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Evaluation of Different Cucumber (*Cucumis sativus* L.) Hybrids for Growth, Yield and Quality

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Authors' contributions

This work was carried out in collaboration between both authors. Author AE formulated the theory and conducted the calculations and explored and oversawed the outcomes of this research under the guidance of author VB. Author VB validated the analytical techniques. Authors AE and VB collectively deliberated the results and both authors played a role in shaping the final manuscript.

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ABSTRACT

Cucumber is a popular vegetable belonging to the gourd family (Cucurbitaceae). It is widely cultivated and consumed worldwide for its refreshing and crunchy texture. Cucumbers are typically grown as annual climbing or creeping vines, producing elongated, cylindrical, or oval-shaped fruits with green skin and edible seeds. They are known for their high-water content, making them an excellent hydrating and low-calorie food option. It has a mild, slightly sweet flavor. Therefore, 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 Kharif season 2022-2023 with a view to check performance of different Hybrids of cucumber under Prayagraj agro climatic conditions. From the above experimental finding it was be concluded that the Hybrid NBH-842 was statistically significant and higher in terms of growth

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parameters like vine length, earliness in flowering and maturity and variety NBH-842 yield parameters like fruit weight and fruit yield per vine while NBH-Manvi plus for fruit length, fruit diameter, and fruit yield per vine. Hybrid Prasad-100 showed best performance for quality parameters including TSS and Vitamin C content.

Keywords: Cucumis sativa; hybrids; TSS; Cucurbitaceae.

1. INTRODUCTION

In the Cucurbitaceae family, cucumber is a well-known and widely cultivated crawling vine plant. It generates long, cylindric fruits that are used as vegetables. This annual plant, which is now grown on several continents, was originally native to South Asia. There are three main types of cucumber: slicing, pickling, and burpless/seedless, each with a number of cultivars that have been created over time. Even though they are not closely related to the cultivated cucumber, plants in the *Echinocystis* and *Marah* genera are referred to as "wild cucumber" in North America. Most cucumber cultivars depend on bees, especially honeybees, which are frequently brought in large numbers to cucumber fields during the blooming season to ensure successful pollination and fruit formation. Other bee species, including bumblebees, can act as pollinators. Cucumber cultivars that exhibit parthenocarpy, or the ability to produce seedless fruits without pollination, are interesting. Known for being diploid, day-neutral, and thermophilic, cucumbers thrive in many parts of India. They are second only to watermelon in terms of importance as a crop in the cucurbit family. Cucumbers were also the first vegetable crop to have its DNA sequenced. Cucurbitacin, a chemical compound, is thought to be the cause of cucumbers' bitterness.

Botanically Cucumber is known as *Cucumis sativus* L. belongs to family Cucurbitaceae. It is a diploid self-pollinated species with chromosome number 2n=2x=14 [1]. According to Vavlov [2], the Indo-Burma region of Hindustan is where cucumbers first appeared. It is primarily grown in China, India, Turkey, Iran, and other south-east Asian nations. "*Cucumis hardwickii*" is the ancestor of the cucumber. 15:1 is the economic sex ratio. In 2020–21, India will produce 1608.29 million tonnes of cucumbers on an area of 94 million ha (Source: NHB, Ministry of Agriculture & Farmers Welfare, Government of India, 2021-22). In terms of area and production of cucumbers in 2021–2022, West Bengal comes in first place, followed by Madhya Pradesh and Haryana. 20.68 million tonnes of cucumbers will be produced in Jammu and Kashmir in 2021–2022. Cucumbers are used in pickles, salads, and as cooked vegetables. Ayurvedic medicine uses it in a variety of ways. According to 'Unani' medicines, the oil from its seed is God for the brain and the body. Cucumber has 96.3 g water, magnesium 11 mg, sodium 10.2 mg, Vitamin C 7 mg, 2.5g Carbohydrates, Oxalic acid 15 mg, Calcium 10 mg, Sulphur 17 mg, Potassium 50 mg and many other nutrients out of 100 g of edible portion. Choudhary, [3]. It is considered as quality dietary food due to its excellent digestibility and rich water content (96.3 g/100 g). For people who experience constipation, cucumber works as a reliable laxative. Cucumber juice is a useful food for the treatment of gastric and duodenal ulcers, as well as hyperacidity. Cucumber is a crop that does best in warm climates and cannot withstand even a slight frost. Regardless of soil type, from sandy to heavy clay, the crop thrives in a temperature range of 18°C to 24°C and a pH range of 5.5–6.7. In India, it is the only crop grown during the *Zaid* and *Kharif* seasons. It is well suited to hot and humid climates with 60 to 75 cm of annual rainfall. Cucumber, however, is not water resistant. There are several difficulties with growing cucumbers in the Prayagraj area. Firstly, the region experiences hot and dry summers, which can lead to water stress for cucumber plants, requiring efficient irrigation systems. Secondly, the high humidity during the monsoon can promote the spread of fungal diseases like powdery mildew and downy mildew, necessitating careful disease management practices. Additionally, the region is prone to pest infestations such as aphids, whiteflies, and cucumber beetles, demanding proper pest control strategies. The soil in some areas may lack essential nutrients, requiring appropriate soil amendments and fertilization to support cucumber growth. Finally, extreme weather events like hailstorms and heavy rains can damage cucumber plants and reduce yield. Addressing these challenges through proper water management, disease control, pest management, and soil improvement practices is crucial for successful cucumber cultivation in Prayagraj. Few local varieties have gained

importance in Uttar Pradesh climatic conditions. Varietal evaluation in a group of cultivars is a prerequisite for a successful breeding program. Thus, study was done to evaluate the best performing hybrid varieties compared to local variety. There are many good performing varieties which are available in the market also. According to Prayagraj agro-climatic conditions Cucumber can be grown successfully with higher yield. In view of the above-mentioned facts, the present study on the varietal evaluation of Cucumber varieties under Prayagraj agro-climatic condition.

2. MATERIALS AND METHODS

The present investigation entitled was done to understand the plant growth, fruit yield and quality of fruit of different F_1 hybrids of cucumber. The investigation was carried out at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the winter season of 2022-23. The experiment was laid in Randomized block design with 12 Hybrids and 3 replications. