Himachal Journal of Agricultural Research 48(2): 220-224 (2022)

Performance of parthenocarpic cucumber (*Cucumis sativus* L.) genotypes for yield and quality characters under protected environment

Manpreet Kaur* and Parveen Sharma
Department of Vegetable Science and Floriculture, College of Agriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062, India.
*Corresponding author: e-mail: 1294manpreet@gmail.com
Manuscript Received: 11.03.2022; Accepted: 25.04.2022

Abstract

The experimental material comprises eight parthenocarpic cucumber genotypes to study the comparative performance of these genotypes for yield and quality characteristics under protected environment. The experiment was laid out in Randomized Block Design with three replications in spring-summer during 2020 at Vegetable Research Farm, Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. DDPCG1 and DDPCG4 are good performing genotypes for yield related characters taken under study. Among all genotypes, DDPCG1 had maximum fruit weight, number of fruits per plant and yield/plant. DDPCG4 took minimum days to first fruit picking and maximum harvest duration. Lowest nodal position of first female flower, maximum fruit diameter and vine length were noticed in DDPCG5. For quality parameters, DDPCG5 had maximum pericarp thickness and TSS.

Key words: Cucumber, gynoecious, protected, quality and yield

Cucumber (*Cucumis sativus* L.) is the most important member of cucurbitaceae family due to its economic importance. It is primary source of vitamins and minerals with low calorific value. It helps to cure kidney infection, jaundice, stomach problems and indigestion (Ahirwar and Singh, 2018). It is believed to be originated in India and the wild relative *Cucumis sativus* var. *hardwickii* is the progenitor of the cultivated cucumber (Choudhary *et al*. 2015; Kaur and Sharma 2021). It is most suitable vegetable for protected conditions due to year round production and higher demand in market. Due to its origin in India, it has accumulated most of the genetic variability which helps to improve various characters through selection. Germplasm purity is difficult to maintain due to higher cross pollination in cucumber. It depicts wide range of variability with no uniformity in characters like fruit size, shape, color and yield among existing germplasm (Sharma *et al.* 2017). Parthenocarpic and gynoecious genotypes are widely grown under protected conditions which, bear female flowers in every node and develop seedless fruits. Presence of genetic variability in germplasm helps in crop improvement through selection.

In open field conditions, monoecious varieties of cucumber are being grown in both summer and rainy seasons with varying degrees of success because of biotic stress and abiotic stress *viz*., heavy incidence of red pumpkin beetle and fruit fly and poor fruit quality including bitter fruits due to vagaries of weather, varying moisture etc. The farmers spray different types of agrochemicals, indiscriminately to check these stresses and result in environmental pollution. Cultivation of parthenocarpic cucumber under the protected environment is only the solution to have cucumber crop free from agro-chemicals (Sharma *et al.* 2021). Yield of parthenocarpic cucumber varieties is often higher than that of conventional seeded varieties due to association with gynoecious traits. Hence, to obtain a good quality produce and production, there is a need to cultivate parthenocarpic genotypes of cucumber under protected conditions such as green houses or polyhouses. Therefore, this study was done to compare the yield and quality features of parthenocarpic genotypes under protected conditions.

Materials and Methods

The experiment was conducted at Department of Vegetable Science and Floriculture, College of Agriculture, CSKHPKV, Palampur during spring-summer 2020 under naturally ventilated polyhouse. The experimental farm is situated at 32°6' N latitude and 76°3'E longitude at an elevation of 1,290.80 m above mean sea level. The experimental material consists of eight genotypes of parthenocarpic cucumber along with one check (PPC-3) were evaluated in Randomized Block Design (RBD) with three replications in modified naturally ventilated polyhouse. Nursery was raised in soil-less media having mixture of cocopeat: perlite: vermiculite in the ratio of 3:1:1 and was transplanted under naturally ventilated polyhouse after 35 days. The experiment was laid out in Randomized Block Design (RBD) with three replications. Regular irrigation, earthing up, fertilization, stacking and crop protection measures were adopted as per package of practices. The observations were recorded on five plants taken randomly for the characters viz., days to anthesis of first female flower, nodal position of first female flower, number of female flowers/node, days to first fruit picking, fruit length (cm), fruit diameter (cm), fruit weight (g), number of fruits per plant, marketable yield per plant (kg), yield per meter square area (kg), harvest duration (days), internodal length (cm), vine length (cm), flesh thickness (cm) and total soluble solids (°brix). The data on different parameters were subjected to statistical analysis by the method described by Cochran and Cox (1963).

