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# Performance of Cucumber (*Cucucmis sativus* L.) as Influenced by Humic Acid and Micro Nutrients Application under Polyhouse Condition

**Somendra Meena*, K.D. Ameta, R.A. Kaushik, Shankar Lal Meena and Madhu Singh**

Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India
**Corresponding author*

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**A B S T R A C T**

An experiment was conducted at Hi-tech unit of Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan to study the varietal performance of cucumber as influenced by different application of humic acid and micronutrient treatments. There were seven treatments of humic acid and micro nutrients applications. The experiment was laid out in completely randomized design with three replications during 2014-15. Observations were recorded for different characteristics related to vegetative, yield and yield attributing and moisture content. Treatment $T_7$ [(RDF + humic acid 10 kg/ha soil application + humic acid 0.1% foliar spray + micronutrient mixture foliar spray (0.5% Zn + 0.2% B + 0.5% Mn)] was best in regards vegetative traits *viz.* vine length (cm), number of branch per plant and leaf area ($cm^2$). Yield and yield attributing characteristics like number of fruits per vine, fruit weight (g), fruit length (cm), fruit diameter (cm), volume of fruit (cc), yield per plant (kg) and yield per square meter (kg) were significantly influenced by effect of humic acid and micronutrients.

## Introduction

Cucumber (*Cucumis sativus* L.) a popular warm season vegetable, belongs to family cucurbitaceae and grows throughout the world under tropical and subtropical conditions. It is said to be the native of northern India (Pursglove, 1969) whereas China is considered as one of the secondary centers of genetic diversification (De Candolle, 1882). The fruits of cucumbers possesses various medicinal properties *e.g.* cooling effect, prevents constipation, checks jaundice and indigestion (Nandkarni, 1927). Nutritionally 100g of edible portion of cucumber contains 96.3 g moisture, 2.5 g carbohydrates, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 10 mg calcium, 0.4 g fiber and traces of vitamin C and iron. In Rajasthan, the approximate area under this crop is around 4550 hectares with total production of about 14323 metric tons, whereas in India, cucumber is cultivated in an area of 18,000 hectares with a production of 1,20,000 tonnes (Anjanappa *et al*., 2012)

Cucumber is most popular crop growing under protected conditions due to its short life cycle. Parthenocarpic and gynoecious cucumber cultivars increase the potential to yield a high fruit load in controlled environments resulting in a high harvest index. Plants exhibiting a high harvest index will more efficiently use the limited growing area in a growth chamber. Polyhouse

cultivation is still a new and emerging trend for growing vegetables in India. India, being a vast country with diverse and extreme agro climatic conditions, the protected vegetable cultivation technology can be utilized for year round production of high value vegetable crops, with more yield. Protected cultivation actually achieves higher water and nutrient use efficiencies. Increasing photosynthetic efficiency and reduction in transpiratory losses are added advantages of protected cultivation. Both of these factors are of vital importance for healthy and luxuriant growth of crop plants. This technology is highly suitable for farmers in peri-urban areas of the country, especially in northern plains of India. Successful protected cultivation requires careful planning and attention including nutrient management to produce economic yield of good quality. Humic acid, as a commercial product contains 44-58 per cent C, 42-46 per cent O, 6-8 per cent H and 0.5-4 per cent N, as well as many other elements (Larcher, 2003) which improves soil fertility and increases the availability of nutrient elements by holding them on mineral surfaces. The humic substances are mostly used to remove or decrease the negative effects of chemical fertilizers from the soil and have a major effect on plant growth, as shown by many scientists (Ghabbour and Davies, 2001). Humic substances can stabilize soil structure (Piccolo and Mbagwu, 1990) and increase cation exchange. Root growth enhancement has been attributed to improved soil structure, stimulation of soil microflora, and plant growth regulator effects (Chen and Aviad, 1990). The availability of nutrients from the humic substances, chelation of nutrients by the humates (Stevenson, 1991), or through more complex physiological interactions (Vaughan *et al.,* 1985).

