

Performance of different hybrids of cucumber (*Cucumis sativus* L.) in terms of growth, yield and quality.

ABSTRACT

The present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, during the *Rabi* season 2023, with a view to check the performance of different hybrids of cucumber under Prayagraj agro-climatic conditions. The experiment was laid in a randomized block design with eight hybrids and with three replicates. The hybrids comprised of V₁ (Shruti), V₂ (Maria), V₃ (LHC 1395), V₄ (Radhe), V₅ (Indaram Jaya), V₆ (Niyamat) and V₇ (CCH-1). From the above experimental finding it was concluded that the hybrid Niyamat performed best in terms of growth parameters like vine length at harvest (182.62 cm), maximum number of leaves (15.93) in earliness in maturity (61.00 days for first fruit harvest). Hybrid CCH-1 performed the best for yield parameters, such as like the highest number of fruits per plant (14.59 fruits), maximum fruit length (16.72 cm), fruit diameter (3.60 cm), and fruit yield per vine (2.60 kg/vine). It showed best performance for TSS (3.15 °Brix). The maximum Benefit cost ratio was recorded for Hybrid CCH-1 at 2.13.

Keywords: *Cucumis sativus*, hybrids, TSS, Benefit Cost ratio.

Introduction

The Cucurbitaceae, also called cucurbits or the gourd family, is a plant family consisting of approximately 965 species in approximately 95 genera, of which the most important to humans are *Luffa*, which the common name is also luffa, sometimes spelled loofah (when fully ripened, two species of this fibrous fruit are the source of the loofah scrubbing sponge). This family of plants is grown in temperate regions and the tropics. The earliest cultivated plants in the Old and New Worlds were those bearing edible fruits. Regarding when it comes to the quantity and proportion of plant species used as food for humans, the Cucurbitaceae family is among the largest families. The Cucurbitaceae family comprises the largest group of summer vegetable crops, known as cucurbits. With the exception of coccinia and pointed gourds (Parval), which are dioecious, most the majority of cucurbits are monoecious. There are also a number of andro-monoecious and hermaphrodite cultivars are also available for certain crops (melons). The fruit is botanically a pepo. Within the Cucurbitaceae family, cucumbers are widely grown creeping vine plants that produce fruits that are typically cylindrical and are eaten as vegetables. Cucumbers are considered thought of as an annual plants. They are come in three main varieties: slicing, pickling, and burpless/seedless. Within each of these varieties, numerous cultivars have been developed for each of these varieties. Although the cucumber originated in South Asia, it is now grown on most continents due to the global trade in cucumber varieties. Although they are not closely related, plants in the genera *Echinocystis* and *Marah* are referred to as "wild cucumbers" in North America. Grown throughout India, cucumber is a day-neutral, thermophilic, and geitonogamy

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diploid crop. After watermelon, it is the second-most important crop among cucurbits. ~~Cucurbitacin causes bitterness in cucumber is due to 'cucurbitacin'. The most~~ favourable temperature for cucumber ~~growth~~ is 18°C-24°C. It accounts to 12-13% of the total ~~cucurbits' acreage of cucurbits. Botanically~~ Cucumber, ~~also is~~ known as *Cucumis sativus* L., belongs to ~~the family~~ Cucurbitaceae ~~family~~. It has a chromosome number of $2n=2x=14$ (Mckay, 1930). India is the birthplace of cucumber, which has a variety of morphological characteristics, including growth habit, fruit size, shape, thickness, number of spines, tenderness, and colour. Numerous landraces and local forms with ~~a limited distributions~~ have accumulated in various growing areas ~~owing due~~ to ongoing selection. Little is known about the genetic diversity of regional genotypes in India, despite the fact that cucumbers have a wide variety of morphological features (Lv *et al.*, 2012). Cucumber is native to the foothills of the Himalayas of Nepal, where the wild, bitter-fruited form, *C. sativus* var. *Hardwickii*, ~~were can be~~ found. They are ~~the directly~~ seed-sown vegetables ~~with having~~ hard seed coats, which ~~require need~~ more time for germination and sometimes exhibit uneven germination (Devi *et al.*, 2013). On the basis of flowering habit, cucumber has three types- "gynoeious" which produces only female flowers, "predominantly gynoeious" which also bears some male flowers and "monoecious" which produces both male and female flowers. The first two types produce ~~fruits~~ parthenocarpic ~~fruits~~, and fruit ~~development occur takes place~~ without pollination, whereas pollination is required by monoecious types for seed setting, which is accomplished by honeybees (Mehdi *et al.*, 2012). Cucumber cultivars are usually classified ~~based on their the basis of how they are~~ used, fresh market (slicer), and pickling. In general, ~~slicer fruits of slicers~~ are larger than pickling cultivars, and they develop ~~a darker and heavier skin with a~~ uniformly cylindrical shape (Bose *et al.*, 2002). This classification includes several fruit characteristics, such as shape, colour, spine type (coarse or fine), spine colour (white or black), fruit length/diameter ratio, skin thickness, and surface (Rana, 2008).

