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Effect of Growing Media and Fertigation Schedules on Growth and Yield of Cucumber (*Cucumis sativus* L.) under Polyhouse Condition

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A B S T R A C T

An experiment was conducted to study the "Effect of growing media and fertigation schedules on growth and yield of cucumber (*Cucumis sativus* L.) under polyhouse condition" during *kharif* season of 2016 at Department of Horticulture, S.K.N. College of Agriculture, Jobner. The growing media: garden soil 18 kg/bag + vermicompost 2 kg/bag + cocopeat 2 cm layer at top shows the increase in all growth characters (chlorophyll and number of days taken to first flower appearance), yield attributes [number of fruits per vine, average fruit weight and fruit yield per 1000 m^2 (11.89 t)], quality attributes (TSS, ascorbic acid, N, P, K content in fruits). The treatment fertigation schedule at 2 days interval provide higher value for all growth characters (chlorophyll and number of days taken to first flower appearance), yield attributes [of fruits per vine, average fruit weight and fruit yield per 1000 m^2 (9.75 t)], quality attributes (TSS, ascorbic acid, N, P, K content in fruits).

Introduction

The cucumber (*Cucumis sativus* L.) is essentially a warm season crop mainly grown in tropical and subtropical regions where it is cultivated in the field. This crop belonging to family cucurbitaceace is generally known as "cucurbits". It consist of a wide range of vegetables either used for salad purpose (cucumber) or for cooking (all gourds), pickling (West Indian Gherkin) or as desert fruit (musk melon, water melon) or candiel or preserved (ash gourd). As a group, cucurbits occupy the largest area in India and in other tropical countries. Cucumber (*Cucumis sativus* L.) is commonly known as khira, dosakagu, sukasa, kakri, vellarikki and kakrikai. Cucumber is one of the oldest cultivated vegetable crops having its origin probably in India. It has been known in history for over 3000 years. From India, it seems to have spread to Asia and Africa and then to Europe. It was ancient Greeks and Romans in about 300 B.C. (Tekale *et al.*, 2014).

A growing medium is a substance through which roots grow and extract water and nutrients. Media for vegetable crops are

composed of soil and different organic matters. The soil is generally used as a basic medium because it is cheapest and easy to procure. Soil can be supplemented with the organic matters by adding vermicompost, farm yard manure, cocopeat etc. to enrich adequate nutrients for the plants. The growing medium also plays an important role in seed germination not only it act as a support, but also a source of key nutrients for plant growth. The composition of the medium influence the quality of the seedling (Wilson *et al.*, 2001). There is a better relationship between the manure and rooting rather than conventional soil mix and less susceptibility of the seedlings to soil borne pest and disease (Akanbi *et al.*, 2002).

The fertigation saves about 25 to 30 per cent of fertilizers coupled with higher productivity and quality (Raman *et al*., 2000). As the fertilizer is the costly input it is very essential to increase the fertilizer use efficiency by standardizing the fertigation schedule for various crops. Cucumber is one of the most important crop grown in protected condition for achieving higher productivity. However, there is no specific recommendation about scheduling of fertigation. Very meager research work has been carried out on apportioning or scheduling of fertilizers, hence there is scope to increase the productivity of cucumber by adopting suitable fertigation level and schedule. Hence the present research work has carried out to study the effect of fertigation levels and schedules on the growth, yield and quality of cucumber grown under polyhouse condition.