To improve the yield and quality of the product, it is necessary to pay attention on the optimum balanced use of nutrients through fertilizer application. Plants require mineral elements for normal growth and development. Plants requirements to essential for the normal life processes of plants and are needed in very small amounts are called trace elements or minor elements such as boron, zinc, manganese etc. In this study, we determine the influence of exogenously applied humic acid (HA) and micronutrients on growth and yield of cucumber grown in a greenhouse.

## Materials and Methods

The experiment was conducted under naturally ventilated poly house at Hi-tech Horticulture Unit, Rajasthan College of Agriculture, Udaipur (Rajasthan) during 2014-15. The trial was laid out in Completely Randomized Design with three replications. The polyhouse was covered with aluminate sheet and ultra violet stabilized low density polyethylene sheet having 200 micron thickness with provision of foggers. The experiment was comprised of seven treatments RDF (control)-$T_1$, RDF+ Humic acid 10 kg/ha (soil application)-$T_2$, RDF+ Humic acid 0.1 % (foliar spray)-$T_3$, RDF+ Humic acid 10 kg/ha + Humic acid 0.1 % (foliar spray)-$T_4$, RDF+ Humic acid 10 kg/ha + micronutrient mixture (foliar spray)-$T_5$, RDF + Humic acid 0.1% + micronutrient mixture (foliar spray)-$T_6$ and RDF+ Humic acid 10 kg/ha + Humic acid 0.1% + micronutrient mixture (foliar spray) -$T_7$. For green house cultivation of cucumber, the seedlings were raised on soil-less media (Mixture of vermiculite, perlite and cocopith) in plug trays having cells of 2" in size. Two weeks old seedlings at 2-3 true leaf stage were transplanted. The recommended dose of fertilizer *viz.* nitrogen@120 kg/ha, phosphorus@80 kg/ha and potash @80 kg/ha were applied through water soluble fertilizer. As per treatments soil application of humic acid was applied through drenching after

transplanting and foliar spray of humic acid was applied after 30 days, whereas foliar spray of micronutrient mixture was applied 60 day after transplanting. All the cultural practices including irrigation and hoeing were carried out as per the standard commercial procedures. Spraying for pests and diseases were applied whenever it appeared necessary throughout the growing season. Plants were vertically trained with plastic ropes. Data were recorded for vine length (m), leaf area ($cm^2$), number of branches per vine, number of fruits per vine, fruit weight (g), fruit length (cm), fruit volume (cc), fruit diameter (cm) and yield per vine (kg) and moisture content (per cent) from randomly selected five tagged plants of each treatment and further analyzed. All data were subjected to analysis of variance to determine the treatment effects.

## Results and Discussion

Results showed (Table: 1 and 2) that application of humic acid and micronutrients significantly affect all the characters studied. Results obtained indicated significant differences for vine length having a range of 216.33 cm ($T_1$) to 304.33 cm ($T_7$), similar trained were also obtained by Boehme *et al.*, (2005).

**Table.1** Effect of humic acid and micronutrients on fruit parameter and yield at the time of last harvesting

| S.No. | Detail of Treatment | Fruit weight (g) | Fruit length (cm) | Fruit diameter (cm) | Fruit volume (cc) | Yield (kg/vine) | Yield (kg/sqm) |
|---|---|---|---|---|---|---|---|
| **1.** | RDF (control) | 115.86 | 15.78 | 2.86 | 101.78 | 2.88 | 11.48 |
| **2.** | RDF+ Humic acid 10 kg/ha (soil application) | 116.97 | 16.45 | 2.88 | 102.53 | 2.98 | 12.50 |
| **3.** | RDF+ Humic acid 0.1 % (foliar spray) | 117.06 | 16.77 | 2.87 | 103.41 | 3.11 | 13.10 |
| **4.** | RDF+ Humic acid 10 kg/ha + Humic acid 0.1 % (foliar spray) | 119.12 | 17.10 | 2.89 | 104.98 | 3.24 | 13.88 |
| **5.** | RDF+ Humic acid 10 kg/ha + micronutrient mixture (foliar spray) | 121.86 | 17.06 | 2.95 | 108.61 | 3.66 | 14.11 |
| **6.** | RDF + Humic acid 0.1% + micronutrient mixture (foliar spray) | 123.00 | 17.39 | 3.10 | 107.07 | 3.44 | 14.02 |
| **7.** | RDF+ Humic acid 10 kg/ha + Humic acid0.1%+micronutrient mixture | 125.00 | 17.50 | 2.96 | 109.71 | 4.01 | 15.98 |
| **8.** | **CD 5%** | 1.26 | 0.25 | 0.05 | 0.27 | 0.06 | 1.51 |

