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## PERFORMANCE OF BOTTLE GOURD [*LAGENARIA SICERARIA* (MOL.) STANDL] GENOTYPES UNDER OPEN AND PROTECTED CONDITIONS

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### ABSTRACT

The present study was conducted on bottle gourd [*Lagenaria siceraria* (Mol.) Standl] genotypes for growth and yield parameters under open and protected conditions during 2017-2018. The experiment was laid out in randomized block design with three replications. Eight different genotypes Punjab Komal, Punjab Round, PSPL, Chutki, Vardan, Ankur Amit and Gopika were evaluated under open and protected conditions for growth and yield characters. Results revealed that in open field condition genotype Punjab Round found superior in respect of average fruit weight (933.33 g) and fruit yield per ha (60.62 t). PSPL takes minimum days to male flower (56.22) and minimum days to female flower (59.11) among all the genotypes. Genotype Nandani exhibit maximum plant height (7.51 m) and no. of fruits per plant (13.00). Whereas under Protected Conditions genotype Punjab Round was found superior in plant height (6.43 m), average fruit weight (926.13 g) and fruit yield per ha (359.80 t). PSPL exhibits maximum no. of fruits per plant (18.20). Minimum days to first male (49.40) and days to first female flower (58.41) was recorded in genotype Vardan. Among all the genotypes PSPL and Punjab Round showed superiority under both the conditions for most of the traits. So, they can be used for further research programmes as well as to develop the new hybrids and also recommended to farmers for off-season cultivation as well.

**Key words :** Growth, Open condition, Protected condition, Yield.

### Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] belongs to cucurbitaceae family and from the genus *Lagenaria* having chromosome number  $2n=22$ . Bottle gourd is a vegetable crop and also used as a traditional medicine and have immunomodulatory, hepatoprotective, cardioprotective, antioxidant, anti-stress and adaptogenic, antihyperlipidemic, analgesic, and anti-inflammatory properties (Irshad *et al.*, 2014). For successful cultivation of bottle gourd, temperature is more important where 25°C to 30°C required for seed germination and night temperature 18°C to 22°C with day temperature 30°C to 55°C required for optimum growth (Parle and Kaur, 2011). The poor production and productivity of bottle gourd is because of the poor genetic make-up of open pollinated mixed seed or local strain (Ara *et al.*, 2014). Under open (field) conditions bottle

gourd is grown from March to December in arid conditions by adjusting planting schedule. Fruit yield and quality are very low under high day temperature, high vapour pressure and low rainfall during month of July to September (Samadia and More, 2008). Bottle gourd is a cross pollinated, annual climber species and having wider genetic variability across the world and grown in two seasons *i.e.* summer as well as in rainy season (Neelum *et al.*, 2014).

From last few years, off season vegetable cultivation has gained popularity and attention among vegetable growers of the world. India has also move in the period of greenhouse vegetable cultivation. Total areas under protected vegetables production are not higher than 10000 hectares (Wani *et al.*, 2011). India being a huge country with diverse and extreme agro - climatic conditions, the protected vegetable cultivation technology can be

exploited for year round (off season) cultivation of high value low volume vegetable crops (parthenocarpic cucumber, muskmelon, capsicum etc.) having high demanded in the market. Among the protected structure, plastic low tunnel is a cheap and better way for off-season cultivation of cucurbits (Singh *et al.*, 2007). Protected cultivation of vegetables is a vital tool to cultivate vegetables even during extremes climate. Moreover a practical cropping sequence will play an important role in making farming more profitable mostly for small and marginal farmers (Srivastava *et al.*, 2002). Under protected condition, the production cost under polyhouse is about 1.5 times higher than that of open field; conversely return is about two times higher. Solanaceous and cucurbitaceous families of vegetables are major determinants for production and profitability as well as deserve adoption by farmers (Kishore *et al.*, 2014). Keeping all the above facts in view, an experiment was planned with the following objectives: to study the performance of different genotypes of bottle gourd for growth and yield parameters under open and protected condition.

