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#### Bhoopendra Singh

Ph.D. Scholar, Department of Horticulture Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, Uttar Pradesh, India

#### Devi Singh

Assistant Professor, Department of Horticulture Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, Uttar Pradesh, India

#### VM Prasad

Professor, Department of Horticulture Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, Uttar Pradesh, India

#### Sudhir Jamwal

Ph.D. Scholar, Department of Horticulture Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, Uttar Pradesh, India

#### Correspondence

##### Bhoopendra Singh

Ph.D. Scholar, Department of Horticulture Sam Higginbottom University of Agriculture Technology and Sciences Prayagraj, Uttar Pradesh, India

## Effect of cultivar, spacing and dose of NPK on vegetative growth, yield, quality and cost benefit ratio of cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse

Bhoopendra Singh, Devi Singh, VM Prasad and Sudhir Jamwal

#### Abstract

The present investigation was conducted 2017-19 was carried out at Vegetable Research Farm SHUATS, Prayagraj, Allahabad U.P. with three replications. In this way, the experiments were comprising of total twenty seven treatment combinations of three cultivars namely, Pant Parthenocarpic Cucumber -2 (V<sub>1</sub>)' Pant Parthenocarpic Cucumber -3 (V<sub>2</sub>) and Hilton (V<sub>3</sub>); three plant geometry i.e. 60 x 30 cm (P<sub>1</sub>), 60 x 40 cm (P<sub>2</sub>) and 60 x 50 cm (P<sub>3</sub>) and three NPK, fertilizers doses like, 20:10:22 Kg/1000m<sup>2</sup> (D<sub>1</sub>), 25:15:27 Kg/1000m<sup>2</sup> (D<sub>2</sub>) and 30:20:32 Kg/1000m<sup>2</sup> (D<sub>3</sub>) of NPK combination.. The results revealed that all the treatments and their combinations had significantly influenced the growth, yield, quality and BC ration of treatment combination. Among the different cultivars used in the study, Pant Parthenocarpic Cucumber - 3 (V<sub>2</sub>) were found statistically superior to enhance vine length (2.73 m), stem girth (0.80 cm) leaf area (412.34 cm<sup>2</sup>), Internodal distance (8.38 cm) minimum days required to first flower bud initiation (42.14 DAS), days to first fruit harvest (55.42 DAS), number of fruits per vine (21.89), average weight of fruit (116.41 g), fruit length (18.35 cm) and fruit width (3.45 cm) which ultimately gave maximum yield per vine (2.82 kg per plant) during pooled, respectively. Further, among the various spacing treatments, spacing (P<sub>3</sub>) i.e. 60 x 50 cm was found to be significantly superior with respect to vegetative growth, yield per plant and quality of fruits except yield per sq. meter significantly higher yield per sq. meter was recorded in spacing P<sub>1</sub> (60 x30 cm) and least in P<sub>3</sub> (60 x50 cm) during both the year. In case of dose of fertilizer application, the application of fertilizers through manually apply the root zone of plant was found superior to maximum fertilizers apply compared to minimum fertilizers apply. Maximum number of fruits per vine, average fruit weight (g), yield per vine (kg) and yield per sq. meter (kg) were recorded in both the year maximum fertilizers apply in D<sub>3</sub>.

**Keywords:** parthenocarpic cucumber, dose of fertilizers, spacing, polyhouse, growth, yield, quality

#### Introduction

Cucumber (*Cucumis sativus* L.) is one of the most important vegetable crops of the cucurbitaceae family and having a chromosome number, 2n = 14. As a vegetable crop cucumber has great economic importance in India. The immature fruit of cucumber are use as salad and for making pickles, rayata and brined on commercial scale. (Bairagi *et al.* 2013) [2]. The global production of cucumber is 71.36 million tons (FAOSTAT 2014) [3] and commercially cultivated in countries like China, India, Turkey, Iran, Japan, Europe and United States. In the world more than 55 countries adopted protected cultivation technology; China has the largest area of 2.7 mha under protected cultivation. The total area of protected cultivation in India is approx 30,000 ha. Contributes 0.23% of the total area under the horticulture crop cultivation in India at and of 11<sup>th</sup> five year plan (Shweta *et al.* 2014) [7]. The total area of cucumber growing In India 78,000 hectares with an annual production of 11.42 lakh MT (National Horticulture Board 2016-17) [5]. The main areas of cucumber cultivation are river beds of Yamuna, Ganges and Narmada in North and Kaveri, Krishna and Godavari in South. The cucumber demand is increasing round the year which could not be met through open field cultivation. However, there is great potential of cucumber and possibility of growing three crops per year which in turn, can in increase the production and productivity many folds to meet the domestic demand and export. Greenhouse production technology of cucumber emphasizes the need of proper plant density in order to boost up the production per unit area by utilizing the available space and nutrients applied. There is need to assess the optimum plant density for the protected cultivation under polyhouse in various region. (Lal *et al.* 2014) [4].

