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Performance of Different Hybrids of Cucumber (*Cucumis sativus* L.) in Terms of 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.

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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 cucumber hybrids under agro-climatic conditions. The experiment was laid in a randomized block design with eight hybrids and three replicats. The hybrids comprised V_1, V_2, V_3 (LHC 1395); V_4, V_5, V_6 and V_7 (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

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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 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.

1. INTRODUCTION

The Cucurbitaceae, also called cucurbits or the gourd family, is a plant family consisting of approximately965 species in approximately 95 genera, of which the most important to humans are *Luffa*, which 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 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 diocious, most cucurbits are monoecious. number of andro-monoecious and hermaphrodite cultivars are also available for certain crops (melons). The ruit is botanical epo. 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 considere annual plants. The three main varieties: slicing, pickling, and burpless/seedless [1,2]. Numerous cultivars have been developed for each of these varieties. Although cucumber originated in South Asia, it is now grown on most continents due to global trade in cucumber varieties. Although 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 diploid crop. After watermelon, it is the second most important crop among cucurbits. Cucurbitacin causes bitterness in cucumber. The most favorable temperature for cucumber growth is 18°C-24°C. It accounts to 12-13% of the total acreage of cucurbits. Cucumber, also known as *Cucumis sativus* L., belongs to the Cucurbitaceae *family.* It has a chromosome number of 2n=2x=14 [3]. 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 color. Numerous landraces and local forms with limited distributions have accumulated in various growing areas owing 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 [4]. Cucumber is native to the foothills of the Himalayas of Nepal, where the wild bitter-fruited form, *C. sativus var. Hardwickii,* found. They are directly seed-sown vegetables hard seed coats, which require more time for germination and sometimes exhibit uneven germination [5-7]]. On the basis of flowering habit, cucumber has three types- “gynoecious” which produces only female flowers, “predominantly gynoecious” which also bears some male flowers and “monoecious” which produces both male and female flowers. The first two types produce parthenocarpic fruits, and fruit development without pollination, whereas pollination is required by monoecious types for seed setting, which is accomplished by honeybees [8]. Cucumber cultivars are usually classified based on theiruse, fresh market (slicer), and pickling. In general, slicer fruits are larger than pickling cultivars, and they develop darker and heavier skin with a uniformly cylindrical shape [9-11]. This classification includes several fruit characteristics, such as shape, color, spine type (coarse or fine), spine color (white or black), fruit length/diameter ratio, skin thickness, and surface (Rana, 2008).

2. MATERIALS AND METHODS

The experiment was conducted 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, 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. Meteorological data for cropping seasons. In the present investigation, the design used for the analysis of variables was a Randomized Block Design (RBD) comprising seven genotypes replicated three times each.

2.1 Vine Length (cm)

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

2.2 Number of Leaves Per Vine

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

2.3 T.S.S. (°Brix)

The percentage of total soluble solids in the fruit was determined using portable hand-refractometer. The juice sample for this purpose was obtained from strained juice. The observed value of T.S.S. was recorded using the scale of the instrument (0-32 range).

2.4 Vitamin C Content (mg/100g of fruits pulp)

The itamin C content or ascorbic acid content in the pulp was estimated using 2, 6 dichlorophenol indophenol dye as reported by Ranganna (1986) as follows.

3. RESULTS AND DISCUSSION

3.1 Vine Length

The vine length performance of various cucumber hybrids is reported in Table 1 In the current study, and it was discovered that the hybrid had statistically significant differences. The hybrid Radhe had the longest vine (3.63 cm) measured at 15 DAS, while the hybrid Niyamat had the second longest vine (3.46 cm). In the hybrid, shortest vine length (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 vine (65.74 cm) measured at 45 DAS, whereas hybrid Shruti had the second longest vine (63.80 cm). In the hybrid, shortest vine length of 51.40 cm was noted at 45 DAS. The hybrid Niyamat had the longest vine (182.62 cm) measured at the harvest stage, while hybrid CCH-1 had the second longest vine (157.85 cm). In the hybrid, the shortest vine length (143.76 cm was noted at the harvest stage. The hybrid Niyamat 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 surface area for photosynthesis, leading to increased biomass production and fruit yield. Moreover, extended vines may enhance canopy coverage, reduce weed competition, and improve fruit quality by shielding the fruits from direct sunlight. Therefore, the genetic predisposition of the Niyamat hybrid for better vine length is a valuable trait with significant implications for maximizing productivity and profitability in cucumber cultivation. Studies on cucumber (Shah et al., 2017; [12-14] have reported similar results.

3.2 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 highest 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 shruti 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 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 at 45 DAS. The cucumber hybrid Niyamat 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 regulat 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 vigor. More leaves mean more surface area for photosynthesis, which leads to increased carbohydrate production and nutrient assimilation. This can improve plant growth, fruit yield, and 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 the highest number of leaves per vine presents a valuable trait with significant implications for maximizing productivity and yield in cucumber cultivation. Studies on cucumbers [15-17,13] reported similar results.

3.3 TSS

Comparing the various cucumber hybrids for TSS, he current study's findings demonstrated that hybrids differed significantly in terms of TSS. The highest TSS (3.15 °Brix) was observed for 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 hybrid CCH-1 likely exhibits better Total Soluble Solids (TSS) content than 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 fruit, leading to higher TSS levels. The significance lies in improved fruit quality and consumer appeal. A higher TSS content indicates sweeter fruits with enhanced flavor 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 a valuable trait with significant economic implications in cucumber cultivation. These findings were previously reported in studies on cucumbers by Patel et al.[15,12,16,14].

3.4 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

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

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. [15,12,16,14,17].

3.5 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. 247040, followed by hybrid Indaram Jaya with Rs. 225887, and the minimum (Rs. 162433) was recorded in hybrid Shruti. The maximum net returns were recorded in hybrid CCH-1 with Rs. 130,798, followed by hybrid Indaram Jaya with Rs. 109645, and the minimum (Rs. 46191) 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.

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

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

Hybrid Notatior	Hybrid details	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

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

4. 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 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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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