Research Article

Effect of Humic Acid and Micro Nutrients on Growth and Yield of Poly House Grown Cucumber (*Cucumis sativus* L.)

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Abstract

An experiment was conducted at Hi-tech unit of Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan to study the response of growth and yield of poly house grown cucumber cultivar "Kian" (*Cucumis sativus* L.) to different applications of humic acid and micro nutrients. There were seven treatments of humic acid and micro nutrients applications. The experiment was laid out in completely randomized design with three replications during 2013-14. Analysis of variance showed significant differences for all the characters studied except specific gravity and moisture content. The maximum vine length (9.107 m), number of fruits (40.867), fruit length (18.303 cm), TSS (3.830 per cent) and total yield per vine (3.810 kg) were reported for treatment T_7 (RDF+ Humic acid 10 kg/ha + Humic acid 0.1% + micronutrient mixture) followed by treatments T_5 (RDF+ Humic acid 10 kg/ha + micronutrient mixture) having 3.710 kg yield and T_4 (RDF+ Humic acid 10 kg/ha + Humic acid 0.1 %) with yield of 3.520 kg per vine, whereas minimum yield (2.960 kg) was showed by RDF (control).

Keywords: Cucumber, humic acid, polyhouse, yield, micronutrients

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Introduction

Cucumber (*Cucumis sativus* L.) is a warm season vegetable belongs to family cucurbitaceae. It grows throughout the world under tropical and subtropical conditions. It is said to be the native northern India [1]. Although its calorie and nutritional value is very low, it is a primary source of vitamins and minerals in the human diet [2]. In addition to its delicious taste, it has high medicinal value for human beings. It is well known for natural diuretic and thus can serve as an active drug for secreting and promoting flow of urine. The fruits of cucumber possesses various medicinal properties *e.g.* cooling effect, prevents constipation, checks jaundice and indigestion [3]. Due to high content of potassium (50-80 mg/100g), cucumber can highly be useful for both high and low blood pressures [4]. It is fast growing crop and compared with many crops, cucumber reaches harvest stage rapidly hence cucumber became most popular crop for poly house conditions. The cucumber fruit products are used not only for fresh eating and culinary cooking, but also for salad and pickling [5]. Cucumber is high yielding crop so it is responsive to fertilizers and organic matter. Humic substances are generated through organic matter decomposition and employed as soil fertilizers in order to improve soil structure and soil microorganisms [6], [7] and [8] found that humic acid promotes the uptake of N, P, Fe and Cu of tomato and other plants. The positive effect of humic acid on the uptake of N, P, Ca, Mg, Fe and Zn was also proved with corn plants [9]. Foliar sprays of these substances also promote growth, and increases yield and quality in a number of plant species [10] at least partially through increasing nutrient uptake, serving as a source of mineral plant nutrients and regulator of their release [11]. Likewise, humic substances have been shown to stimulate shoot and root growth and nutrient uptake of vegetable crops [12]. To elucidate the effects of humic substances, several hypotheses suggesting the formation of a complex between these substances and mineral ions, their involvement in the enhancement of enzyme catalysis, their influence of stimulating respiration, photosynthesis and nucleic acid metabolism, and their hormonal activity have been reported in carrot and higher plants, respectively, [13] and [14]. 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.

Material and Methods

The experiment was conducted under naturally ventilated polyhouse at Hi-tech Horticulture Unit, Rajasthan College of Agriculture, Udaipur (Rajasthan) during June, 2013 to January, 2014. 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@100 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 45 days, whereas foliar spray of micronutrient mixture was applied 90 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), stem diameter (cm), 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 quality characteristics (specific gravity (g/cc), TSS (per cent) 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