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MATERIALS AND METHODS

The experiment was ~~conducted carried out~~ at the Horticultural Research Farm, specifically located within the Department of Horticulture at the Naini Agricultural Institute. This institute is affiliated with ~~the~~ Sam Higginbottom University of Agriculture, Technology, and Science (SHUATS) in Prayagraj. The experimental field ~~was~~ located on the left side of Allahabad-Rewa Road, in close proximity to the Yamuna River, ~~at a distance of~~ approximately 8 km from Allahabad ~~City~~. The experimental site ~~was~~ located at a latitude of 25.57° N and a longitude of 81.51° E. ~~The Meteorological data for the~~ cropping seasons. In the present investigation, the design used for ~~the~~ analysis of variables ~~was were a~~ Randomized Block Design (RBD) comprising seven genotypes replicated ~~three times three~~ each ~~enlisted~~.

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Vine length (cm)

Vine length was measured from the ground level to the last tip of the main stem ~~of the plant~~ of five randomly selected plants at 15, 30, and 45 DAS and at the harvest stage.

Number of leaves per vine

~~The n~~Number of leaves per vine was counted and recorded ~~for~~ individual plants from each replication and hybrid sown at 15, 30, and 45 DAS.

T.S.S. (°Brix)

The percentage of total soluble solids ~~in~~ the fruit was determined ~~using with the help of~~ Portable ~~h~~Hand-r-~~R~~Refractometer. The ~~sample of~~ juice ~~sample~~ for this purpose was ~~obtained~~~~taken~~ from ~~the~~ strained juice. The observed value of T.S.S. was recorded ~~using from~~ the scale of the instrument (0-32 range).

Vitamin C content (mg/100g of fruits pulp)

~~The v~~Vitamin C content or ~~a~~Ascorbic acid content in the pulp was estimated ~~by~~ using 2, 6 dichlorophenol indophenol dye as reported by Ranganna (1986) as follows:

RESULTS AND DISCUSSION

Vine length

The vine length performance of various cucumber hybrids ~~for vine length~~ is reported in Table 1. In the current study, and it was discovered that the hybrid had statistically significant differences ~~statistically noted~~. The hybrid Radhe had the longest vines (3.63 cm) measured at 15 DAS, while the hybrid Niyamat had the second longest vine (3.46 cm). In the hybrid, ~~the~~Shruti shortest vine length (~~of~~ 2.90 cm) was noted at 15 DAS. The hybrid Maria had the longest vines (19.67 cm) measured at 30 DAS, while the hybrid Radhe had the second longest vine (19.40 cm). In the hybrid, Indaram Jaya, with the shortest vine length of 16.93 cm was noted at 30 DAS. The hybrid LHC-1395 had the longest vines (65.74 cm) measured at 45 DAS, ~~whereas~~~~while~~ hybrid Shruti had the second longest vine (63.80 cm). In the hybrid, ~~Radhe~~ shortest vine length of 51.40 cm was noted at 45 DAS. The hybrid Niyamat had the longest vines (182.62 cm) measured at the harvest stage, while hybrid CCH-1 had the second longest vine (157.85 cm). In the hybrid, ~~Radhe~~ shortest vine length (~~of~~ 143.76 cm) was noted at the harvest stage. The hybrid Niyamat ~~of~~ cucumber likely exhibits better vine length compared to other genotypes due to a combination of genetic factors and environmental conditions. Genetic traits within the Niyamat hybrid may include alleles that promote vigorous vine growth, such as genes regulating internode elongation, branching patterns, and hormone signalling pathways. These genetic characteristics contribute to the development of longer vines during the growth stages. The significance of better vine length in the Niyamat hybrid lies in its potential to maximize space utilization, light interception, and, ultimately, yield. Longer vines provide ~~greater~~~~more~~ surface area for photosynthesis, leading to increased biomass production and fruit yield. Moreover, extended vines may enhance canopy coverage, ~~reduc~~ing weed competition, and ~~impro~~ving fruit quality by shielding the fruits from

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direct sunlight. Therefore, the genetic predisposition of the Niyamat hybrid for better vine length is presents a valuable trait with significant implications for maximizing productivity and profitability in cucumber cultivation. StudiesResearch on cucumber (Shah *et al.*, 2017; Rathore *et al.*, 2017; Bhagwat *et al.*, 2018 and Sadiq *et al.*, 2019) have reported similar results.