Materials and Methods

A field experiment was conducted during '*Kharif*' season of the year 2016 at Horticulture farm S.K.N. College of Agriculture, Jobner, Jaipur at 75^0 28′ longitude and 26^0 05′ latitude and altitude of 427 metres above mean sea level. The experiment was laid out in randomized block design with three replications under polyhouse condition. the experiment comprised 18 treatment combinations. 6 combination of growing media [Garden soil (GS) 20 kg per bag (G_0), Garden soil (GS) 20 kg per bag + Cocopeat 2 cm layer at top (G_1), GS 15 kg per beg + FYM 5 kg per beg (G_2), GS 18 kg per bag + Vermicompost 2 kg per bag (G_3), GS 15 kg per beg + FYM 5 kg per beg + Cocopeat 2 cm layer at top (G_4), GS 18 kg per bag + Vermicompost 2 kg per bag + Cocopeat 2 cm layer at top (G_5)] and 3 fertigation schedules [equal amount of fertilizers (19:19:19, 0:0:50, urea, $CaNO_3$, $MgSO_4$ and borex)] were applied at 2 days (S_1), 4 days (S_2) and 6 days (S_3) interval. Garden soil was collected from Horticulture farm by removing surface soil upto a depth of 5cm. The texture of soil was loamy sand (entisol) with pH 8.2, ECe 1.35 dSm^{-1}, organic carbon 0.20 %, available nitrogen 135 kg ha^{-1}, available phosphorus 16.25 kg.

Leaf sample of cucumber was collected from the field as per standard procedure at flowering for chlorophyll content and fruit sample collected at second and third harvesting for TSS, ascorbic acid, N, P, K content of fruits. TSS was estimated in ^{0} Brix with the help of hand refractometer and ascorbic acid (Vitamin C) content was estimated by the dichlorophenol indophenols dye method, and expressed in mg/100 g. Fruit sample were dried and ground for analysis of N, P, K content of fruits. Nitrogen was estimated by Colorimetric method as suggested by Snell and Snell (1939) using the Spectronic-20 (Model SL-177). Phosphorus was estimated by digesting fruit sample with tri-acid mixture of HNO_3: H_2SO_4: $HClO_4$ (10:1:4) using Vanadomolybdo Phosphate yellow colour method and the intensity of colour was measured at 470 nm in a spectrophotometer (Jackson, 1973). Potassium

was estimated by digesting leaf sample with tri-acid mixture of HNO_3: H_2SO_4: $HClO_4$ (10:1:4) and was estimated by flame photometer as per the method as suggested by Bhargava and Raghupathi (1993). Data generated from the experimental plots were analysed using SAS 9.3 version of the statistical package (SAS Institute Inc, 2011). Analysis of variance (ANOVA) was performed using PROCANOVA. Means were separated using Fisher's least significant difference (LSD) test at a probability level of p d" 0.05.

Results and Discussion

The data regarding the effect of growing media and fertigation schedules have been summarized and presented as mean of single year (2016).

Effect of growing media

Significantly higher values for chlorophyll content in leaves and optimum days taken for first flower appearance were recorded under treatment G_5 (soil + vermicompost + cocopeat) over other treatments although, treatment G_4 (soil + FYM + cocopeat) remained statistically at par to it for chlorophyll content (Table 1).

Treatment G_5 (soil + vermicompost + cocopeat) registered significantly higher values for number of fruits per vine, average fruit weight and fruit yield per 1000 m^2 over rest of treatments and remained at par to G_4 (soil + FYM + cocopeat) for number of fruits per vine (Table 1). Higher values for yield attributes might be due to higher accessibility of chemical fertilizers through fertigation and vermicompost which can induce protein production that causes more meristem cells and cell division and finally led to higher average fruit weight of cucumber and finally yield (Salardini and Mojtahedi, 1988).

Significantly higher values for TSS, ascorbic acid content, nitrogen, phosphorus and potassium content were recorded in treatment G_5 (soil + vermicompost + cocopeat) and minimum with G_0 (soil). Treatment G_5 was found significantly superior over rest of the treatments although, treatment G_5 and G_4 were found statistically at par with each other for TSS, phosphorus and potassium content (Table 1). Increase in ascorbic acid and TSS content of fruit in could be attributed to better growing media which helped in better uptake of NPK nutrients including micronutrients which inurn influence the quality traits in cucumber. The results are in conformity with the findings of Grimstand (1990), Koodzeij and Kostecka (1994) and Asano (1994) in cucumber.

