

DOI No.: <http://doi.org/10.53550/EEC.2022.v28i04s.039>

# Eco-friendly cucumber production approach under protected cultivation

K.S. Rajawat\*, K.D. Ameta R.A. Kaushik and Mohan Singh

*Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India*

(Received 14 December, 2021; Accepted 19 January, 2022)

## ABSTRACT

A study was conducted at Hi-Tech Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur to evaluate the effect of different nutrient sources in cucumber under Naturally Ventilated Polyhouse. The present study comprises eight treatment combinations with four replications under completely randomized design. From the study, it was found that maximum vine length (388.33 cm), minimum days to first harvest (36.00) and maximum fruit weight (120.39 g) were recorded with the application of 75 per cent organic + 25 per cent inorganic fertilizers and total yield per vine (3468.83 g) was found with the application of 50 per cent organic + 50 per cent inorganic fertilizers. The overall results suggest that application of different combinations of organic and inorganic nutrient sources at optimum level proved to be effective in growth, flowering, yield and quality of cucumber.

**Key words :** *Cucumber, Protected cultivation, Nutrient management, Organic manures*

## Introduction

Cucumber (*Cucumis sativus* L.) is one of the most popular and widely grown vegetable all over the India. It belongs to the family cucurbitaceae and is reported to have originated in India. It is one of the quickest maturing vine vegetable crop and widely grown throughout the country. The immature fruits of cucumber are used as salad, pickling and seed possess cooling properties. Fruits are good for people suffering from constipation, jaundice and indigestion. Among various cucurbits, cucumber is grown in area of 78000 ha with 1142000 MT productions in India (Anon., 2017).

In recent years, chemical fertilizers no doubt have played a significant role in providing nutrients for intensive crop production but increased use of chemical fertilizers in green house an unbalanced manner has created problem of nutrient deficiencies,

diminishing soil fertility and unsustainable crop yields. For suitable yield supply of balanced nutrition to the plant having the entire essential nutrient element, which would be possible by adopting integrated nutrient management. Integrated nutrient management system refers to the balanced use of chemical fertilizers in combination with organic manures, crop residues, bio fertilizers and other biological sources (Thriveni *et al.*, 2015). However, considering the recent concept of eco-friendly production under green house, the use of cost effective and eco-friendly organic manures and biofertilizers with suitable integration of inorganic fertilizers restores the soil health while keeping the soil productive and sustainable with quality produce under protected conditions This approach of nutrient management under polyhouse condition aims at efficient and judicious use of optimum combination of organic, inorganic and biological nutrient sources.

## Materials and Methods

An experiment was carried out at Hi-tech Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during two consecutive years 2017 and 2018, to assess the effect of various organic manures, chemical fertilizers and biofertilizers on growth, yield and quality parameters of cucumber under naturally ventilated polyhouse. The experiment was laid out in completely randomized design with eight treatment combinations replicated four times. The treatments involved were as follows:

| Notation       | Treatments                                                                                                                                                                                                                                                                                                           |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T <sub>1</sub> | 100 per cent RDF (Inorganic source)                                                                                                                                                                                                                                                                                  |
| T <sub>2</sub> | 100 per cent RDF+ biofertilizers                                                                                                                                                                                                                                                                                     |
| T <sub>3</sub> | 100 per cent vermicompost + biofertilizers                                                                                                                                                                                                                                                                           |
| T <sub>4</sub> | 100 per cent vermicompost                                                                                                                                                                                                                                                                                            |
| T <sub>5</sub> | 100 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers)                                                                                                                                                                                       |
| T <sub>6</sub> | 75 % Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers) + innovative practices (BD 500 @ 75 g per hectare before sowing and 20 DAS + BD-501 @ 2.5 g per hectare 2-4 leaf stage + mataka khad 10 per cent at 20 DAP + Panchagavya @ 10 per cent 20 DAS |
| T <sub>7</sub> | 50 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers)+ 50 per cent inorganic fertilizers                                                                                                                                                     |
| T <sub>8</sub> | 75 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + <i>Azotobacter</i> , integrated crop management) + 25 per cent inorganic fertilizers                                                                                                                   |