Table 1 Performance of different hybrids of cucumber for vine length.

Hybrid Notation	Hybrid details	Vine length (cm)			
		15 DAS	30 DAS	45 DAS	Harvest
V ₁	Shruti	2.90	18.18	63.80	108.89
V ₂	Maria	3.24	19.67	58.45	152.43
V ₃	LHC 1395	3.43	18.87	65.74	153.45
V ₄	Radhe	3.63	19.40	51.40	143.76
V ₅	Indaram Jaya	3.33	16.93	60.33	155.24
V ₆	Niyamat	3.46	17.47	60.47	182.62
V ₇	CCH-1	3.33	17.07	63.67	157.85
'F' Test		S	S	S	S
SE d (±)		0.24	1.19	3.79	3.24
CD_{0.05}		0.53	2.60	8.25	7.06
CV.		9.00	8.02	7.66	2.63

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Number of leaves per vine

It was found in the current study that there were statistically significant differences among hybrids of cucumber for number of leaves per vine. With 2.87 leaves, the hybrid Niyamat had the highestmaximum number of leaves per vine overall; Radhe and Indaram Jaya had the second-highest number of leaves, with 2.80 leaves per vine. The lowest number of leaves per vine (2.40) was observed in the hybrid sShruti observed at 15 DAS. With 5.40 leaves, the hybrid Niyamat had the maximum number of leaves per vine, followed by hybrid Shruti with 4.87 leaves per vine. The lowest number of leaves per vine (4.13) was observed in hybrid CCH-1 observed at 30 DAS. With 15.93 leaves, the hybrid Niyamat had the maximum number of leaves per vine; Indaram Jaya had the second-highest number of leaves, with 14.20 leaves per vine. The lowest number of leaves per vine (11.00) was observed in Shruti observed at 45 DAS. The cucumber hybrid Niyamat of eueumber likely achieves the highest number of leaves per vine compared to other genotypes due to its specific genetic makeup and favorable environmental conditions. Genetic factors within the Niyamat hybrid may include alleles that promote prolific leaf growth, such as genes that regulateing leaf initiation, expansion, and retention. These genetic characteristics resulted in the development of a greater number of leaves on each vine during the growth stages. The significance of the highest number of leaves per vine in the Niyamat hybrid lies in its potential to enhance the photosynthetic efficiency and overall plant vigour. More leaves mean more surface area for photosynthesis, which leadsing to increased carbohydrate

production and nutrient assimilation. This can result in improved plant growth, higher fruit yield, and better fruit quality. Additionally, a dense canopy of leaves may help suppress weed growth and conserve soil moisture, thereby contributing to more sustainable and efficient cucumber cultivation practices. Therefore, the genetic predisposition of the Niyamat hybrid to produce for the highest number of leaves per vine presents a valuable trait with significant implications for maximizing productivity and yield in cucumber cultivation. Studies Research on cucumbers (Patel *et al.*, 2013; Shah *et al.*, 2016; Pal *et al.*, 2017; Bhagwat *et al.*, 2018) reported similar results.

Table 2 Performance of different hybrids of cucumber for number of leaves per vine.

Hybrid Notation	Hybrid details	Number of leaves per vine		
		15 DAS	30 DAS	45 DAS
V ₁	Shruti	2.40	4.87	11.00
V ₂	Maria	2.67	4.73	13.40
V ₃	LHC 1395	2.43	4.50	11.80
V ₄	Radhe	2.80	4.53	13.47
V ₅	Indaram Jaya	2.80	4.53	14.20
V ₆	Niyamat	2.87	5.40	15.93
V ₇	CCH-1	2.13	4.13	12.87
‘F’ Test		S	S	S
SE d (±)		0.15	0.32	0.86
CD _{0.05}		0.32	0.70	1.88
CV.		6.99	8.48	7.99