### Materials and Methods

**Experimental site :** The present investigation was carried out at Lovely Professional University, Phagwara (Punjab) during summer season (main season) and winter season (off season) of 2017-18. Climate of Phagwara is a local plain. The average annual temperature is 24.1°C. At an average temperature of 33.6°C, June is the warmest month of the year and January is the coolest month of the year. Between the driest and rainiest months, the difference in precipitation is 191 mm. During the year, the average temperatures differ by 20.9°C. The average rainfall is 686 mm.

**Experiment detail :** The experiment comprised of two environmental conditions (open & protected) and eight genotypes (Pusa Summer Prolific Long, Punjab Komal, Punjab Round, Vardan, Chutki, Nandani, Ankur Amit & Gopika) laid out in Randomised Block Design (RBD) with three replications. Investigation was divided into two experiments *viz.*, Experiment-I: cultivation of bottle gourd under open condition and Experiment-II: cultivation of bottle gourd genotypes under protected conditions.

**Crop raising :** Experiment-I was conducted in open condition with eight genotypes of bottle gourd during summer season (March to July) of 2017-18. For cultivation of crop, seedlings were raised in plastic protrays with soil less media having cells of 1.5" in size. Three weeks old seedlings having 2-3 true leaves were transplanted at

2 m × 1.20 m. Experiment-II was conducted in protected condition with eight genotypes of bottle gourd during winter season (September to March) of 2017-18. Seedlings were raised on in plastic protrays and three weeks old seedlings at 2-3 true leaf stage were transplanted at 60 cm × 60 cm. The recommended dose of N, P and K (100: 60: 50 kg/ha) was applied in the form of urea, single super phosphate and muriate of potash, respectively. 50% nitrogen and full dose of phosphorus and potassium were applied during soil preparation and rest of the nitrogen was applied one month after transplanting. The experimental site was kept free from weeds by periodical hand weeding. 3-4 hand weeding was done during the crop growth. Irrigation was given at an interval of 5 - 6 days depending on the soil moisture condition. Fruits were harvested at marketable and physiological maturity. Generally 2 pickings were done in a weekly interval.

**Observation recorded :** Five plants were selected at random in each treatment per replication and utilized for recording observations for growth and yield parameters. Growth parameters - Days to first male flower, Days to first female flower, Plant height (m); Yield parameters - Average fruit weight (g), Number of fruits per plant, Fruit yield (t/ha).

**Statistical analysis :** Experimental data were subjected to statistical analysis. The data were analysed by OPSTAT open data analysis software (Sheoran *et al.*, 1998).

### Results and Discussion

#### Performance of growth parameters under open and protected condition

**Days to first male flower :** Observations recorded on days to first male flower is given in Table 1. Under open condition, there is high significant difference between PSPL and Chutki. Genotype with minimum days to male flower was PSPL and maximum days taken by Chutki which was *at par* with Punjab Komal, Punjab Round, Nandani, Ankur Amit and Gopika. Whereas in protected condition male flower in minimum days was observed in Vardan *at par* with Ankur Amit and PSPL while, Punjab Komal showed male flower on highest which was *at par* with Gopika, Punjab Round and Nandani. Protected structures adjust the climatic conditions and promotes early flowering. Similar results also found by Kumar (2018) in bottle gourd and Ibarra *et al.* (2001) in muskmelon under protected cultivation.

**Days to first female flower :** There were significant differences among genotypes for days to first female flower as illustrated in Table 1. In open condition genotype PSPL was the earliest followed by Ankur Amit, while

