Performance of Bottle Gourd (*Lagenaria siceraria* L.) Genotypes for Growth, Yield and Quality

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

An experiment on the "Performance of Bottle Gourd (*Lagenaria siceraria* L.) Genotypes for Growth, Yield and Quality" was conducted during February to May. 2022, in field of Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the performance of 10 genotypes of Bottle Gourd *i.e.* (IET/2021/BOGVAR-1, IET/2021/BOGVAR-2, IET/2021/BOGVAR-3, IET/2021/BOGVAR-4, IET/2021/BOGVAR-5, IET/2021/BOVAR-6, IET/2021/BOGVAR-7, IET/2021/BOGVAR-8, IET/2021/BOGVAR-9 and IET/2021/BOGVAR-10) obtained from different sources evaluated for plant growth, yield and quality have been discussed and interpreted in the light of previous research work. The experiment was conducted in Randomized block design, were each replicated thrice. From the present experimental findings it was founded that the genotype IET/2021/BOGVAR-8 was recorded with the maximum number of female flowers (15.40), vine length (228.33cm), number of fruits/plant (10.80 fruits), yield per hectare (438.7 q/ha), TSS (4.13°B) gross return (658050), net return (508807), and B:C ratio (4.4).

Keywords: Bottle gourd; genotypes; growth; yield and quality.

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1. INTRODUCTION

Bottle gourd *Lagenaria siceraria* (2n=2x=22) belongs to family Cucurbitaceae and is one of the most ancient crops cultivated during summer throughout the world. The genus *Lagenaria* is derived from the word lagena, meaning the bottle. It is also known as Calabash, Doodhi and Lauki in different parts of India **(**Deore et al.*.,* 2009). Its primary centre of origin is Africa **(**Singh, 1990). The fossil records indicate its culture in India even before 200 B.C. It has been found wild in India, the Moluccas and Ethiopia. It has spread to western countries from India and Africa [1,2]. The genus *Lagenaria* includes six species that are distributed in Africa, Madagascar, Indo- Malaysia and the neotropics. There is only one cultivated species, *Lagenaria siceraria*, which is annual and monoecious. The five other species are wild, perennial and dioecious, occurring in East Africa and Madagascar [3-5].

2. MATERIALS AND METHODS

The study was conducted during summer season at Horticulture Research Farm, SHUATS, Prayagraj (U.P.) India. The experiment consists of 10 genotypes namely IET/2021/BOGVAR-1, IET/2021/BOGVAR-2, IET/2021/BOGVAR-3, IET/2021/BOGVAR-4, IET/2021/BOGVAR-5, IET/2021/BOGVAR-6, IET/2021/BOGVAR-7, IET/2021/BOGVAR-8, IET/2021/BOGVAR-9, IET/2021/BOGVAR-10. The experiment was carried out with Randomized Block Design with 3 replications at 2.50 m x 0.60 m row to row and plant to plant spacing. All the recommended cultural practices were adopted to raise healthy crop. Data were recorded on five randomly selected plants with respect to characters *viz.,* days to first male and female flowers appear, node number at which first male and female flower appear, number of male and female flowers, days to fruit set, days to first fruit picking, vine length (cm), fruit weight (g), fruit length (cm), fruit diameter (cm), number of fruits per plant, fruit yield (q/ha) and TSS (^{0}B). The data were subjected to statistical and biometrical analysis [6-8].

3. RESULTS AND DISCUSSION

The analysis of variance of all the characters under study is presented in Tables 1 and 2. This analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all characters. This is an indication of existence of sufficient variability among the genotypes for fruit yield and its components traits. Significant mean sum of squares due to fruit yield and attributing characters revealed existence of considerable variability in material studied for improvement for various traits. These findings are in general agreement with the findings of Bhardwaj et al. [9] and Padmakshi thakur [8].

Days to first male flower (DAT): The minimum number of days to 1st male flower emergence was recorded in the genotype IET/2021/BOGVAR-5 (34) followed by the IET/2021/BOGVAR-3 (36.40) and maximum number of days to 1st male flower emergence was recorded in the genotype IET/2021/BOGVAR-10 (51.73). The Days to First Male flower emergence play an important role in deciding the earliness or lateness of crop in general. The variation in the first male flower emergence might have been due to internodal length, number of inter nodal and vigour of the crop. Similar finding were reported by Sharma and Sengupta [10], Padmakshi Thakur et al. [8] and Singh et al. (2017) in Bottle.