Effect of fertigation schedules

Perusal of data in table 1 reveals that treatment S_1 (fertigation at 2 days interval) was recorded significantly maximum values for chlorophyll content at 45 days and optimum days taken for first flower appearance over rest of the treatments. This might be due to frequent and increased application of fertilizers directly in the vicinity of the root zone increases the availability and uptake of nutrients which leads to increase the cell size and cell elongation resulted in healthy and vigorous plant growth.

These results were in accordance with Lee *et al.,* (2005), Eifediyi and Remison (2009), Sharma *et al.,* (2009) and Jilani *et al.,* (2009). Also, the frequent application at 2 days interval increases the availability of nutrients leads to increases the uptake of N, P and K during growth period which increased protein and protoplasm synthesis for higher rate of mitosis resulted in increase the growth attributes. These results are in agreement with those reported by Al-Jaloud *et al.,* (1999) and Shinde *et al.,* (2010).

Table.1 Effect of growing media and fertigation schedules on growth, yield and quality parameters of cucumber

Treatments	Chlorophyll (mg/g)	First flower appearance(days)	No. of fruits per vine	Average fruit weight (g)	Fruit yield per 1000 m^2 (t)	Ascorbic acid (mg/100g)	TSS (°Brix)	Nitrogen (mg/100g)	Phosphor-us (mg/100g)	Potassiu-m (mg/100g)
Growing Media:										
G_0 : **GS (20 kg)**	0.874	25.19	22.29	147.96	5.31	6.51	3.02	95.20	21.89	138.38
G_1 : **GS (20 kg) + CC**	0.883	27.52	22.58	153.15	5.57	6.65	3.04	96.22	22.07	138.71
G_2 : **GS (15 kg) + FYM (5kg/ bag)**	0.885	28.67	37.52	161.12	9.72	6.68	3.05	97.47	22.30	139.80
G_3 : **GS (18 kg) + VC (2kg/ bag)**	0.891	30.14	37.77	167.4	10.17	6.69	3.07	98.43	22.57	140.19
G_4 : **GS (15 kg) + FYM (5kg /bag) + CC**	0.896	31.38	38.33	181.69	11.21	6.84	3.09	100.38	22.78	140.57
G_5 : **GS (18 kg) + VC (2kg/bag) + CC**	**0.900**	32.64	38.96	189.51	11.89	7.12	3.12	102.26	23.01	141.18
SEm±	0.001	**0.19**	**0.41**	**1.19**	**0.10**	**0.08**	**0.02**	**0.63**	**0.09**	**0.27**
CD (P = 0.05)	0.004	**0.52**	**1.14**	**3.34**	**0.27**	**0.23**	**0.05**	**1.77**	**0.25**	**0.77**
Fertigation Schedules:										
S_1 : **at 2 days interval**	**0.896**	32.03	34.78	172.10	9.75	6.96	3.09	100.82	22.82	140.49
S_2 : **at 4 days interval**	**0.888**	30.05	33.45	170.04	9.27	6.83	3.06	97.88	22.65	140.07
S_3 : **at 6 days interval**	**0.881**	25.69	30.5	158.28	7.91	6.45	3.04	96.29	21.85	138.86
SEm±	0.001	**0.13**	**0.29**	**0.84**	**0.07**	**0.06**	**0.01**	**0.45**	**0.06**	**0.19**
CD (P = 0.05)	0.003	**0.37**	**0.80**	**2.36**	**0.19**	**0.16**	**0.03**	**1.25**	**0.18**	**0.54**
Interaction	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**NS**	**NS**	**Sig**	**Sig**	**NS**

GS: Garden soil; FYM: Farm Yard Manure; VC: Vermicompost; CC: Cocopeat 2 cm layer at top
*Optimum no. of days for flower appearance in terminator variety of cucumber is 32-35DAS