**Table 1:** Mean values for growth parameters.

Treatments	Days to first male flower		Days to first female flower		Plant height (m)	
	Open	Protected	Open	Protected	Open	Protected
PSPL	56.22	51.00	59.11	59.09	5.23	5.93
Punjab Komal	62.89	57.40	67.22	67.36	3.70	4.89
Vardan	68.33	49.40	73.00	58.41	4.17	5.14
Chutki	70.00	52.40	74.44	62.32	3.94	5.29
Punjab Round	66.22	56.60	68.66	64.91	5.56	6.43
Nandani	63.22	53.80	64.89	65.23	7.51	5.92
Ankur Amit	61.78	50.00	62.78	59.45	4.03	6.02
Gopika	66.33	62.6	69.00	69.77	4.76	4.98
C.D.	2.72	3.75	3.32	2.63	0.52	0.6
SE(m)	0.89	1.23	1.08	0.86	0.17	0.19
C.V.	2.39	3.92	2.79	2.35	6.04	6.04

genotype Chutki took the maximum days for female flower initiation *at par* with Vardan. While in protected condition Vardan was the earliest genotype *at par* with PSPL and Ankur Amit. Genotype Gopika took the maximum days for female flower initiation *at par* with Punjab Komal. Variation in days to male and female flower is might be due to genetic makeup of plant, hormonal activity, climatic conditions (temperature and light intensity) and fertility of soil. Obtained results were confirmative with Kumar *et al.* (2018), Trimulesh *et al.* (2016) in bottle gourd and Singh *et al.* (2016) in bitter gourd with different genotypes.

**Plant height (m) :** Plant height is an important yield contributing character, because it leads to more number of branches and ultimately result in increased productivity. All the genotypes studied indicated significant variations for plant height ranged from 3.70 – 7.51 m in open condition and 4.89 – 6.43 m in protected condition. The analysis of variance for plant height mentioned in Table 1 showed significant differences among the genotypes in both the conditions. In open conditions maximum plant height was recorded in Nandani followed by Punjab Round and minimum in Punjab komal which was *at par* with Chutki, Ankur Amit and Vardan. Whereas in protected conditions maximum plant height was observed in Punjab Round *at par* with Ankur Amit, PSPL, Nandani and minimum in Punjab komal *at par* with Gopika, Vardan and Chutki. Variations in plant height may be due to the variation in the genetic makeup of the genotype. The vine length of cultivar Punjab Round is desirable for good yield because of climbing nature of plant and protected condition. Variation in plant height was also found by Harika *et al.* (2012), Uddin *et al.* (2014), Das *et al.* (2015), Ilyas *et al.* (2017) in bottle gourd under open conditions and Suthar *et al.* (2006) in cucumber under

protected conditions with different genotypes.

### Performance of yield parameters under open and protected condition

**Average fruit weight (g) :** Significant differences were observed among all the genotypes for average fruit weight in both open and protected condition as given in Table 2. In open condition highest average fruit weight was recorded in Punjab Round followed by PSPL, whereas lowest was observed in Nandani. Ankur Amit, Punjab Komal, PSPL and Punjab Round were statistically superior to Nandani. Vardan, Chutki and Gopika were *at par*. Likewise in protected condition mean values of genotypes revealed that the genotype Punjab Round had the maximum fruit weight and minimum average fruit weight in Chutki. Results showed that Ankur Amit, Gopika and Vardan were significantly superior to Chutki whereas Nandani, PSPL, Punjab Komal were *at par*. The maximum weight of fruit may be due to higher fruit length, fruit diameter, seed cavity length, width, seed cavity size and seed content. In both the growing conditions maximum higher fruit of each genotype is recorded in open conditions as compared to protected conditions. Higher fruit weight of the crop leads to fruit yield per plant and yield per hectare. Results were confirmatory with the findings of Harika *et al.* (2012) in bottle gourd under open conditions and Kumar *et al.* (2018) in protected cultivation of bottle gourd.

