Vegetable Science (2011) 38(2) : 215-217

Short communication

Response of cultivars, plant geometry and methods of fertilizer application on parthenocarpic cucumber (*Cucumis sativus* L.) under zero energy polyhouse condition

Alka Sharma, RA Kaushik, DK Sarolia and RP Sharma

Received : Dec 2010 / Accepted : June 2011

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 quality vegetable crops, with high yield. Protected cultivation has 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. But protected cultivation requires careful planning and attention including selection of varieties, suitable production technology like spacing, time of planting, water and nutrient management and plant protection to produce economic yield of good quality.

Besides the cultivar and plant geometry, cucumber requires a constant water supply along with fertilizer application to reach high quality yield. In general, zero-energy polyhouse cucumbers are irrigated through drip system of irrigation and fertilizers are also applied along with irrigation water according to the crop growth and season of cultivation. In view of importance of protected cultivation, the study was initiated to find out suitable cultivar, plant geometry and method of fertilizer application in cucumber grown under naturally ventilated polyhouse.

The experiment was conducted under naturally ventilated polyhouse at Hi-tech Horticulture Unit, Rajasthan College of Agriculture, Udaipur (Rajasthan) during rainy season of 2007-08 and 2008-09. The trial was laid out in Factorial Completely Randomized Design with three replications. The size of the zero energy polyhouse was 28m×32m (896 m^2) covered with ultra violet stabilized low density polyethylene sheet having 200 micron thickness. The experiment was comprised of three cultivars namely, Hilton (V_1), Isatis (V_2) and Kian (V_3); three levels of spacing 60×30 cm (S_1), 60×40 cm (S_2) and 60×50 cm (S_3) and two methods of fertilizer application *viz.*, Conventional method (F_1) with a recommended dose (NPK @ 9:5.4:10.8 kg per 1000 sq. meter) and second Fertigation (F_2). In case of fertigation, same dose of NPK were applied through irrigation water in the ratio of 5:3:6 at twice in a week with the concentrations Nitrogen - 0.300 g N/3 liter water/m^2, Phosphorus - 0.180 g P_2O_5/3 liter water/m^2, Potassium

RA Kaushik, DK Sarolia
Department of Horticulture,
Rajasthan College of Agriculture,
Maharana Pratap University of Agriculture and Technology,
Udaipur - 313 001, Rajasthan, India

Alka Sharma
Corresponding author & Research Scholar,
Department of Horticulture,
Rajasthan College of Agriculture,
Udaipur

RP Sharma
Division of Crop Production, Indian Institute of Vegetable Research, Varanasi-221305. India

- 0.360 g K_2O/3 liter water/m^2. In case of conventional method of fertilizer application, ½ dose of N and full dose of P and K were applied before transplanting. Remaining half dose of N was applied in two split doses i.e. at 30 DAT and 60 DAT. In this way, total 18 treatments were used in the present study.

For green house cultivation of cucumber, the seedlings were raised on soil-less media in plastic protrays having cells of 1.5" in size. The seedlings were ready for transplanting within 15-18 days. Three weeks old seedlings at 2-3 true leaf stage were transplanted at 60×30, 60×40 and 60×50 cm according to the different treatment combinations. All the cultural practices including irrigation and hoeing were carried out, following the standard commercial procedures. Spraying for pests and diseases were applied whenever it appeared necessary throughout the growing season. Vines were vertically trained and maintained as single stems by the continuous pruning of all laterals.

Data on growth characteristics (vine length, girth of the stem, internodal distance and leaf area), flowering characteristics, yield and yield attributing characteristics such as fruit set (%), fruit drop (%), number of fruits per vine, average fruit weight (g), yield per vine (kg) and yield per sq. meter (kg/m^2) and fruit quality characteristics *viz*., fruit length (cm), fruit width (cm), moisture content (%), TSS (%) and pigment status of fruits were recorded from randomly selected five tagged plants of each treatment and further analyzed. All data were subjected to analysis of variance to determine main treatment effect and interactions. The cost of cultivation per 500 square meters was calculated treatment wise. The yield (kg/m^2) gross income and net income per 500 square meters and benefit-cost ratio were also calculated.