Days to first female flower (DAT): The minimum number of days to 1st female flower emergence was recorded in the genotype IET/2021/BOGVAR-8 (55.33) followed by the IET/2021/BOGVAR-6 (56.66) and maximum number of days to 1st female flower emergence was recorded in the genotype IET/2021 /BOGVAR-10 (76.60). The Days to First Female flower emergence play an important role in deciding the earliness or lateness of crop in general. The variation in the first female flower emergence might have been due to internodal length, number of inter nodal and vigour of the crop. Similar finding were reported by Kumar et al. [11], Sharma and Sengupta [10].

Node at first male flower appear: The minimum number of node at 1st male flower emergence was recorded in the genotype IET/2021/BOGVAR-5 (5.66) followed by the IET/2021/BOGVAR-6 (7.40) and maximum number of node at 1st male flower emergence was recorded in the genotype IET/2021/BOGVAR-10 (17.26**)**. The Node at which First Male appears is an important role deciding total number of male flowers. The view was supported by Deepthi et al. [12], Vaishali (2016), Kunjam et al. [13] and Mishra et al. [14] in Bottle gourd.

Node at first female flower appear: The minimum number of node at 1st female flower emergence was recorded in the genotype

Table 1. Performance of bottle gourd (*Lagenaria siceraria* L.) genotypes for growth, yield and quality

Genotypes	Days to first male flower appear (DAT)	Days to first female flower appear (DAT)	Node number at first male flower appear	Node number at first female flower appear	Number of male flowers	Number of female flowers
IET/2021/BOGVAR-1	39.73	63.46	8.86	24.66	30.20	7.06
IET/2021/BOGVAR-2	40.80	69.26	9.80	24.73	29.06	10.80
IET/2021/BOGVAR-3	36.40	71.13	8.33	30.73	25.46	10.26
IET/2021/BOGVAR-4	41.40	67.00	8.93	23.53	20.60	10.13
IET/2021/BOGVAR-5	34.00	58.66	5.66	21.33	25.73	9.86
IET/2021/BOGVAR-6	41.20	56.66	7.40	16.60	31.33	13.93
IET/2021/BOGVAR-7	47.86	59.20	12.40	26.20	23.13	10.60
IET/2021/BOGVAR-8	42.20	55.33	9.20	19.20	37.73	15.40
IET/2021/BOGVAR-9	43.60	63.06	10.20	21.40	26.80	10.73
IET/2021/BOGVAR-10	51.73	76.60	17.26	19.13	21.33	11.33
F-Test	**S**	**S**	**S**	**S**	**S**	**S**
SE.d(±)	**1.39**	**5.25**	**1.24**	**3.15**	**2.65**	**1.43**
C.D at 5%	**2.91**	**11.02**	**2.61**	**6.63**	**5.57**	**3**
C.V.	**4.05**	**10.03**	**15.54**	**16.98**	**11.96**	**15.89**

Table 2. Performance of bottle gourd (*Lagenaria siceraria* L.) genotypes for growth, yield and quality

Genotypes	Days to fruit setting (DAT)	Days to first fruit picking (DAT)	Vine length (cm)	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Fruit yield (q/ha)	TSS (^{0}B)
IET/2021/BOGVAR-1	65.60	73.40	185.40	875.43	27.63	5.40	4.93	259.2	2.58
IET/2021/BOGVAR-2	71.26	79.33	186.80	783.20	23.17	5.64	7.20	335.8	2.40
IET/2021/BOGVAR-3	73.13	81.66	178.33	568.68	22.95	6.11	6.60	224.6	3.56
IET/2021/BOGVAR-4	69.06	78.33	145.20	607.28	9.81	11.97	6.53	237.2	1.66
IET/2021/BOGVAR-5	60.66	71.06	145.86	582.75	10.40	11.83	6.26	218.8	2.29
IET/2021/BOGVAR-6	56.66	66.93	181.00	750.08	23.58	9.24	8.73	393.3	3.21
IET/2021/BOGVAR-7	61.06	67.13	176.33	946.18	11.72	14.53	6.73	383.7	1.75
IET/2021/BOGVAR-8	59.26	69.40	228.33	675.13	27.38	6.97	10.80	438.7	4.13
IET/2021/BOGVAR-9	67.40	76.53	152.00	643.86	21.74	5.83	6.66	257.8	3.06
IET/2021/BOGVAR-10	79.60	86.46	177.13	579.76	20.80	4.93	5.73	199.3	2.46
F-Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
SE.d(±)	**5.14**	**5.48**	**12.57**	**25.04**	**1.35**	**0.37**	**0.79**	**33.86**	**0.49**
C.D at 5%	**10.79**	**11.5**	**26.42**	**52.61**	**2.83**	**0.77**	**1.66**	**71.14**	**1.02**
C.V.	**9.48**	**8.94**	**8.77**	**4.37**	**8.29**	**5.43**	**13.81**	**14.06**	**21.93**