**No. of fruits per plant :** The analysis of variance and means for no. of fruits per plant are presented in Table 1. In open conditions number of fruits per plant ranged from 6.34 (Vardan) to 13.00 (Nandani) fruits per plant. The genotype with higher number of fruits per plant was Nandani (13.00) followed by Ankur Amit, PSPL and genotype Vardan had lowest fruits per plant which was

**Table 2 :** Mean values for yield parameters.

Treatments	Average fruit weight (g)		No. of fruits per plant		Fruit yield (t/ha)	
	Open	Protected	Open	Protected	Open	Protected
PSPL	710.00	486.40	10.22	18.20	48.94	243.93
Punjab Komal	676.67	508.00	9.33	12.20	42.80	171.10
Vardan	523.33	558.00	6.34	14.60	27.33	226.06
Chutki	540.00	436.00	7.11	10.40	30.50	127.84
Punjab Round	933.34	926.13	9.89	13.87	60.62	359.80
Nandani	503.33	477.8	13.00	12.40	44.53	164.02
Ankur Amit	646.67	692.16	10.67	11.80	46.48	228.05
Gopika	546.67	632.00	7.78	9.60	29.59	167.11
C.D.	69.33	78.72	1.09	1.80	4.48	44.87
SE(m)	22.64	25.71	0.35	0.59	1.46	14.65
C.V.	6.18	7.55	6.60	7.90	6.12	12.03

*at par* with Chutki. Whereas in protected condition no. of fruits per plant ranged from 9.60 to 18.20. The genotype with maximum no. of fruits per plant was PSPL followed by Vardan and minimum no. of fruits per plant was recorded in Gopika *at par* with genotype Chutki. Higher number of fruits per plant results higher fruit yield per plant and fruit yield per hectare. The variation in number of fruits per vine might have been due to sex ratio, fruit set percentage, genetic nature and response to fluctuating climatic conditions. Higher number of fruit set in protected conditions than open conditions might be due to favourable environment conditions in the protected structure, less infestation of insect pest and more number of fruit set. Variation in number of fruits per vine was also reported by Harika *et al.* (2012) in bottle gourd and Singh *et al.* (2016) in bitter gourd with different genotypes.

**Fruit yield (t/ha) :** A significant wide range of variation was recorded for this character as presented in Table 2. In open condition fruit yield per hectare was ranged from 27.33-60.62 t/ha, where as in protected conditions it ranged from 127.84-359.80 t/ha. In open conditions maximum fruit yield per hectare was observed in genotype Punjab Round followed by PSPL and minimum yield per hectare was observed in genotype Vardan *at par* Gopika and Chutki. Similarly, in protected conditions maximum fruit yield was recorded in Punjab Round followed by PSPL while, minimum fruit yield per hectare was recorded in genotype Chutki, which was *at par* with Nandani, Gopika and Punjab Komal. In both the conditions Punjab Round followed by PSPL recoded highest yield among all the genotypes. Fruit yield positively correlated with number of fruits per plant and plant population. The number plants in protected conditions are higher than the open field conditions was due to closer spacing inside the protected structure. The variation is

fruit yield per plant and fruit yield per hectare might be due to sex ratio, fruit set percentage, fruit length, fruit diameter, genetic nature of genotypes, climatic and soil condition. Similar results were also given by Suthar *et al.* (2006), Sood and Sharma (2006), Singh and Kumar (2009), Kolhe *et al.* (2009) and Ram *et al.* (2007) in bottle gourd. Vegetative growth was greatest in plants in the tunnel where the thermal condition were best and total marketable yield were highest under poly tunnel Siwek and Capecka (1999). Similar results were also found by Kumar *et al.* (2018) in protected cultivation of bottle gourd with different genotypes.

### Conclusion

Analysis of variance found highly significant for most of the characters studied. Therefore, it is evident that sufficient variability exists among the genotypes studied. In Open Conditions genotypes observed highest mean performance for growth characters is 'PSPL' for days to first male flower and days to first female flower and 'Nandani' for plant height. The genotypes observed best for yield characters are 'Punjab Round' for average fruit weight and fruit yield per hectare and 'Nandani' for no. of fruits per plant. Whereas in Protected Conditions for growth parameters genotypes perform best is 'Punjab Round' for plant height and 'Vardan' for days to first male flower and days to first female flower. For yield character genotype performs best is 'Punjab Round' for average fruit weight and fruit yield per hectare and 'PSPL' for no. of fruits per plant. So the genotypes 'Punjab Round' and 'PSPL' may be recommended for commercial cultivation both under open and protected conditions by the farmers.

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