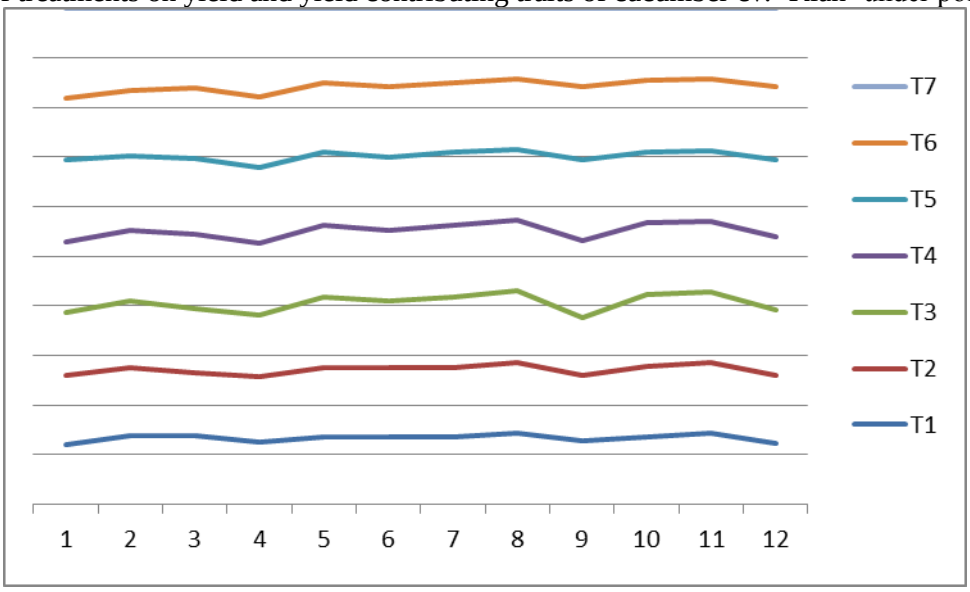
Results showed (**Table 1**and **Figure 1**) that application of humic acid and micronutrients significantly affect all the characters studied except specific gravity and moisture content of cucumber grown under poly house condition. Results obtained indicated significant differences for vine length having a range of 6.08 m (T_1) to 9.107 m (T_7), similar trained were also obtained in cucumber [15]. 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 in tomato [16]. 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.

Table 1 Effect of treatments on yield and yield contributing traits of cucumber cv. 'Kian' under polyhouse condition

Character	Vine length (m)	Stem diameter (cm)	Number of branches per vine	Number of fruits per vine	Fruit weight (g)	Fruit length (cm)	Fruit volume (cc)	Specific gravity (g/cc	Fruit diameter (cm)	TSS (per cent)	Moisture content (per cent)	Yield per vine (kg)
Treatment												
T_1	6.080	0.797	4.767	28.933	98.933	15.837	103.947	0.950	2.820	3.557	94.940	2.960
T_2	7.040	0.800	4.367	30.133	102.133	16.293	106.320	0.957	2.873	3.773	95.337	3.287
T_3	6.273	0.770	4.467	28.800	103.800	15.357	108.503	0.960	2.547	3.790	94.870	3.167
T_4	7.213	0.830	5.200	33.133	105.667	16.703	111.903	0.943	3.430	3.827	95.110	3.520
T_5	8.320	0.857	5.267	35.500	107.100	17.167	113.117	0.950	3.567	3.743	95.120	3.710
T_6	6.253	0.763	4.933	32.700	101.533	16.487	106.577	0.950	3.280	3.780	95.057	3.510
T_7	9.107	0.963	5.500	40.867	109.267	18.303	114.857	0.953	3.437	3.830	95.587	3.810
CD	0.670	0.046	0.640	2.879	5.415	0.697	6.453	NS	0.201	0.144	NS	0.465
SEm	0.219	0.015	0.209	0.940	1.768	0.228	2.107	0.005	0.065	0.047	0.161	0.152

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). Specific gravity and moisture content showed non significant effect of treatments and did not showed any response of humic acid applications. Total soluble solids showed significant differences with a range of 3.557 per cent (T_1) to 3.830 per cent (T_7). 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 in tomato [17] and [18]. 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.

Figure 1 Effect of treatments on yield and yield contributing traits of cucumber cv. 'Kian' under polyhouse condition



Conclusion

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. The maximum yield per vine was achieved by application of RDF (100:80:80, N:P:K, respectively) with humic acid @ 10 kg per ha and foliar spray of micronutrient.