Significantly maximum number of fruits per vine, average fruit weight and fruit yield per 1000 m^2 were observed in treatment S_1 (fertigation at 2 days interval) over S_2 (at 4 days) and S_3 (at 6 days) (Table 1). The enhanced supply of nutrients through increased fertigation level in the root vicinity of plant maintain optimum nutrient concentration in the root zone throughout the crop growth period, which increases the uptake of moisture and nutrients resulted in increasing all the growth attributes of cucumber which increases the photosynthetic rate and absorbed APAR resulted in more translocation of photosynthates towards reproductive organ (sink) which ultimately increases the yield attributes of cucumber. Janapriya *et al.,* (2010) also reported significantly higher yield and yield attributes under increased fertigation level. Similar results are also reported by Sharma *et al.*, (2009), Dai *et al.,* (2011) and Zhang *et al.,* (2011). The supply of nutrients through fertigation in the required duration has helped in efficient uptake resulting in increased length and girth of the fruits. The results are in conformity with the results of Das *et al.*, (1987), Choudhari and More (2002), Manohar (2002), Peil and Lopez (2002), Rodriguez *et al.,* (2007), Sharma *et al.,* (2009), Shinde *et al.,* (2010).

Treatment S_1 (fertigation at 2 days interval) was recorded significantly maximum values for ascorbic acid, TSS, nitrogen, phosphorus and potassium content over rest of fertigation treatments, although it was remained at par to treatment S_2 (fertigation at 4 days interval) for values of ascorbic acid, TSS, phosphorus and potassium content. Fertigation is supplying fertilizers along with irrigation is one of the most effective convenient methods of supplying nutrients of water according to the specific requirements of the crop to maintain optimum soil fertility and to increase the quality of the produce (Shingure *et al.*, 1999) might be the probable reason which led improvement in quality attributes of cucumber during experiment.

References

Akanbi, W.B., Togun, A.O., Adediran, T.A., Olabde, O. S. and Olanivi, J. O. 2002. Effect of split application of organo-mineral fertilizer on okra growth, nutrient uptake and fruit yield. *Crop Research*, 29 (2): 223-239

Al-Jaloud, A., Ongkingno, T., Al-Saharay, S. and Al-Bashir, W. 1999. Effect of fertigation frequencies on growth and yield of greenhouse cucumber. *Saudi Journal of Biological Sciences,* 2 (6): 156-166.

Asano, J. C. (1994). Effect of organic manures on quality of vegetables. *Journal of Agricultural Research* 18 (1): 31-36.

Bhargava, B.S. and Raghupathi, H.B. 1993. In: Method of analysis of Soil, Plant, Water and fertilizers. H. L. S. Tandon (Ed) F.D.C.O., New Delhi. pp 41.

Choudhari, S.M. and More, T. A. 2002. Fertigation, fertilizer and spacing requirement of tropical gynoecious cucumber hybrids. *Acta Horticulturae,* 588: 233-240.

Dai, J., Liu, S., Zhang, W., Xu, R., Luo, W., Zhang, S., Yin, X., Han, L. and Chen, W. 2011. Quantifying the effects of nitrogen on fruit growth and yield of cucumber crop in greenhouse. *Scientia Horticulturae,* 130: 551-561.

Das, M.K., Maity, T.K. and Som, M.G. 1987. Growth and yield of pointed gourd as influenced by nitrogen and phosphorus fertilization. *Vegetable Science,* 14 (1):18-26.

Eifediyi, E.K. and Remison, S.U. 2009. The effects of inorganic fertilizers on the yield of two varieties of cucumber. *Report and Opinion,* 1 (5): 74-80

Grimstand, S.O., 1990. Evaluation trials of greenhouse cucumbers. Verdiproving av veksthusagurk. *Gartneryrket*, 80 (21): 16-18.

Jackson, M.L. 1973. Soil chemical analysis. Prentice Hall of India Private Limited, New Delhi, India, pp. 183–192.

Janapriya, S., Palanisamyand, D. and Ranghaswami, M.V. 2010. Soilless media and fertigation for naturally ventilated polyhouse production of cucumber (*Cucumis sativus* L.) cv. green long. *International Journal of Agricultural and Environment Biotechnology*, 3 (2): 199-203.