## Materials and Methods

The experimental situated in the river basin of the Ganga and Yamuna it is situated at 28<sup>o</sup>.87' N latitude 81<sup>o</sup>.15' E longitude with an altitude of 98 m above the mean sea level. Average annual rainfall is 1013.4 mm. The polyhouse was covered with ultra violet stabilized low density polyethylene sheet having 200 micron thickness. The experiment was comprising of total twenty seven treatment combinations of three level of spacing viz. 60×30 cm (P1), 60×40 cm (P2) and 60×50 cm (P3), three cultivar viz. Pant Parthenocarpic Cucumber -2 (V1), Pant Parthenocarpic Cucumber -3 (V2) and Hilton (V3) with three dose of fertilizers viz. D1 20:10:22, D2 25:15:27 and D3 30:20:32 kg/1000 sq.m. The experiment was laid out following factorial randomized block design with three replications. Observations were recorded for fifteen different characteristics related to vegetative growth, yield and quality attributing traits. The economics of different treatments were determined on the basis of prevailing market price of inputs and produce. The data recorded for various characters were subjected to statistical analysis using analysis of variance (ANOVA) under factorial RBD.

## Result and Discussion

The above mentioned result, it has been revealed that the interaction effect of cultivars, spacing and dose of fertilizers application on vine length of cucumber during winter season had a significant effect. The maximum plant height (3.04 m) was reported in treatment T<sub>18</sub>, V<sub>2</sub>S<sub>3</sub>P<sub>3</sub> (PPC-3+30:20:32kg+60X50 cm).The above data among the various yield attributing characters days to first fruit harvest, number of fruits per plant, average weight of fruit yield per plant and yield per sq. meter were recorded in the present investigation. The character days to first fruit harvest (DAS) was found to be significantly influenced by main effects as cultivars, spacing and dose of fertilizer during the winter session. However the interaction effects of cultivars, plant geometry and dose of fertilizer application, were found to have significant influence on minimum number of days required to first fruit harvest in treatment combination T<sub>18</sub> (52.40 DAS) and was closely followed by T<sub>17</sub> (54.00 DAS). The interaction effect of cultivars, spacing and dose of fertilizer application on number of fruits per vine and maximum average fruit weight were found to have a significant effect in combined treatment T<sub>18</sub> V<sub>2</sub>+D<sub>3</sub>+P<sub>3</sub>. Different cultivars, plant geometry and dose of fertilizer application significantly influenced the