IET/2021/BOGVAR-6 (16.60) followed by the IET/2021/BOGVAR-10 (19.13) and maximum number of node at 1st female flower emergence was recorded in the genotype IET/2021/BOGVAR-7 (26.20). The Node at which First Female appears is an important role deciding total number of male flowers. The view was supported by Vaishali (2016), Kunjam et al. [13] and Mishra et al. [14] in Bottle gourd.

Number of male flowers: The minimum number of male flowers was recorded in the genotype IET/2021/BOGVAR-4 (20.60) followed by the IET/2021/BOGVAR-10 (21.33) and maximum number of male flowers was recorded in the genotype IET/2021/BOGVAR-8 (37.73). The results are conformity with the findings of (Daryono et al. 2018). Where, he concludes that ethepon treatment affected the formation of watermelon flower by increasing the number of female or hermaphrodite flower and decreasing the number of male flowers, especially in the concentration of 75 ppm and 100 ppm. Poornima singh et al. [15], Padmakshi Thakur et al. [8].

Number of female flowers: The minimum number of female flowers was recorded in the genotype IET/2021/BOGVAR-1 (7.06) followed by the IET/2021/BOGVAR-5 (9.86) and maximum number of female flowers was recorded in the genotype IET/2021/BOGVAR-8 (15.40).

Days to fruits setting (DAT): The minimum days to first fruit setting was recorded in the genotype IET/2021/BOGVAR-6 (56.66) followed by the IET/2021/BOGVAR-8 (59.26) and maximum days to first fruit setting was recorded in the genotype IET/2021/BOGVAR-10 (79.60). The fruit setting shows the days to setting of fruit from the female flower get pollination to become mature. The similar results were shown by Padmakshi Thakur et al. [8], Poornima singh et al. [15].

Days to fruit picking (DAT): The minimum days to first fruit picking was recorded in the genotype IET/2021/BOGVAR-6 (66.93) followed by the IET/2021/BOGVAR-7 (67.13) and maximum days to first fruit picking was recorded in the genotype IET/2021/BOGVAR-10 (86.46). It may be due to mobilization of food materials from source to sink in best treatment. Similar results were had also been obtained by Kumar et al. [11], Padmakshi Thakur et al. [8], Kumar et al. [16] and Mishra et al. [14] [15] in Bottle gourd.

Vine length (cm): The minimum vine length was recorded in the genotype IET/2021/BOGVAR-4

(145.20) followed by the IET/2021/BOGVAR-5 (145.86) and maximum vine length was recorded in the genotype IET/2021/BOGVAR-8 (228.33). The variation in plant height might be due to specific genetic makeup of different genotypes, inherent properties and vigour to crop. The variations of plant height in bottle gourd have also reported by Thakur et al. (2013) Padmakshi Thakur et al. [8], Kunjam et al. [13], in Bottle gourd.

Fruit weight (g): The minimum fruit weight was recorded in the genotype IET/2021/BOGVAR-3 (568.68) followed by the IET/2021/BOGVAR-10 (579.76) and maximum fruit weight was recorded in the genotype IET/2021/BOGVAR-7 (946.18). The significant variation in weight of fruits might have been due to fruit set percentage, fruit length, number of fruits per vine, fruit weight and fruit width, genetic nature, environmental factor and vigour of the crop and higher uptake of nutrient. The findings were supported by Husnan et al. (2013), [17], Padmakshi Thakur et al. [8], Damor et al [8], Sushil kumar et al. [16] and Mishra et al [14] also reported more or less similar results in Bottle gourd.