Jilani, M.S., Bakar, A., Waseem, K. and Kiran, M. 2009. Effect of different levels of NPK on the growth and yield of cucumber (*Cucumis sativus* L.) under the plastic tunnel. *Journal of Agriculture Social Sciences*, 5: 99–101.

Koodzeij M and Kostecka J (1994). Some quality characteristics. In cucumber and carrot grown on vermicomposts. *Zezyty-Naukeme-Akademii-Roluicoz-ej-im-Hugona-Koataja-w-karkowie, Serja-Naakowa*, 41: 89-93.

Lee, J.H., Park, S.K., Lee, Y.H., Lee, Y.B. 2005. Effect of fertigation level and frequency on uptake of nutrients, growth and yield in cucumber. *Journal of Korean Society for Horticultural Science*, 46 (6): 356-362.

Manohar, K.R. 2002. Evaluation of capsicum (*Capsicum annuum*) genotypes and effect of source of fertilizers and levels of fertigation under cost effective green house. *Ph. D (Agri.). Horticulture*, Thesis submitted to UAS Bangalore.

Peil, R.M. and Lopez, J.G. 2002. Fruit growth and biomass allocation to the fruits in cucumber: effect of plant density and arrangement. *Acta Horticulturae*, 588: 75-80.

Raman, S.S., Murthy, K.M.D., Ramesh, G., Palaniappan, S.P. and Chelliah, S. 2000. Effect of fertigation on growth and yield of gherkin. Veg. Sci. 27 (1): 64-66.

Rodriguez, J.C., Shaw, N.L. and Cantliffe, D.J. 2007. Influence of plant density on yield and fruit quality of greenhouse-grown galia muskmelons. *Hortculture Technology*, 17 (4): 580-585.

Salardini, A., Mojtahedi, A. 1988. Principal of plant nutrition. *University of Tehran Press*, Tehran, Iran.

SAS Institute Inc. 2011. *SAS* ® *9.3* Macro Language: Reference. Cary, NC: SAS Institute Inc. SAS Institute. 1999. Statistical Analysis System Inc. J SAS users' guide, Statistical Analysis Institute. Carry NC**,** pp: 112

Sharma, M.K., Negi, S. and Kumari. S. 2009. Effect of different growing media and fertigation levels on production of cucumber (*Cucumis sativus*) under protected conditions in the hills. *Indian Journal of. Agriculture Science,* 79 (11): 853-856.

Shindhe, J.B., Malunjkar, B.D., Raut, R.S., Patil, P.D. and Thawal, D.W. 2010. Response of cucumber to fertigation under drip irrigation system. *Bioinfoet*, 7 (2): 161-164.

Shingure P S, Lallan Ram, Marathe R A and Yadav R P 1999. Effect of nitrogen fertigation on vegetative growth and leaf nutrient content of acid lime (*Citrus aurantifolia* Swingle) in central India. *Indian Journal of Soil Conservation*, 27 (1): 45-49.

Snell, F.D. and Snell, C.T. 1939. Colorimetric methods of analysis 3rd Ed. 11 van Nortrand Co. Inc., New York.

Tekale, C.D., Tumbare, A.D., Tekale, G.S., Danawale, N.J. and Tambe, S.T. 2014. Effect of different fertigation levels and schedules on growth and yield of cucumber under polyhouse conditions. *International Journal of Current Research*, 6 (7): 7353-7355.

Wilson, S.B., Stoffella, P.J. and Graetz, D.A.

2001. Use of compost as a media amendment for containerized production of two subtropical perennials. *Journal of Environmental Horticulture*, 19 (1): 37–42.

Zhang, H., Chi, D., Wang, q., Fang, J. and Fang, X. 2011. Yield and quality response of cucumber to nitrogen fertilization under subsurface drip irrigation in solar greenhouse. *Agricultural Sciences in China*, 10 (6): 921-930.

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