**Table.2** Effect of humic acid and micronutrients on Vine length, Number of branches per plant, Leaf area, moisture (%) and Number of Fruits per vine of cucumber at the time of last harvesting

| S.No. | Detail of Treatment | Vine length (cm) | No. of branches plant$^{-1}$ | Leaf area (cm$^2$) | Moisture (%) | Number of Fruits per vine |
|---|---|---|---|---|---|---|
| **1.** | RDF (control) | 216.33 | 7.4 | 423.36 | 93.41 | 19.80 |
| **2.** | RDF+ Humic acid 10 kg/ha (soil application) | 234.33 | 8.0 | 433.71 | 93.86 | 20.90 |
| **3.** | RDF+ Humic acid 0.1 % (foliar spray) | 236.67 | 8.2 | 440.81 | 93.97 | 23.80 |
| **4.** | RDF+ Humic acid 10 kg/ha + Humic acid 0.1 % (foliar spray) | 251.00 | 8.3 | 449.33 | 94.57 | 23.90 |
| **5.** | RDF+ Humic acid 10 kg/ha + micronutrient mixture (foliar spray) | 263.67 | 8.6 | 460.37 | 90.86 | 27.20 |
| **6.** | RDF + Humic acid 0.1% + micronutrient mixture (foliar spray) | 277.67 | 9.0 | 475.53 | 91.02 | 26.10 |
| **7.** | RDF+ Humic acid 10 kg/ha + Humic acid0.1%+micronutrient mixture | 304.33 | 9.0 | 484.91 | 92.86 | 30.10 |
| **8.** | **CD 5%** | 12.13 | 0.5 | 36.04 | 3.16 | 0.74 |

The effect of treatments on stem diameter also showed significant differences, where maximum value (0.969 cm) was recorded for RDF+ Humic acid 10 kg/ha + Humic acid 0.1% + micronutrient mixture ($T_7$) followed by $T_5$ (0.857 cm) where as minimum value for this trait was observed for ($T_6$) 0.763 cm. Men values for number of branches per vine and number of fruits per vine were also reported significantly higher for $T_7$ *i.e.* 5.500 and 40.867, respectively. These results are consistent with the previous findings of Fortun and Lopez, 1982; Adani *et al.,* 1998; Hoang, 2003. They found that humates have positive effects on plant growth and positive effect of humic acid on the nutrients uptake was also proved with tomato, cucumber and other plants**.** Fruit weight and fruit length showed statistically significant effect of various treatment application having ranges of 98.933 g (control) to 109.267 g ($T_7$) and 15.357 cm ($T_3$) to 18.303 cm ($T_7$), respectively. The effect of high humic acid treatment was also statistically significant for fruit volume and fruit diameter which showed maximum values for treatment $T_7$. Fruit volume was ranges from 103.947 cc ($T_1$) to 114.857 cc ($T_7$) whereas fruit diameter was ranges from 2.547 cm ($T_3$) to 3.437 cm ($T_7$). Moisture content showed non significant effect of treatments and did not showed any response of humic acid applications. Among all the treatments applied, significantly higher yield was obtained for $T_7$ (3.810 kg) followed by $T_5$ (3.710 kg) as compare to minimum (2.960 kg) in control. These findings were in accordance with those obtained by Brownell *et al.*, 1987; Yildirim, 2007; Karakurt *et al.*, 2009. They reported that the foliar sprays of humic acid and micronutrients also promoted growth, and increased yield and quality in a number of plant species. Based on the above findings, it could be concluded that cucumber crop is highly responsive to humic acid application and yield can be significantly increased by applying humic acids both as soil application as well as by foliar spray.

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