Results and Discussion

The average performance of different parthenocarpic gynoecious genotypes for various traits is given in Table 1. Earliness is a desirable attribute, as the early crop produce invariably and fetches a higher price in the market. The mean value of genotypes for days to anthesis of first female flower varied from 21.67 to 26.33 days with grand mean of 24 days (Table 1). Among genotypes, PPC-3 (Standard

Table 1. Mean performance of gynoecious parthenocarpic cucumber (*Cucumis sativus* L.) genotypes for various traits

Genotypes	Days to anthesis of first female flower	Nodal position of first female flower	Number of female flowers/ node	Days to first fruit picking	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Number of fruits per plant	Marketable yield per plant (kg)
DDPCG4	23.33	3.07	1.53	43	17.07	4.2	111.00	22.87	2.54
DDPCG1	24.33	2.59	1.46	48.33	20.51	4.12	112.20	28.91	3.24
Punjab Kheera-1 (PK-1)	25	3.13	2.07	43.33	13.98	3.68	88.25	18.50	1.64
Pant parthenocarpic cucumber (PPC-2)	22	3.03	1.21	50.33	21.65	4.18	95	17.92	1.71
DDCPCW1	24.33	2.57	1.05	44.67	19.12	4.11	108.83	22.48	2.46
DDPCG2	25.67	2.92	1.17	46.33	17.44	3.79	111.32	28.44	3.15
DDPCG5	26.33	2.24	1.96	45.67	17.09	4.23	93.53	21.41	1.99
Pant parthenocarpic cucumber (PPC-3) (Standard check)	21	3.80	1.22	47.33	18.87	4.13	106.67	26.28	2.82
Mean	24.00	2.92	1.46	46.13	18.22	4.06	103.35	23.35	2.44
Range	21-26.33	2.24-3.80	1.05-2.07	43-50.33	13.98-21.65	3.68-4.23	88.25-112.20	17.92-28.91	1.64-3.24
CV	7.47	10.79	8.09	2.77	7.28	3.08	8.31	10.34	11.03
CD	3.14	0.55	0.21	2.24	2.32	0.22	15.03	4.24	0.47

check) took minimum days to anthesis of first female flower which was statically at par with PPC-2 and DDPCG4. While maximum days taken by DDPCG5. Days to first fruit picking ranged from 43-50.33 with mean vale of 46.13. DDPCG4 took minimum days to first fruit picking which was statistically at par with PK-1 and DDPCW1. 3 genotypes were significantly earlier to standard check. Choudhary *et al*. (2015) and Ene *et al.* (2016) also observed similar significant differences for days to anthesis of first female flower and days to first fruit picking.

Nodal position of first female flower depicts the early maturity of a genotype, lower the nodal position of first female flower, earlier will be the variety in fruiting and growers fetch remunerative returns. The mean value of genotypes for nodal position of first female flower ranged from 2.24 to 3.80 with grand mean of 2.92. Wide variability with respect to this particular trait was also reported by Singh *et al*. (2017), Ahirwar *et al.* (2018) and Shah *et al.* (2018). The mean value of genotypes for number of female flowers per node varied from 1.05 to 2.07 and grand mean for this character was 1.46. Maximum number of female flowers per node was noticed in PK-1 which was statistically at par with DDPCG5. Minimum number of female flowers per node was observed in DDPCW1. Earlier, wide variation for this character was also been reported by Dogra (2012) and Singh *et al*. (2017).