The raised beds of 1 meter width having 45 cm above from ground level along with length of polyhouse were prepared the plot size was 7 m X 1 m and spacing was followed 45 cm X 30 cm. Basal dose of NADEP compost, vermi-compost, and non-edible cakes were calculated as per treatment and thoroughly mixed in the soil one week before sowing. Bio-fertilizers (PSB + ZSB + *Azotobacter*) @ 4 kg per ha were inoculated and applied one week after sowing. Fertigation schedule was followed and NPK

was applied in liquid form along with irrigation water twice in a week as water soluble NPK mixture (19:19:19) and (0:52:34) along with micronutrient and calcium nitrate. All cultural practices were followed regularly during entire crop growth period and observations were recorded on growth, yield and quality parameters. The data was analyzed statistically following the method of Panse and Sukhatme (1985).

## Results and Discussion

**Growth parameters:-** The growth parameters differed significantly with influence of different types and levels of fertilizers, Maximum (388.33 cm) vine length was recorded with the application of 75 per cent organic + 25 per cent inorganic fertilizers (T<sub>8</sub>). Similar findings have also been reported by Mohan *et al.* (2016) in cucumber under polyhouse conditions. Maximum number of branches per plant (6.03) were noticed with the treatment T<sub>2</sub> (100 per cent RDF + biofertilizers) and maximum leaf area (514.03 cm<sup>2</sup>) was recorded with T<sub>7</sub> (50 per cent organic and 50 per cent inorganic fertilizers). Maximum vine length, higher number of branches and leaf area might be due to favorable microclimatic condition inside the polyhouse which helped the better nutrient, water and solar radiation utilization for the photosynthesis and also the maintaining higher temperature inside polyhouse might have helped in rapid cellular elongation and multiplication resulting in higher number of branches per plant, vine length and leaf area. Findings of Anjanappa *et al.* (2012) are in conformity of these

**Table 1.** Growth parameters as influenced by different organic manures, inorganic fertilizers and their combinations in cucumber.

| Treatments     | Vine length (cm) | Number of branches per plant | Leaf area (cm <sup>2</sup> ) |
|----------------|------------------|------------------------------|------------------------------|
| T <sub>1</sub> | 379.71           | 4.20                         | 406.12                       |
| T <sub>2</sub> | 382.03           | 6.03                         | 412.47                       |
| T <sub>3</sub> | 369.89           | 5.85                         | 389.29                       |
| T <sub>4</sub> | 365.56           | 4.98                         | 381.78                       |
| T <sub>5</sub> | 368.18           | 5.05                         | 398.36                       |
| T <sub>6</sub> | 360.39           | 5.78                         | 381.18                       |
| T <sub>7</sub> | 381.58           | 5.28                         | 414.03                       |
| T <sub>8</sub> | 388.33           | 5.00                         | 411.81                       |
| SEm±           | 3.314            | 0.11                         | 5.24                         |
| CD 5 %         | 9.424            | 0.31                         | 14.92                        |

results. Ahamad *et al.* (2015) also revealed that application of organic manure, chemical fertilizers and *P. fluorescens* separately and in combination significantly enhanced the growth related attributes of cucumber. Similar findings were also reported by Mohan *et al.* (2016) and Pradeepkumar *et al.* (2017) in cucumber.

**Yield attributes and yield:** Minimum days to first harvest (36.00) and maximum fruit weight (120.39 g) were recorded with the application of 75 per cent organic + 25 per cent inorganic fertilizers ( $T_8$ ). Early flowering might be due to better translocation of nutrients to plants aerial parts as reported by Singh *et al.* (2017). Application of organic and inorganic fertilizers along with biofertilizers increased the phosphorus level which perhaps resulted in proper formation of nucleic acid and cell division increased the fruit weight and C:N ratio in balanced manner might have increased the carbohydrate synthesis which ultimately enhanced the fruit weight. These findings are also in consonance with the findings of Kanaujia and Daniel (2016) and Anjanappa *et al.* (2012) in cucumber.