Fruit length (cm): The minimum fruit length was recorded in the genotype IET/2021/BOGVAR-4 (9.81) followed by the IET/2021/BOGVAR-5 (10.40) and maximum fruit length was recorded in the genotype IET/2021/BOGVAR-1 (27.63). The results are in agreement with the finding of Kumar et al. [11], Padmakshi Thakur et al. [8], [16] and Mishra et al. [14] in Bottle gourd.

Fruit diameter (cm): The minimum fruit diameter was recorded in the genotype IET/2021/BOGVAR-10 (4.93) followed by the IET/2021/BOGVAR-1 (5.40) and maximum fruit diameter was recorded in the genotype IET/2021/BOGVAR-7 (14.53). Similar results have been reported Husna et al. [18], Padmakshi Thakur et al. [8], Damor et al [19], [16] and Mishra et al [14] in Bottle gourd.

Number of fruits per plant: The minimum number of fruits per plant was recorded in the genotype IET/2021/BOGVAR-1 (4.93) followed by the IET/2021/BOGVAR-10 (5.73) and maximum number of fruits per plant was recorded in the genotype IET/2021/BOGVAR-8 (10.80). The results are conformity with the findings of [6], [9], Padmakshi Thakur et al. [3], Sushil kumar et al. [16].

Fruit yield (q/ha): The minimum yield per hectare was recorded in the genotype

IET/2021/BOGVAR-10 (199.3) followed by the IET/2021/BOGVAR-5 (218.8) and maximum yield per hectare was recorded in the genotype IET/2021/BOGVAR-8 (438.7). The results are in agreement with the finding of Kamal et al. [20], Padmakshi Thakur et al. [8], Deepthi et al. [12] and [16] in Bottle gourd.

TSS (^{0}B): The minimum TSS was recorded in the genotype IET/2021/BOGVAR- 4 (1.66) followed by the IET/2021/BOGVAR-7 (1.75) and maximum TSS was recorded in the genotype IET/2021/BOGVAR- 8 (4.13). The results are conformity with the finding of Harika et al. [7] and Muhammad Iqbal et al. [21].

Economics: Maximum gross returns, Net Return and Cost Benefit Ratio Rs. 658050/ha, Rs. 508807/ha and (1:4.4) respectively was recorded in the genotype IET/2021/BOGVAR-8 and the minimum Gross Return, Net Return and Cost Benefit Ratio (Rs. 298950/ha, Rs. 149707/ha and 1:2.0) respectively was recorded in the genotype IET/2021/BOGVAR-10 as presented in table. As the economics is the need of the farmers while taking decision regarding the adoption of the techniques and scientific knowledge. Hence, IET/2021/BOGVAR-8 gave the highest gross return, net return, and cost benefit is due to higher productivity and enhanced fruit quality, which increase the market value of the fruit.

4. CONCLUSION

The results from the present investigation concluded that Bottle gourd Genotype IET/2021/BOGVAR-8 was recorded maximum number of female flowers (15.40), vine length (228.33 cm), number of fruits per plant (10.80 fruits), average yield per plant (7.31kg/plant), average yield per hectare (438.7 q/ha), TSS (4.13 ^{o}B).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Abhishek, Vikash. Rajput., Jitendra Kumar., and Saurabh, Tomar. Evaluation of bottle gourd genotypes (*Lagenaria siceraria*) for various yield and maturity characters, Department of Horticulture, CSAUAT, Kanpur. 2021;20:530-532.
2. Achu MB, Achu E, Fokou C, Tchiegang M, Fotso FM. Nutritivevalue of some Cucurbitaceae oil seeds from different regions. African Journal of Biotechnology. 2005;4:1329-1334.
3. Chandra Leela, Devi Singh. Evaluation Trial on Bottle Gourd [*Lagenaria siceraria*] Under Prayagraj Agro-Climatic Conditions. International Journal of Agriculture, Environment and Biotechnology. 2020; 13(4): 517-520.
4. Chandramouli, RVSK Reddy, M Ravindra Babu, K Uma Jyothi, K Uma Krishna and M Paratpara Rao. Genetic variability studies for yield and yield attributing traits in F2 generation of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) Journal of Horticulture; 2021. ISSN: 2415-7086.
5. Narayan K. Genetic diversity and correlation studies in bottle gourd germplasm under Baster condition. XI Chhattisgarh young scientist congress. Journal of Agricultural Science. 2013;1(5): 15.
6. Husna A, Mahmud F, Islam MR, Mahmud MA. Genetic Variability, Correlation and Path Co-Efficient Analysis in Bottle Gourd (*Lagenaria siceraria* L.), Advances in Biological Research. 2011;5 (6):323-327.
7. Harika M, Gasti VD, Shantappa T, Mulge R, Shirol AM, Mastiholi AB, Kulkarni MS. Evaluation of bottle gourd genotypes [*Lagenaria siceraria* (Mol.) Standl.] for various horticultural characters. Karnataka Journal of Agricultural Sciences. 2012;25(2): 241-244.
8. Padmakshi Thakur, Dhananjay Sharma, Vaibhav Kant Visen and Sasmita Priyadarsini Dash. Evaluation of bottle gourd [*lagenaria siceraria* (mol.) Standl.] Genotypes. Plant Archives. 2015;15(2): 1037-1040.
   ISSN 0972-5210
9. Bhardwaj DR, Singh A, Singh U. Genetic variability of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] by multivariate analysis. In Proc. of National symposium on abiotic and biotic stress management in vegetable crops. India. Society Vegetable Science. 2013;370.
10. Sharma A, Sengupta SK. Genetic diversity, heritability and morphological characterization in bottle gourd [*Lagenaria Siceraria* (Mol.) Standl.]. The Bioscan. 2013;8(4):1461-1465.
11. Kumar R, Prasad VM. Hybrid evaluation trial in bottle gourd gourd [Lagenaria siceraria (Mol.) Standl.]. Environment and Eco. 2011;29(1):74-77.