Interaction effect of cultivars, spacing and method of fertilizer application significantly influenced the vegetative growth characteristics as vine length,

Table 1: Interaction effect of cultivars, spacing and method of fertilizer application on growth, yield and quality characteristics of parthenocarpic cucumber under zero energy polyhouse condition during rainy season

S. No.	Treatment	Vine length (m)	Inter-nodal distance (cm)	Leaf area (cm^2)	Days to flower bud initiation	Fruit set (%)	Fruit drop (%)	Number of fruits per vine	Average fruit weight (g)	yield per vine (kg)	yield per sq. meter (kg)	Fruit length (cm)	Fruit width (cm)	TSS (%)	Total chloro-phyll content (mg g^{-1} fresh weight)
1.	$V_1S_1F_1$	2.95	8.80	481.86	34.61	47.79	8.18	26.93	98.07	3.15	17.47	17.01	3.38	3.36	1.17
2.	$V_1S_1F_2$	3.36	8.44	502.43	33.40	50.30	6.88	31.60	103.36	3.46	19.22	18.25	3.62	3.37	1.26
3.	$V_1S_2F_1$	3.09	8.55	485.68	34.37	51.52	8.89	27.27	98.11	3.20	13.31	17.05	3.39	3.33	1.24
4.	$V_1S_2F_2$	3.46	8.19	507.74	34.33	51.57	4.90	33.60	112.77	3.72	15.49	19.53	3.88	3.49	1.30
5.	$V_1S_3F_1$	3.15	8.65	497.80	36.47	49.92	6.74	29.93	104.16	3.39	11.30	17.63	3.50	3.37	1.36
6.	$V_1S_3F_2$	3.71	7.97	530.43	32.94	55.14	4.09	36.00	115.23	3.99	13.30	19.84	3.94	3.45	1.35
7.	$V_2S_1F_1$	2.74	8.84	429.79	37.40	45.38	9.75	28.40	97.64	3.02	16.76	16.43	3.26	3.79	1.23
8.	$V_2S_1F_2$	2.85	9.02	452.59	36.18	45.09	7.45	30.13	91.26	3.09	17.15	17.36	3.45	3.75	1.34
9.	$V_2S_2F_1$	2.84	9.42	428.62	38.21	43.38	8.55	27.13	93.26	2.85	11.85	17.28	3.43	3.68	1.26
10.	$V_2S_2F_2$	3.04	8.84	469.71	36.07	49.51	5.48	28.80	94.84	3.12	12.96	17.51	3.48	3.81	1.39
11.	$V_2S_3F_1$	3.18	8.68	453.53	33.85	47.83	7.59	28.00	102.90	3.04	10.11	17.52	3.48	3.70	1.32
12.	$V_2S_3F_2$	3.27	8.80	475.57	33.90	48.33	5.14	31.33	105.29	3.19	10.61	18.55	3.68	3.86	1.39
13.	$V_3S_1F_1$	2.85	9.18	428.36	34.07	44.54	10.48	23.80	99.53	2.87	15.92	16.89	3.35	3.47	1.32
14.	$V_3S_1F_2$	3.17	9.06	453.52	36.82	46.61	7.76	31.87	100.58	3.15	17.51	18.08	3.59	3.48	1.42
15.	$V_3S_2F_1$	3.02	9.00	441.39	37.40	42.80	9.12	28.67	102.44	2.92	12.16	17.51	3.48	3.46	1.41
16.	$V_3S_2F_2$	3.09	8.76	456.86	37.77	44.31	6.00	30.87	96.77	3.15	13.11	18.67	3.71	3.60	1.49
17.	$V_3S_3F_1$	3.19	9.04	458.58	34.13	47.32	8.56	27.33	104.56	3.02	10.07	18.16	3.61	3.52	1.36
18.	$V_3S_3F_2$	3.29	8.64	500.76	33.87	48.98	6.42	31.60	102.86	3.32	11.06	18.70	3.71	3.56	1.41
	SEm±	0.024	0.065	3.133	0.259	1.217	0.256	0.698	1.177	0.019	0.081	0.242	0.051	0.055	0.028
	CD at 5%	0.068	0.182	8.831	0.731	3.431	0.720	1.967	3.319	0.053	0.229	0.683	0.144	NS	NS

V_1, Hilton; V_2, Isatis and V_3, Kian; S_1, 60cm×30cm; S_2, 60cm×40cm; S_3, 60cm×50cm; F_1, Conventional method; F_2, Fertigation

internodal distance and leaf area of parthenocarpic cucumber under zero-energy polyhouse condition during rainy season (Table 1). The pooled maximum vine length (3.71 m), leaf area (530.43 cm^2) and minimum internodal distance (7.97 cm) were recorded in treatment $V_1S_3F_2$ (Hilton + 60×50 cm + Fertigation). This might be due to the combined effect of cultivars, wider spacing and timely and uniformly availability of all the macro-nutrients through fertigation. The present results are supported by the findings of Arora *et al.* (2006) in greenhouse grown tomato; Ban *et al.* (2006) in melons. Drip fertigation of cucumber adequately sustain favourable vegetative and reproductive growth as compare to conventional method of fertilizer application. These results are in accordance with the findings of Choudhari and More (2002) in gynoecious cucumber hybrids.