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TSS

The results of comparing the various cucumber hybrids of cucumbers for TSS, the current study's findings demonstrated that hybrids differed statistically significantly in terms of TSS. The highest TSS (3.15 °Brix) was observed displayed for by the hybrid CCH-1, which was comparable to Indaram Jaya's 3.02 °Brix). In hybrid Shruti, the lowest TSS (2.03 °Brix) was recorded. Cucumber hHybrid CCH-1 of cucumber likely exhibits better Total Soluble Solids (TSS) content than compared to other hybrids due to its specific genetic makeup and environmental conditions. Genetic factors within CCH-1 may include alleles that regulate sugar metabolism, transport, and accumulation in fruits, leading to higher TSS levels. The significance lies in improved fruit quality and consumer appeal. A higher TSS content indicates sweeter fruits with enhanced flavour and nutritional value, increasing consumer satisfaction and demand. Additionally, fruits with a better TSS may command premium prices in the market, enhancing profitability for growers. Therefore, CCH-1's genetic predisposition for better TSS is presents a valuable trait with significant economic implications in cucumber cultivation. These findings were previously year earlier reported in studies on cucumbers by Patel *et al.*, 2013; Rathore *et al.*, 2017; Pal *et al.*, 2017; Sadiq *et al.*, 2019.

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Table 3. Performance of different hybrids of cucumber for TSS and Vitamin C content (mg).

Hybrid Not	Hybrid detail	TSS (°Brix)	Vitamin C content (mg)
V ₁	Shruti	2.03	4.27
V ₂	Maria	2.37	4.25
V ₃	LHC 1395	2.26	4.50
V ₄	Radhe	2.93	5.36
V ₅	Indaram Jaya	3.02	5.13
V ₆	Niyamat	2.70	5.21
V ₇	CCH-1	3.15	4.94
'F' Test		S	S
SE d (±)		0.17	0.33
CD_{0.05}		0.37	0.72
CV.		7.98	8.38

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Vitamin C content

Table 3. reports the results of comparing the various hybrids of cucumbers for vitamin C content, The current study's findings demonstrated that hybrids differed statistically significantly in terms of vitamin C content. The highest vitamin C content (5.36 mg) was displayed by the hybrid Radhe, which was comparable to hybrid Niyamat's 5.21 mg. In hybrid Maria, the lowest vitamin C content (4.25 mg) was recorded. Cucumber hybrid Radhe probably has higher vitamin C content than other hybrids because of its unique genetic composition and growing environment. Radhe might have alleles that improve the biosynthetic processes that produce and accumulate vitamin C in fruits. Improved nutritional value and benefits to consumer health are the main reasons for the significance. Improved fruit quality is indicated by a higher vitamin C content, which increases demand and customer satisfaction. Furthermore, fruits with higher vitamin C content enhance immune system support and balance, potentially improving consumers' health. Consequently, Radhe's genetic tendency towards higher vitamin C content offers a useful characteristic with important consequences for consumer health and competitiveness in the market. The results were previously published in studies on cucumber by **Patel et al., 2013; Rathore et al., 2017; Pal et al., 2017; Sadiq et al., 2019; Harshitha and Shyamamma, 2021.**

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Table 4. Performance of different hybrids on BC Ratio of Cucumber

Sl No.	Hybrids	Fruit yield (q/ha)	Cost of Cultivation (INR/ha)	Gross Return (INR/ha)	Net Return (INR/ha)	Benefit Cost Ratio
V ₁	Shruti	81.22	1,16,242	1,62,433	46,191	1.40
V ₂	Maria	96.72	1,16,242	1,93,433	77,191	1.66
V ₃	LHC 1395	93.34	1,16,242	1,86,687	70,445	1.61
V ₄	Radhe	97.24	1,16,242	1,94,480	78,238	1.67
V ₅	Indaram Jaya	112.94	1,16,242	2,25,887	1,09,645	1.94
V ₆	Niyamat	102.34	1,16,242	2,04,687	88,445	1.76
V ₇	CCH-1	123.52	1,16,242	2,47,040	1,30,798	2.13

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Economics of different hybrids:

The economics of all hybrids were calculated according to the expenditure incurred from then raising until harvesting of fruits, viz. Cost of cultivation, gross return, net return, and benefit: cost ratio was calculated and is presented in table 4. Maximum gross returns were recorded in hybrid CCH-1 with Rs. 2,47,040, followed by hybrid Indaram Jaya with Rs. 2,25,887, and the minimum (Rs. 1,62,433) was recorded in hybrid Shruti. The maximum net returns were recorded in hybrid CCH-1 with Rs. 1,30,798, followed by hybrid Indaram Jaya with Rs. 1,09,645, and the minimum (Rs. 46,191) was recorded in hybrid Shruti. The maximum BC ratio was recorded in hybrid CCH-1 with 2.13, followed by hybrid Indaram Jaya with 1.94 and the minimum (1.40) was recorded in hybrid Shruti.