yield per plant and yield per sq meter of cucumber under polyhouse condition during winter season. Interaction of cultivars, spacing and dose of fertilizer had significant influence on yield per vine of cucumber. Maximum yield per vine (3.20 kg per vine) was obtained in combined treatment T<sub>18</sub> V<sub>2</sub>+D<sub>3</sub>+ P<sub>3</sub> (Pant Parthenocarpic Cucumber -3 + 60 x 50 cm +30:20:32 Kg). These results indicated that maximum yields are functions of greater number of plants per unit area. In the present investigation, two cultivars (Pant parthenocarpic cucumber-3 and Pant parthenocarpic cucumber-2) improve the quality characteristics of fruits like fruit length and fruit width of cucumber under polyhouse condition during winter season. As per pooled analysis, The maximum fruit length (19.50 cm) was recorded in treatment T<sub>18</sub>, V<sub>2</sub>+D<sub>3</sub>+P<sub>3</sub> (Pant parthenocarpic cucumber -3 + 60 x 50 cm + 30:20:32 Kg). As compare to T<sub>1</sub> treatment combination. However, The data presented in reveals that the moisture content and Organoleptic value of the fruit was significantly affected due to interaction effect of cultivars, spacing and dose of fertilizer application. On the basis of pooled data, treatment T<sub>18</sub>, V<sub>2</sub>+D<sub>3</sub>+P<sub>3</sub> (Pant parthenocarpic cucumber -3 + 60 x 50 cm + 30:20:32 Kg).Exhibited higher moisture content (95.65 %) in T<sub>12</sub>, V<sub>2</sub>+D<sub>1</sub>+P<sub>3</sub> and Organoleptic acceptance (8.75) during pooled. However the interaction effects of cultivars, plant geometry and dose of fertilizer application, were found to have non-significant influence on TSS, Fruit volume and Specific gravity are maximum value in treatment combination T<sub>18</sub> V<sub>2</sub>+D<sub>3</sub>+P<sub>3</sub> (3.57,126.50 and 0.95 respectively) and was closely followed by T<sub>17</sub>(V<sub>2</sub>+D<sub>3</sub>+P<sub>2</sub>).

## Conclusion

The results, summarized above, it can be concluded that T<sub>18</sub> (PPC-3 + 30:20:32 kg + 60 x 50 cm) was found significantly superior in respect of growth, flowering, yield and quality parameters. Most of the parameters and yield attributes also attained significantly greater values under higher plant population with spacing 60cm x 50 cm were found to be appropriate spacing and fertilizer dose 30:20:32 level, respectively. The cucumber variety Pant Parthenocarpic-3 (V<sub>2</sub>) was produced highly productive as compared to Hilton and Pant Parthenocarpic-2 of cucumber (*Cucumis sativus* L.) under the protected polyhouse condition. It was found optimum for achieving higher yield and the highest benefit cost ratio was recorded in the treatment T<sub>18</sub>, (V<sub>2</sub>+D<sub>3</sub>+P<sub>3</sub>) as compared to rest of the treatments.