Fruit length and diameter have direct influence on the marketable yield as well as on consumer preference. Fruits having cylindrical shape with tenderness are highly preferred by consumers and fetch lucrative returns to the growers. The mean value of genotypes for fruit length ranged from 13.98 to 21.65 with grand mean of 18.22 cm. Maximum fruit length was observed in PPC-2 which was statistically at par with DDPCG1. 2 genotypes were found superior than the standard check (PPC-3). The mean value of genotypes for fruit diameter ranged from 3.68 to 4.23 with grand mean of 4.06 cm (Table 1). Maximum fruit diameter was observed in DDPCG5 which was statistically at par with DDPCG4, Standard check (PPC-3), DDPCG1 and DDPCW1. While minimum fruit diameter was observed in PK-1. Earlier workers viz., Jakhar *et al.* (2016), Singh *et al*. (2017) and Sharma *et al*. (2019) reported significant variations for fruit length and diameter.

Fruits with higher weight are required by the farmers in order to get more marketable yield per plant. The perusal of data (Table 1) showed a range of 88.25 g to 112.20 g for fruit weight and had grand mean of 103.35 g. Maximum fruit weight was noticed in DDPCG1 which was statistically at par with DDPCG2, DDPCG4, DDPCW1 and PPC-3 (standard check). Significant variation for fruit weight was observed by Pal *et al*. (2017), Bhagwat *et al.* (2018), Dingal *et al*. (2018).

Number of fruits per plant is the most important component trait which is directly related to increased fruit yield per plant. Comparison of the mean values revealed that the number of fruits per plant ranged from 17.92 to 28.91. DDPCG1 has maximum number of fruits per plant which was statically at par with DDPCG2 and PCC-3 (standard check). Earlier workers viz., Bhagwat *et al*. (2018), Shah *et al.* (2018), Nagamani *et al*. (2019) and Sharma *et al.* (2019) also reported wide range of number of fruits per plant in their germplasm.

The ultimate goal of any research programme is to achieve maximization of marketable yield. This is also the key factor in adoption or rejection of a cultivar by the farmer. The fruit yield per plant and fruit yield per meter square ranged from 1.64 to 3.24 kg and 9.81 to 19.46 kg, respectively. Significantly maximum value for these traits was noticed in DDPCG1 which was statically at par with DDPCG2 and PPC-3. Two genotypes gave significantly higher fruit yield per plant as compared to the standard check. Presence of wide genetic variation with respect to marketable yield per plant was also reported by Sharma *et al*. (2000), Choudhary *et al*. (2015), Pal *et al*. (2017), Bhagwat *et al*. (2018) and Sharma *et al*. (2019). Prolonged availability of marketable fruits is highly desirable attribute of the parthenocarpic cucumber and generally genotypes having prolonged harvest duration are preferred to be grown under polyhouse for getting higher yield. The perusal of data (Table 2) showed a range of 36-47 days for harvest duration with grand mean of 40.63 days. Maximum harvest duration was reported in DDPCG4 which was statically at par with DDPCG1 and DDPCG2. Five genotypes were found superior for harvest duration than standard check. Similar variations regarding harvest duration

Table 2. **Mean performance of gynoecious parthenocarpic cucumber (*Cucumis sativus* L.) genotypes for yield per meter square area (kg), harvest duration (days), internodal length (cm), vine length (cm), flesh thickness (cm), total soluble solids (°brix)**