Conclusion

From the above experimental finding it concluded that the hybrid Niyamat performed best in terms of growth parameters like vine length at harvest (182.62 cm), maximum number of leaves (15.93) in earliness in maturity (61.00 days for first fruit harvest). Hybrid CCH-1 performed the best for yield parameters, such as like the highest number of fruits per plant (14.59 fruits), maximum fruit length (16.72 cm), fruit diameter (3.60 cm), and fruit yield per vine (2.60 kg/vine). It showed best performance for TSS (3.15 °Brix). The maximum Benefit cost ratio was recorded for Hybrid CCH-1 at 2.13.

REFERENCES

- Bhagwat, A., Srinivasa, V., Bhammanakati, S., and Shubha, A. S. (2018).** Evaluation of Cucumber (*Cucumis sativus* L.) Genotypes under Hill Zone of Karnataka, India. *International Journal of Current Microbiology and Applied Sciences*.7(9): 837-842.
- Bose, T.K, Kabir, J, Maity, T.K, Parthasarathy, V.A. and Som, M.G. (2002).** Vegetable crops. Naya Prakash publishers. Calcutta. 1: 521.
- Devi, T. S., Shivaprakash, M. K. and Maina, C. C. (2013).** Efficacy of seed bio-priming in enhancing seedling vigour of cucumber (*Cucumis sativus* L.) under biotic stress conditions. *Mysore Journal of Agricultural Science*.47(1): 107 - 111.
- Harshitha, C. K., and Shyamamma, S. (2021).** Morphological Characterization of Local Cucumber (*Cucumis sativus* L.) Genotypes for Fruit Quality Traits. *Mysore Journal of Agricultural Sciences*.55(4): 130-141.
- Iqbal, M., Khalid, U., Muhammad, A., Shakeel, A. J., Muhammad, M. and Imran, K. (2021).** Evaluation of Bottle Gourd Hybrids for Yield and Quality Traits. *Sarhad Journal of Agriculture*.35(1): 27-35.
- Lv, J., Qi, J., Shi, Q., Shen, D., Zhang, S. and Shao, G., (2012).** Genetic diversity and population structure of cucumber (*Cucumis sativus* L.). *PLoS One*.7(10): e46919.
- Mason, D. D., Bogard, J. R., and Sulser, T. B, (2019).** Gaps between fruit and vegetable production, demand, and recommended consumption at global and national levels: an integrated modelling study. *The Lancet Planetary Health*. 3(7): e318-e329.
- McKay, J. W. (1930).** Chromosome numbers in the Cucurbitaceae. *Botanical Gazette*. 89:416-417.
- Mehdi, M, Ahmed, N, Jabeen, N, Khan, S.H. and Afroza, B. (2012).** Effect of ethrel on hybrid seed production of cucumber (*Cucumis sativus* L.) under open and protected conditions. *The Asian Journal of Horticulture*.7(2): 558-560.
- Pal, S., Sharma, H. R., and Yadav, N. (2017).** Evaluation of cucumber genotypes for yield and quality traits. *Journal of Hill Agriculture*.8(2): 144-150.

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- Patel, J. K., Vijay, B., Singh, D., Prasad, V. M. and Rangare, S. B. (2013).** Performance of cucumber (*Cucumis sativus* L.) hybrids in agro-climatic conditions of Prayagraj. *Hort-Flora Research Spectrum*. **2**(1): 50-55.
- Rathore, J. S., Collis, J. P., Singh, G., Singh, K. R. and Jat, B. L. (2017).** Studies on Genetic Variability in Cucumber (*Luffa acutangula* L. (Roxb.)) Hybrids in Allahabad Agro-Climate Condition. *International Journal of Current Microbiology and Applied Sciences***6**(2): 317-338.
- Sadiq, G. A., Najibullah, O., Khalid, A. Z. and Safdary, A. J. (2019).** Evaluation of growth and yield performance of five cucumbers (*Cucumis sativus* L.) hybrids; Case study Kunduz province, Afghanistan. *International Journal of Advanced Education and Research*.**4**(6): 22-28.
- Shah, K. N., Rana, D. K., and Singh, V. (2016).** Evaluation of different cucumber strains for various horticultural traits under valley conditions of Garhwal Himalaya. *Journal of Plant Development Sciences*.**8**(12): 599-603.