In present investigation, all the yield and yield attributing characteristics as given in table 1 clearly exhibited significant influence by interaction effect of cultivars, spacing and method of fertilizer application. The pooled maximum fruit set (55.14%) with minimum fruit drop (4.09%) was reported in combined treatment $V_1S_3F_2$ (Hilton + 60×50 cm + Fertigation). These findings are quite analogous with that of Fonseca *et al.* (2003) and Hanna and Adams (1991) in cucumber. The pooled maximum number of fruits per vine (36.00) and average fruit weight (115.23 g) were observed in same treatment i.e. $V_1S_3F_2$(Hilton + 60×50 cm + Fertigation). The similar findings of increase in average fruit weight and number of fruits per vine with wider spacing was reported by Mantur and Patil (2008) and Bahadur and Singh (2005) in tomato. Choudhari and More (2002) reported maximum number of fruits per vine and fruit weight at 1.80 m × 0.45 m spacing with fertigation experimentation in tropical gynoecious cucumber hybrid namely Phule Prachi. The pooled maximum yield per vine (3.99 kg) was noticed in $V_1S_3F_2$(Hilton + 60×50 cm + Fertigation); whereas, pooled maximum yield per sq. meter (19.22 kg per sq. m.) was obtained in $V_1S_1F_2$ (Hilton + 60×30 cm + Fertigation). It is concluded that the main factors responsible for the increase in fruit yield per unit area at narrow spacing were due to greater crop biomass. These results indicated that maximum yields are function of greater number of plants per unit area. The present findings are in accordance with the results of Papadopoulos and Pararajasingham (1997). The increased in yield attributes under fertigation in tomato may be attributed to better water utilization and higher uptake of nutrients.

Fruit length and fruit width of cucumber were found to be significantly influenced by interaction effect of cultivars, spacing and method of fertilizer application. The pooled maximum fruit length (19.84 cm) and fruit width (3.94 cm) were observed in $V_1S_3F_2$ (Hilton + 60×50 cm + Fertigation) treatment. Pandey *et al.* (2005) reported the significant differences for fruit length and fruit width of glass house grown capsicum. Maximum fruit diameter was recorded by Choudhari and More (2002) in cucumber through fertigation. In the present investigation, interaction effect of cultivars, spacing and method of fertilizer application had non-significant influence on the TSS and total chlorophyll content of cucumber.

The economics of cucumber production under indigenously designed naturally ventilated polyhouse was worked out by taking the depreciation cost of the structure and by taking the life of the basic steel structure as 20 years, whereas the life of UV plastic film and insect proof net was considered as three years. Indigenously designed naturally ventilated polyhouse, which can be fabricated with the cost of Rs. 500/m^2, is technically suitable and economically feasible for round the year cucumber cultivation. Economic analysis indicate that treatment $V_1S_3F_2$ (Hilton + 60×50 cm + Fertigation) had gross return (Rs. 133000 per 500 sq. m.) and net return of Rs. 91539.39 per 500 sq. meter area. The cost-benefit ratio of cucumber cultivation under zero-energy polyhouse was worked out as 1:2.21 under Udaipur conditions of India.

Based on the above findings, it could be concluded that cucumber should be grown at a spacing of 60×50 cm along with the fertigation practice using parthenocarpic cucumber cultivar 'Hilton' during rainy season for sustaining higher fruit yield and quality cucumber under zero-energy polyhouse condition.

References

Arora SK, Bhatia AK, Singh VP, Yadav SPS (2006) Performance of indeterminate tomato hybrids under greenhouse conditions of north Indian plains. Haryana J Hortic Sci 35 (3&4): 292-294

Ban D, Goreta S, Borosic J (2006) Plant spacing and cultivar affect melon growth and yield components. Scientia Horticulturae 109: 238-243

Choudhari SM, More TA (2002) Fertigation, fertilizer and spacing requirement of tropical gynoecious cucumber hybrids. Acta-Horticulturae (588): 233-240

Gulam ud din Ahmed N, Narayan R, Nazir G, Hussain K (2006) Variability studies in cucumber. Haryana J Hortic Sci 35 (3&4): 297-298

Pandey V, Ahmed Z, Tewari HC, Kumar N (2005) Effect of greenhouse models on plant growth and yield of capsicum in Uttranchal hills of north west Himalayas. Indian J Hort 62(3): 312-313