12. Deepthi BP, Syam. Sundar. Reddy A, Satya Raj Kumar, A. Ramanjaneya, Reddy. Studies on phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance in bottle gourd genotypes for yield and yield components. Plant Archives 2016; 16(2):597-601. ISSN 0972-5210

13. Kunjam K, Som I, Markam R, Netam P. Evaluation of bottle gourd [*Lagenaria siceraria* (Molina) Standl.] genotypes in Chhattisgarh plain. International Journal of Chemical Studies. 2019;7(1): 2385-2387.

14. Mishra S, Pandey S, Kumar N, Pandey VP, Mishra N. Studies on gene action involved in inheritance of yield and yield attributing traits in kharif season bottle gourd [*Lagenaria siceraria* (Molina) standl.] Journal of Pharmacognosy and Phytochemistry. 2019;8(1): 39-44.

15. Poornima Singh, Harpal Singh, Joginder Singh and Gaurav Ahirwar. Studies on different hybrids varieties of bottle gourd (*Lagenaria siceraria* L.) cultivar under Bundelkhand region of U.P. International Journal of Current Microbiology and Applied Sciences. 2020;11: 2691-2695.

16. Sushil kumar, Vandana thakur, Rajni Tiwari and Chormule SR. Evaluation of genotypes for quantitative traits in bottle gourd (*Lagenaria siceraria* (Mol.) standl.).

Journal of Pharmacognosy and Phytochemistry. 2018;7 (3): 841-843.

17. Sahu B, Sarvanan S, Rangare SB, Sinha S, Sao P. Varietal Evaluation of Bottle Gourd Under Allahabad Agro Climatic Condition [*Lagenaria siceraria* (Molina) Standl.]. Trends in Biosciences 2014;7(1): 7-8.

18. Damor AS, Patil JN, Parmer HK, Vyas ND. Studies on genetic variability, heritability and genetic advance for yield and quality traits in bottle gourd [*Lagenaria siceraria* (Molina) Standl.] genotypes. International Journal of Environmental Science & Technology. 2016;5(4):2301-2307.

19. Husna A, Mahmud F, Islam MR, Mahmud MAA, Ratna M. Genetic Variability, Correlation and Path Co-Efficient Analysis in Bottle Gourd (*Lagenaria siceraria* (Molina) Standl.). Advances in Biological Research. 2011;5 (6):323-327.

20. Kamal N, Verma S, Agrawal S, Rao SS. Genetic variability and correlation studies in bottle gourd grown as intercrop in coconut garden. Plant archives. 2012; 12(1):85-88.

21. Iqbal M, Usman K, Arif M, Jatoi SA, Munir M, Khan I. Evaluation of bottle gourd genotypes for yield and quality traits. Sarhad Journal of Agriculture. 2019; 35(1):27-35.

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