Genotypes	Yield per meter square area (kg)	Harvest duration (days)	Internodal length (cm)	Vine length (cm)	Flesh thickness (cm)	Total soluble solids (°Brix)
DDPCG4	15.43	47.00	11.36	339.67	0.94	2.78
DDPCG1	19.46	43.33	11.30	365.73	0.97	2.54
Punjab Kheera-1 (PK-1)	9.81	41.33	10.88	244.73	0.81	2.52
Pant parthenocarpic cucumber (PPC-2)	10.23	42.00	11.75	364.11	1.01	3.02
Pant parthenocarpic cucumber (PPC-3)						
DDCPCW1	14.76	36.33	12.66	333.37	1.05	3.38
DDPCG2	18.90	42.33	10.99	354.44	0.95	2.05
DDPCG5	11.93	36.00	9.97	392.22	1.06	4.16
Pant parthenocarpic cucumber (PPC-3) (Standard check)	16.93	36.67	12.81	384.97	1.02	3.50
Mean	14.68	40.63	11.47	347.41	0.98	3.00
Range	9.81-19.46	36-47	9.97-12.81	244.73-392.22	0.81-1.06	2.05-4.16
CV	11.03	6.58	7.73	3.39	-	2.67
CD	2.83	4.68	1.55	20.63	NS	0.14

were also reported by earlier workers viz., Pal *et al*. (2017), Shah *et al*. (2018) and Sharma *et al*. (2019).

The parthenocarpic cucumber bear fruits at almost every node. Thus, plants with less internodal length are preferred for attaining higher yield. The minimum value for internodal length was noticed in DDPCG5 which was statistically at par with PK-1, DDPCG2, DDPCG1, DDPCG4 and PPC-2. While maximum value observed in PPC-3 (standard check). Ahirwar and Singh (2018) and Sharma *et al.* (2019) also reported wide variations for internodal length among all the genotypes.

Indeterminate types of cultivars having longer vine length are preferred over the semi-determinate and determinate types in high rainfall regions. Highly significant differences exist among the different cucumber genotypes with respect to vine length. The mean value of genotypes for vine length varied from 244.73 to 392.22 cm and grand mean for this character was 347.41 cm (Table 2). The maximum vine length was noticed in DDPCG5 which was statistically at par with PPC-3. Wide variations were reported for vine length by Ranjan *et al.* (2015), Pushpalatha *et al.* (2016), Shah *et al.* (2018) and Sharma *et al.* (2019). Fruit flesh thickness (cm), an associated parameter with shelf life and post-harvest quality of the produce, though the variation in flesh thickness (cm) among the genotypes was non-significant.

The total content of soluble solids on fruits (TSS) is a key trait, as it influences final product flavor and consistency. Table 2 depicts that total soluble solids ranged from 2.05-4.16 ^{0}Brix. Maximum total soluble solids were recorded in DDPCG5 while minimum in DDPCG2. Similar results were also reported by Singh *et al.* (2017), Shah *et al.* (2018) and Sharma *et al.* (2019) for total soluble solids.

Conclusion

Based on the present study, it can be concluded that DDPCG1 and DDPCG4 are good performing genotypes for yield related characters taken under study. Among all genotypes, DDPCG1 had maximum fruit weight, number of fruits per plant, yield/plant. DDPCG4 took minimum days to first fruit picking and maximum harvest duration. Lowest nodal position of first female flower, maximum fruit diameter, vine length and TSS was noticed in DDPCG5.

Conflict of interest: The authors declare no competing interests

References

Ahirwar CS and Singh DK. 2018. Assessment of genetic variability in cucumber (*Cucumis sativus* L.) International Journal of Current Microbiology and Applied Sciences **7**: 813-22.

Bhagwat A, Srinivasa V, Bhammanakati S and Shubha AS. 2018. Evaluation of cucumber (*Cucumis sativus* L.) genotypes under hill zone of Karnataka, India. International Journal of Current Microbiology and Applied Sciences **7**: 837-842.

Choudhary H, Singh DK and Damke SR. 2015. Genetic variability in *Cucumis sativus* var. *hardwickii*: key to cucumber improvement. International Journal of Basic and Applied Agricultural Research **13**: 340-43.