Maximum fruit length (17.23 cm) and fruit diameter (3.30 cm) was noticed with the application of 100 per cent vermicompost + biofertilizers ( $T_3$ ). The increased fruit length and fruit diameter might be due to synthesis of greater amount of food material and translocated to developing fruit whereas higher accessibility of nutrients due to chemical fertilizers and organic manures helped in higher protein synthesis resulted in increased fruit length and fruit diameter of cucumber. Similar findings as also reported by Kanaujia and Daniel (2016) and Bindiya *et al.* (2014)

Significantly higher number of fruits per vine (27.58) and maximum total yield per vine (3468.83 g) were observed with the application of 50 per cent organic + 50 per cent inorganic fertilizers ( $T_7$ ). It is clear from above results that combined application of organic and inorganic fertilizers along with biofertilizers significantly increased the number of fruits per vine and yield per vine in cucumber might be due to higher rate of metabolic activity and more accumulation of carbohydrates with these treatments under favorable microclimate condition inside the polyhouse. These findings are in accordance with Anjanappa *et al.* (2012) and similar findings were also reported by Kanaujia and Daniel (2016), Pradeepkumar *et al.* (2017), Mohan *et al.* (2016) while working with cucumber and Prasad *et al.* (2009) in bitter gourd.

**Table 3.** Quality parameters as influenced by different organic manures, inorganic fertilizers and their combinations in cucumber.

| Treatments | Moisture content (%) | Specific gravity (g/cm <sup>3</sup> ) | Total soluble solids (°Brix) |
|------------|----------------------|---------------------------------------|------------------------------|
| $T_1$      | 94.58                | 0.949                                 | 3.70                         |
| $T_2$      | 95.25                | 0.949                                 | 3.71                         |
| $T_3$      | 94.41                | 0.948                                 | 4.04                         |
| $T_4$      | 94.79                | 0.949                                 | 3.83                         |
| $T_5$      | 94.61                | 0.951                                 | 4.16                         |
| $T_6$      | 93.96                | 0.954                                 | 3.95                         |
| $T_7$      | 94.64                | 0.952                                 | 3.85                         |
| $T_8$      | 94.71                | 0.951                                 | 3.83                         |
| SEm±       | 0.43                 | 0.002                                 | 0.06                         |
| CD 5 %     | NS                   | NS                                    | 0.17                         |

**Table 2.** Yield and yield attributes as influenced by different organic manures, inorganic fertilizers and their combinations in cucumber.

| Treatments | Days to first harvest | Number of fruits per vine | Fruit weight (g) | Fruit length (cm) | Fruit diameter (cm) | Total yield per vine (g) |
|------------|-----------------------|---------------------------|------------------|-------------------|---------------------|--------------------------|
| $T_1$      | 39.23                 | 25.88                     | 117.62           | 14.02             | 2.70                | 3043.55                  |
| $T_2$      | 37.18                 | 27.03                     | 118.42           | 15.52             | 3.09                | 3124.98                  |
| $T_3$      | 37.59                 | 22.08                     | 115.65           | 17.23             | 3.30                | 2461.40                  |
| $T_4$      | 37.05                 | 20.13                     | 115.21           | 14.78             | 2.93                | 2260.35                  |
| $T_5$      | 37.95                 | 23.05                     | 116.52           | 16.00             | 3.04                | 2714.86                  |
| $T_6$      | 37.83                 | 21.01                     | 114.44           | 15.18             | 2.86                | 2217.77                  |
| $T_7$      | 38.45                 | 27.58                     | 119.29           | 16.39             | 3.01                | 3468.83                  |
| $T_8$      | 36.00                 | 27.18                     | 120.39           | 17.19             | 3.23                | 3308.49                  |
| SEm±       | 0.33                  | 0.40                      | 0.95             | 0.26              | 0.06                | 39.11                    |
| CD 5 %     | 0.96                  | 1.16                      | 2.71             | 0.75              | 0.17                | 111.21                   |