**Table 1:** Details of treatment combination in parthenocarpic cucumber under protected condition

Treatments	Treatments combinations	Plant height (m)	Stem girth (cm)	Days of first fruits picking (DAS)	Number of fruit per plant	Fruit weight (g)	Fruits yield per plants (Kg)	Yield per square meter (Kg)	TSS (°Barix)	Moisture %	Fruit volume	Fruits specific gravity	Organoleptic acceptance	Length of fruit (cm)	Width of fruit (cm)	B:C Ratio
T <sub>1</sub>	V1+D1+P1	2.59	0.73	58.25	18.70	112.35	2.35	14.30	3.15	94.25	124.22	0.90	7.35	15.30	3.32	2.84
T <sub>2</sub>	V1+D1+P2	2.73	0.75	57.60	19.35	114.15	2.40	13.50	3.17	94.60	125.14	0.91	7.85	15.70	3.35	2.98
T <sub>3</sub>	V1+D1+P3	2.61	0.77	57.40	19.45	116.25	2.50	10.40	3.20	94.75	126.33	0.92	7.30	16.20	3.39	3.05
T <sub>4</sub>	V1+D2+P1	2.71	0.77	58.10	19.05	113.25	2.45	14.35	3.20	94.50	124.24	0.91	7.85	15.90	3.37	2.80
T <sub>5</sub>	V1+D2+P2	2.75	0.76	57.30	19.85	117.25	2.60	13.55	3.23	94.00	125.18	0.94	7.20	16.60	3.34	3.02
T <sub>6</sub>	V1+D2+P3	2.70	0.78	57.15	20.30	118.45	2.70	10.70	3.23	93.65	126.37	0.94	7.40	17.00	3.43	3.12
T <sub>7</sub>	V1+D3+P1	2.73	0.77	57.15	20.10	114.20	2.60	14.45	3.24	94.40	124.29	0.92	7.30	16.40	3.41	2.87
T <sub>8</sub>	V1+D3+P2	2.71	0.79	56.90	20.40	118.85	2.80	13.65	3.27	93.60	125.20	0.95	7.20	17.00	3.44	3.03
T <sub>9</sub>	V1+D3+P3	2.65	0.79	56.30	20.85	120.25	2.80	10.80	3.31	93.80	126.38	0.95	7.75	17.30	3.47	3.13
T <sub>10</sub>	V2+D1+P1	2.56	0.75	57.10	20.10	112.55	2.55	14.65	3.26	94.60	124.25	0.91	7.25	16.85	3.40	3.05
T <sub>11</sub>	V2+D1+P2	2.73	0.78	56.00	20.75	114.45	2.65	13.70	3.31	94.75	125.17	0.91	7.35	17.50	3.41	3.21
T <sub>12</sub>	V2+D1+P3	2.65	0.77	55.80	21.30	116.50	2.70	11.00	3.34	95.65	126.38	0.92	7.35	17.90	3.45	3.35
T <sub>13</sub>	V2+D2+P1	2.61	0.79	56.70	21.55	113.40	2.65	14.75	3.37	94.60	124.28	0.91	7.20	18.10	3.44	3.17
T <sub>14</sub>	V2+D2+P2	2.73	0.80	56.10	21.70	117.65	2.80	13.70	3.42	94.10	125.20	0.94	7.60	18.50	3.41	3.31
T <sub>15</sub>	V2+D2+P3	2.64	0.81	55.50	22.05	118.80	3.00	11.35	3.44	94.45	126.41	0.94	7.20	18.70	3.47	3.40
T <sub>16</sub>	V2+D3+P1	2.72	0.82	55.20	22.25	114.65	2.85	15.15	3.47	93.70	124.29	0.92	7.15	18.80	3.45	3.19
T <sub>17</sub>	V2+D3+P2	2.90	0.83	54.00	22.55	119.20	3.00	14.80	3.53	94.55	125.46	0.95	7.85	19.30	3.50	3.36
T <sub>18</sub>	V2+D3+P3	3.04	0.85	52.40	24.80	120.50	3.20	12.05	3.57	94.75	126.50	0.95	8.75	19.50	3.55	3.73
T <sub>19</sub>	V3+D1+P1	2.71	0.78	58.00	19.30	112.50	2.45	14.40	3.24	94.15	124.24	0.91	7.25	16.50	3.35	2.93
T <sub>20</sub>	V3+D1+P2	2.72	0.74	57.50	20.05	114.30	2.65	13.60	3.27	93.65	125.16	0.91	7.30	17.00	3.35	3.10
T <sub>21</sub>	V3+D1+P3	2.80	0.77	57.30	20.20	116.45	2.75	10.50	3.28	94.55	126.35	0.92	7.25	17.20	3.40	3.18
T <sub>22</sub>	V3+D2+P1	2.72	0.78	57.90	19.75	113.25	2.85	14.45	3.31	93.70	124.27	0.91	7.10	17.50	3.39	2.90
T <sub>23</sub>	V3+D2+P2	2.71	0.77	57.10	20.45	117.35	2.65	13.65	3.33	94.25	125.19	0.94	7.00	18.00	3.41	3.12
T <sub>24</sub>	V3+D2+P3	2.71	0.78	56.90	20.85	118.60	2.85	10.75	3.36	93.60	126.40	0.94	7.20	18.30	3.44	3.21
T <sub>25</sub>	V3+D3+P1	2.76	0.81	57.05	20.85	114.60	2.75	14.60	3.38	93.70	124.30	0.92	7.25	18.30	3.42	2.99
T <sub>26</sub>	V3+D3+P2	2.72	0.81	56.50	21.10	119.10	2.85	13.80	3.42	94.45	125.25	0.95	7.05	18.50	3.45	3.14
T <sub>27</sub>	V3+D3+P3	2.77	0.81	55.90	21.35	120.25	2.80	10.65	3.44	93.05	126.40	0.95	7.20	18.70	3.49	3.21
F - test		S	S	S	S	S	S	S	NS	S	NS	NS	S	S	S	
S. Ed. (±)		0.005	0.007	0.212	0.175	0.062	0.041	0.101	0.050	0.117	0.648	0.008	0.179	0.069	0.005	
CD at 5%		0.010	0.013	0.431	0.355	0.126	0.083	0.204	0.101	0.238	1.317	0.017	0.365	0.141	0.010	

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