₃ (21.25ml NPK/plant) in total	170.74	13.27	2.40	5.52	21.00	42.00	2.03
T ₄ (23.75ml NPK/plant) in total	179.74	13.70	2.50	6.50	22.33	45.00	2.10
T ₅ (26.25ml NPK/plant) in total	190.02	14.33	3.03	9.10	23.67	51.67	2.23
T ₆ (28.75ml NPK/plant) in total	178.71	13.17	2.57	6.16	21.67	43.67	2.14
T ₇ (31.25ml NPK/plant) in total	176.51	12.57	2.40	5.35	19.00	39.67	2.09
T ₀ (Control)	55.50	4.10	1.77	2.12	3.67	6.33	1.74
F-TEST	S	S	S	S	S	S	S
S.E.(d)	0.63	0.20	0.17	0.36	0.87	1.63	0.099
C.D @ 5%	0.49	0.43	0.37	0.78	1.88	3.53	0.214
C.V.	1.36	2.02	8.54	8.07	5.62	5.22	5.985

Table 2: Effect of different concentrations of liquid NPK on yield and yield attributing parameters in cucumber in vertical hydroponics

TREATEMENTS	Number of fruits/plant	Fruit length(cm)	Fruit diameter(cm)	Average fruit weight	Fruit yield/plant	Fruit yield/structure
T ₁ (16.25ml NPK/plant) in total	18.00	7.94	3.27	64.90	3.70	14.80
T ₂ (18.75ml NPK/plant) in total	19.00	8.32	3.43	66.33	3.85	15.40
T ₃ (21.25ml NPK/plant) in total	19.67	8.92	4.13	69.33	4.28	17.10
T ₄ (23.75ml NPK/plant) in total	20.67	9.68	4.53	72.40	4.68	18.73
T ₅ (26.25ml NPK/plant) in total	22.00	10.07	4.63	75.30	4.79	19.17
T ₆ (28.75ml NPK/plant) in total	20.67	9.13	4.07	71.27	4.23	16.93
T ₇ (31.25ml NPK/plant) in total	17.67	8.53	3.80	70.17	3.93	15.73
T ₀ (Control)	0.00	0.00	0.00	0.00	0.00	0.00
F-TEST	S	S	S	S	S	S
S.E.(d)	0.766	0.14	0.13	0.763	0.08	0.33
C.D @ 5%	1.66	0.29	0.29	1.651	0.18	0.70
C.V.	5.454	2.12	4.73	1.526	2.70	2.70

Conclusion:

On the basis of results obtained from the present study concluded that the effect of the different concentrations of liquid NPK on growth, flowering and yield in cucumber variety Ankita were gave significant effect as compared to control and other treatments. Among all the treatments, **T₅ (26.25 ml NPK& micronutrients/Pl. in total)** was found best in terms of growth and yield parameters of Cucumber in vertical of hydroponic system.

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