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Effect of growing media and micronutrients on growth and yield of cucumber (*Cucumis sativus L.*) under polyhouse condition

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Abstract

An experiment entitled "Effect of growing media and micronutrients on growth, yield and quality of cucumber (*Cucumis sativus L.*) under polyhouse condition" was carried out during *kharif* season 2017 at Department of Horticulture, S.K.N. College of Agriculture, Jobner. The experiment consisted twelve treatment combinations with three growing media (garden soil, garden soil + FYM, garden soil + vermicompost and four foliar spray of micronutrients in Completely Randomized Design with three replications. Growing of cucumber with garden soil 18 kg/bag + vermicompost 2 kg/bag and foliar spray of boron 0.5 % + calcium 0.5% significantly improved all the growth parameters (plant height, number of green leaves per plant, number of nodes per plant, stem diameter, total number of pickings), yield attributes (number of fruits per plant, av. fruit weight, fruit yield per plant, fruit yield per 1000 m² area).

Keywords: Growing media, polyhouse, micronutrients, cucumber

Introduction

Cucumber (*Cucumis sativus L.*) is popularly known as 'khira' in India which belongs to the genus *Cucumis*. It is originated from Southern Asia. It is a coarse prostrate, annual, creeping vine that can reach upward upto 2-3 meter in length. The fruit of cucumber prevents constipation, checks jaundice and indigestion. It is consumed as from vegetable and salads. The main purpose to produce vegetables in protected structures is to get higher profit and disease free seedlings in off season to raise early crop as compared to open field conditions (Duhan, 2016) [8]. Nearly 3½ times higher fruit yield of cucumber was reported under poly-green house (Ganesan and Subashini, 1999) [10]. 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.

Use of different growing media has played significant role in providing soil as well as plant nutrients for intensive crop production. Generally, growth 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 and supplemental of the soil which is aimed to make media more porous while the organic matter (Vermicompost and Farm yard manure) are added so as to enrich adequate nutrients for the seedlings. There is a better relationship between the manures and rooting of plant rather than conventional soil mix which has less susceptibility of the seedlings to soil borne pest and diseases (Akanbi *et al.*, 2002) [11].

Farm Yard Manure (FYM) is also a good source of nutrients and contributed towards buildup of organic matter in soil. It is a mixture of farm waste including animals, plant waste and prepared by decomposing them. Micronutrients also influence the physiological activities in plants play a catalytic role in nutrient absorption and balancing other nutrients. Among the micronutrients boron helps in the absorption of water and carbohydrate metabolism, translocation of carbohydrates in plant, DNA synthesis in meristem, cell division and elongation, active salt absorption, fertilization, water relation and photosynthesis and involves indirectly in metabolism of nitrogen, phosphorous, fat and hormones. Boron also plays an important role in flowering and fruit formation. Similarly, Calcium is also plays a key role in the structure of cell wall and cell membrane, fruit growth and development, as well as general fruit quality. It also enhances the resistance to bacterial and viral disease.



Fig 1: A view of cucumber cultivation in polybags under polyhouse condition

Materials and Methods

The experiment was laid out under naturally ventilated polyhouse at Department of Horticulture, S.K.N. College of Agriculture, Jobner, Rajasthan during 2017. Geographically, Jobner is situated in Jaipur district of Rajasthan at $75^{\circ}28'$ longitude and $26^{\circ}05'$ latitude and altitude of 427 metres above mean sea level. The experiment comprised twelve treatment combinations including 3 combination of growing media Garden soil 20 kg/bag, Garden soil 15 kg/bag + FYM 5 kg/bag, Garden soil 18 kg/bag + Vermicompost 2 kg/bag and 4 foliar application of micronutrients water spray, Foliar spray of B @ 0.5%, Foliar spray of Ca@ 0.5 %, Foliar spray of B @ 0.5% &Ca @ 0.5%. Garden soil was collected upto a depth of 5 cm from Horticulture farm by removing surface soil. The texture of soil was loamy sand (entisol) with pH 8.2, EC 1.35 dSm-1, organic carbon 0.20 %, available nitrogen 135 kg/ ha, available phosphorus 16.25 kg/ha, available potassium 148.6 kg/ ha and sulphur @ 8.40 mg/ kg. Among the different growing media, vermicompost was procured from college vermicompost unit and FYM from Dairy farm of college. A mixture of growing media was prepared as per treatment and polybags of 30 x 30 cm size were filled with the mixture (20 kg/bag). The polybags were perforated at bottom and sides by making 5-6 holes before filling mixture of media. Foliar spray of boron supplied through 'Borax' ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$). However foliar spray of Calcium was supplied through Agricultural lime which is a crushed limestone. It is a soil additive made from pulverized limestone or chalk and the primary active component is calcium carbonate (CaCO_3). Seeds of cucumber cv. 'Hilton' were procured from Jaipur in air-tight polythene packing and sowing of one seed in each polybag was done upto a depth 1.5 to 2 cm sown at approximately 2 cm depth. Observation of growth attributes like Plant height (m), number of green leaves per plant, stem diameter (cm), number of nodes per plant were taken from randomly selected 5 plants of each treatment at 45 and 90 days after sowing. Total 9 number of pickings were taken.

Yield attributes like number of fruits per plant, fruit weight per plant, fruit yield ($\text{t}/1000\text{m}^2$) were taken in each picking and measured from randomly selected five fruits per plant in each picking.