### Quality parameters

Maximum total soluble solids (4.16 °Brix) was recorded with the treatment T<sub>5</sub> (100 per cent organic management) Similarly Anuja and Archana (2012) also reported that application of organic nutrients along with panchagavya 3 per cent foliar spray significantly increased the total soluble solids. Non-significant differences were recorded for moisture content and specific gravity of cucumber, According to pooled data maximum specific gravity (0.954 g/cm<sup>3</sup>) was measured in treatment T<sub>6</sub> (75 per cent organic management) and maximum moisture content (95.25 %) was obtained with T<sub>2</sub> (100 per cent RDF + biofertilizers) Similar findings were also reported by Anjanappa *et al.* (2012) who reported non-significant effect of integrated nutrient management on moisture content ranged (91.83 per cent to 96.06 per cent) of cucumber under protected condition and Bindiya *et al.* (2014) also found non-significant effect on moisture content of cucumber.

On the basis of results it may be concluded that integrated application of organic manures with innovative approaches and inorganic fertilizers along with biofertilizers treatment was found superior and helps to maintain optimum crop growth, yield and quality parameter for cucumber with good quality resulting in sustainable soil productivity on long term basis under protected cultivation.

### Acknowledgement

The authors are grateful to the Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur-313 001 (Rajasthan) for providing the facilities during this research.

### References

- Ahamd, M., Zeshan, S.H., Nasim, M., Zahir, Z.A., Nadeem, S.M., Nazli, F. and Jamil, M. 2015. Improving the productivity of cucumber through combined application of organic fertilizers and *Pseudomonas fluorescens*. *Pak. J. of Agr. Sci.* 52(4) : 1011-1016.
- Anjanappa, M., Kumara, B.S. and Indires, K.M. 2012. Growth, yield and quality attributes of cucumber (cv. Hasan Local) as influenced by integrated nutrient management grown under protected condition. *Mysore J. of Agr. Sci.* 46(1) : 32-37.
- Anonymous. *Indain Horticulture Database*. 2017, www.nhb.gov.in
- Anuja, S. and Archana, S. 2012. Effect of organic nutrients on yield and quality of bitter gourd (*Momordica charantia* L.). *Intl. J. of Agr. Sci.* 8 : 205-208.
- Bindiya, Y., Reddy, I.P. and Srihari, D. 2014. Response of cucumber to combined application of organic manures, biofertilizers and chemical fertilizers. *Veg. Sci.* 41(1): 12-15.
- Kanaujia, S.P. and Daniel, M.L. 2016. Integrated nutrient management for quality production and economics of cucumber on acid alfisol of Nagaland. *Ann. of Plant. and Soil Res.* 18(4): 375-380.
- Mohan, L., Singh, B.K., Singh, A. K., Moharana, D.P., Kumar, H. and Mahapatra, A.S. 2016. Effect of integrated nutrient management on growth and yield attributes of cucumber (*Cucumis sativus* L.) cv. Swarna Ageti under polyhouse conditions. *The Bioscan*. 12(1) : 305-308.
- Panse, V.G. and Sukhatme, P.V. 1985. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi, 145-155.
- Pradeepkumar, T., Bonny, B.P., Midhila, R., John, J., Divya, M.R. and Roch, C.V. 2017. Effect of organic and inorganic nutrient sources on the yield of selected tropical vegetables. *Scientia Hort.* 224 : 84-92.
- Prasad, P.H., Mandal, A.R., Sarkar, A., Thapa, U. and Maity, T.K. 2009. Effect of bio-fertilizers and nitrogen on growth and yield attributed of bitter gourd (*Momordica charantia* L.). *Intl. Conf. on Hort.*, (ICH-2009) Bangalore, Karnataka, 738-740.
- Singh, V., Prasad, V.M., Kasera, S., Singh, B.P. and Mishra, S. 2017. Influence of different organic and inorganic fertilizer combinations on growth, yield and quality of cucumber (*Cucumis Sativus* L.) under protected cultivation. *J. of Pharma. and Phytochem.* 6(4) : 1079-1082.
- Thriveni, V., Mishra, H.N., Pattanayak, S.K. and Maji, A. 2015. Effect of integrated nutrient management of nutrient uptake and recovery of bittergourd (*Momordia charntia* L.). *The Ecoscan Special issue*. 7: 85-89.