References

[1] Pursglove, J.W. 1969. Tropical crops dicotyledons I. longamans. Green & co. Ltd. London & Harlow.
[2] Mah, S.Y., 1989. An effective fungicide for the control of downy mildew on cucumber. MAPPS
[3] Nandkarni, K.M. 1927. Indian materia medica. Nandkarni & Co. Bombay. Newsletter, 12(4): 40.
[4] Kashif, W., Q.M. Kamran and M.S. Jilani, 2008. Effect of Different Nitrogen Levels on Growth and Yield of Cucumber (Cucumis sativus L.). J. Agric. Res., 46(3): 259-266.
[5] Kadans, J.M., 1978. Encyclopedia of Medical Foods. Thorns Pub. Ltd., Willing Borough, North
[6] Halime, O.U., U. Husnu, K. Yasar and P. Huseyin, 2011. Changes in fruit yield and quality in response to foliar and soil humic acid application in cucumber. Scientific Research and Essays, 6(13): 2800-2803.
[7] Tattini, M., A. Chiarini, R. Tafani and M. Castagneto, 1990. Effect of humic acids on growth and nitrogen uptake of container-grown olive (Olea europaea L. 'Maurino'). Internat. Symp. on Olive Growing, Proceeding, Wageningen (Netherlands), 125-128.
[8] Adani, F., P. Genevini, P. Zaccheo and G. Zocchi, 1998. The effect of commercial humic acid on tomato plant growth and mineral nutrition. J. Plant Nutrition, 21(3): 561-575.

[9] Fortun, C. and C. Lopez, 1982. Influence of humic acid on the mineral nutrition and the development of the maize roots, cultivated in normal nutritive solutions and lacking of Fe and Mn. Anades-de Edafologia-yagrobiologia (Spain). Jan-Feb/ 1982, 41(1-2): 335-349.
[10] Karakurt, Y., H. Unlu, H. Unlu and H. Padem, 2009. The influence of foliar and soil fertilization of humic acid on yield and quality of pepper. Acta Agriculturae Scandinavica Section B Plant Soil Science, 59(3): 233- 237.
[11] Atiyeh, R.M., C.A. Edwards, J.D. Metzger, S. Lee and N.Q. Arancon, 2002. The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Biores. Technol., 84: 7-14.
[12] Cimrin, K.M. and I. Yilmaz, 2005. Humic acid applications to lettuce do not improve yield but do improve phosphorus availability. Acta Agriculturae Scandinavica, Section B, Soil and Plant Science, 55: 58-63.
[13] Muscolo, A., F. Bovalo, F. Gionfriddo and S. Nardi, 1999. Earthworm humic matter produces auxin-like effects on Daucus carota cell growth and nitrate metabolism. Soil Biol. Biochem., 31: 1303-1311.
[14] Serenella, N., D.A. Pizzeghelloa, N. Muscolob and A. Vianello, 2002. Physiological effects of humic substances on higher plants. Soil Biol. Biochem., 34: 1527-1536.
[15] Boehme, M., J. Schevtschenko and I. Pinker, 2005. Iron Supply of Cucumbers in Substrate Culture with Humate. Acta Hort. 697 ISHS, 41(1): 329-335.
[16] Hoang, T.L., 2003. Untersuchungen zur Wirkung von Huminsäure auf das Wachstum und die Nährstoffaufnahme von Tomaten (Lycopersicon esculentum MILL) und Wasserspinat (Ipomoea aquatic NORSSK). PhD Thesis, Humboldt-Universität zu Berlin, Landwirtschaftlich-Gärtnerische Fakultät.
[17] Brownell, J.R., G. Nordstrom, J. Marihart and G. Jorgensen, 1987. Crop responses from two new leonardite extracts. Sci. Total Environ., 62: 491-499.
[18] Yildirim, E., 2007. Foliar and soil fertilization of humic acid affect productivity and quality of tomato. Acta Agriculturae Scandinavica Section B-Soil Plant Science, 57: 182-186.

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