Cochran WG and Cox GM. 1963. Experimental Designs. Asia Publishing House, Bombay, 293-316.

Dingal DK, Patil SS, Birada MS and Mantur SM. 2018. Influence of different protected conditions on growth and yield of parthenocarpic cucumber *(Cucumis sativus)* hybrids. Journal of Current Microbiology and Applied Sciences **7**: 1619-1624.

Dogra LK. 2012. Genetic evaluation of some hybrids of cucumber under modified naturally ventilated greenhouse in mid hills of Western Himalayas. M.Sc. Thesis, p 92. Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India.

Ene CO, Ogbonna PE, Agbo CU and Chukwudi UP. 2016. Studies of phenotypic and genotypic variation in sixteen cucumber genotypes. Chilean Journal of Agricultural Research **76**: 307-313.

Jakhar RK, Singh AK and Kumawat N. 2016. Yields attributes and yield of cucumber (*Cucumis sativus* L.) cultivars as influenced by growing conditions in arid zone of Rajasthan. Environment and Ecology **34**: 2258-2261.

Kaur M and Sharma P. 2021. Recent advances in cucumber (*Cucumis sativus* L.). The Journal of Horticultural Science and Biotechnology **97:** 3-23.

Nagamani GV, Kumar JSA, Reddy TBM, Rajesh AM, Amarananjundeswara H, Reddy RLR and Doddabasappa B. 2019. Performance of different parthenocarpic cucumber (*Cucumis sativus* L.) hybrids for yield and yield attributing traits under shade net house. International Journal of Current Microbiology and Applied Sciences **8**: 978-982.

Pal S, Sharma HR, Rai AK and Bhardwaj RK. 2017. Genetic variability, heritability and genetic gain for yield and quality traits in cucumber (*Cucumis sativus* L.). An International Quarterly Journal of Life Sciences **11**: 1985-1990.

Pushpalatha N, Anjanappa M, Devappa V and Pitchaimuthu M. 2016. Genetic variability and heritability for growth and yield in cucumber (*Cucumis sativus* L.). Journal of Horticulture Sciences **11**: 33-36.

Ranjan P, Gangopadhyay KK, Bag MK, Roy A, Srivastava R, Bhardwaj R And Dutta M. 2015. Evaluation of cucumber (*Cucumis sativus* L.) germplasm for agronomic traits and disease resistance and estimation of genetic variability. Indian Journal of Agricultural Sciences **85**: 234 239.

Shah KN, Rana DK and Singh V. 2018. Evaluation of genetic variability, heritability and genetic advance in cucumber (*Cucumis sativus* L.) for various quantitative, qualitative and seed characters. International Journal of Current Microbiology and Applied Sciences **7**: 3296-3303.

Sharma AK, Vidyasagar K and Pathania NK. 2000. Studies on combining ability for earliness and marketable fruit yield in cucumber (*Cucumis sativus* L.). Himachal Journal of Agricultural Research **26**: 54-61.

Sharma P, Dhillon NS, Kumar P and Mehta P. 2019. Evaluation of parthenocarpic cucumber genotypes for fruit yield and its contributing traits under protected environment of N-W Himalayas. International Journal of Chemistry Studies **3**: 04-06.

Sharma P, Kaur M, Shilpa, Sharma A and Bhardwaj N. 2021. Breeding vegetables for protected cultivation: A review. Himachal Journal of Agricultural Research **47**: 1-17.

Sharma S, Kumar R and Sharma HR. 2017. Studies on variability, heritability and genetic gain in cucumber (*Cucumis sativus* L.). Indian Journal of Ecology **44**: 829-33.

Singh Y, Safiullah, Verma A, Sharma S and Sekhon BS. 2017. Genetic evaluation of cucumber (*Cucumis sativus* L.) genotypes for yield and its contributing traits under mid-hill conditions of Himachal Pradesh, India. Environment & Ecology **35**: 3621-3626.