Results and Discussion

Effect of growing media on growth and yield parameters

The higher values for plant height (m), number of green leaves per plant, stem diameter (cm), number of nodes per plant at 45 and 90 days after sowing, total number of pickings maximum number of fruit/plant average fruit weight/plant, fruit yield per plant and per 1000 m^2 were recorded when cucumber crop was sown with growing media G₂ (Garden soil 18 kg/bag + vermicompost 2 kg/bag) which were significantly superior as compared to rest of the treatments (Table 1).

Higher values of growth and yield parameters might be due to use of vermicompost would have facilitated better aeration, adequate drainage and created a favourable soil environment for deeper penetration of roots and higher nutrient extraction from soils. Vermicompost contains more number of N₂ fixing, phosphate solubilizing and other beneficial microbes, antibiotics, vitamins, hormones, enzymes, which have better effect on growth and yield of plants (Bhawalkar, 1992) [5]. Vermicompost also improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth and higher manufacture of food and its subsequent partitioning to sink. The results reported with Sharma *et al.* (2009) [21], Umamaheswarappa *et al.* (2005) [24], and Okoli and Nweke (2015) [16] are in close conformity with these findings. Similar results have also been reported by Prabhu *et al.* (2006) [17].

Azarmi *et al.* (2009) [3], Moraditochaei *et al.* (2011) [15], Vijaya and Seethalakshmi (2011) [25], Yardim *et al.* (2006) [26], Bindiya *et al.* (2006) [7] and Ghasem *et al.* (2014) [11] in cucumber.

Effect of micronutrients on growth and yield parameters

Application of micronutrient had significant effect on plant height, number of green leaves per plant, stem diameter and number of nodes per plant at 45 and 90 days after sowing, total number of pickings, number of fruit/plant, average weight of fruit per plant, fruit yield per plant and per 1000 m^2 were recorded under treatment S₃ (Boron + Calcium) over other treatments. (Table 1)

Foliar application of micronutrients specially boron increased the level of carbohydrates, also helps in absorption of water and carbohydrate metabolism and increased fruit size and fruit yield.

Boron and calcium both promotes calcium metabolism and cell wall integrity and delay cell wall degradation which increase fruit firmness. Ryden *et al.* (2003) on tomato.

Table 1: Effect of Growing Media and micronutrients on Growth parameters of Cucumber

Growing media	Treatments	Plant height (m)		Number of green leaves per plant		Stem Diameter (cm)		Number of nodes per plant	
		45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS
G ₀ - Garden soil (20 kg/bag)		1.18	2.43	26.13	57.05	12.00	1.10	14.39	29.63
G ₁ - Garden soil (15 kg/bag) + FYM (5 kg/bag)		1.46	2.71	33.25	63.50	15.65	1.30	17.80	33.05
G ₂ - Garden soil (18 kg/bag) + VC (2 kg/bag)		1.60	2.86	37.78	68.03	17.88	1.50	19.51	34.76
SEm _±		0.03	0.04	0.59	1.09	0.38	0.03	0.32	0.58
CD (P=0.05)		0.08	0.12	1.72	3.18	1.10	0.08	0.93	1.69
Micronutrients									
S ₀ - Control (water spray)		1.16	2.41	26.01	56.79	0.81	1.09	14.40	29.64

S ₁ - Foliar spray of boron	1.37	2.62	31.90	61.64	0.85	1.28	16.69	31.94
S ₂ - Foliar spray of calcium	1.48	2.73	33.35	64.06	0.96	1.37	18.10	33.34
S ₃ - Foliar spray of boron + calcium	1.64	2.89	38.28	68.95	1.16	1.46	19.75	35.00
SEm ₊	0.03	0.05	0.68	1.25	0.03	0.03	0.37	0.67
CD (P=0.05)	0.09	0.13	1.99	3.68	0.07	0.09	1.07	1.95
CV (%)	6.50	5.15	6.27	5.98	8.04	6.97	6.37	6.14

GS: Garden soil; FYM: Farm Yard Manure; VC: Vermicompost



Fig 2: Cucumber cultivation under polyhouse condition

Table 2: Effect of Growing Media on Yield and quality Parameters of Cucumber

Growing media \ Treatments	Number of pickings	No. of fruits/plant	Average fruit weight (g)	Fruit yield/ plant (kg)	Fruit yield (t/ 1000 m ²)
G ₀ - Garden soil (20 kg/bag)	12.00	24.89	108.71	2.71	4.40
G ₁ - Garden soil (15 kg/bag) + FYM (5 kg/bag)	15.65	29.35	116.23	3.44	6.19
G ₂ - Garden soil (18 kg/bag) + VC (2 kg/bag)	17.88	33.76	121.18	4.13	7.79
SEm ₊	0.38	0.47	1.71	0.09	0.16
CD (P=0.05)	1.10	1.38	5.01	0.27	0.46
Micronutrients					
S ₀ - Control (water spray)	11.94	24.90	105.32	2.63	4.52
S ₁ - Foliar spray of boron	15.34	29.39	113.93	3.36	6.04
S ₂ - Foliar spray of calcium	15.79	30.29	116.20	3.53	6.35
S ₃ - Foliar spray of boron + calcium	17.64	32.76	126.04	4.19	7.61
SEm ₊	0.43	0.54	1.97	0.11	0.18
CD (P=0.05)	1.28	1.59	5.78	0.31	0.53

GS: Garden soil; FYM: Farm Yard Manure; VC: Vermicompost

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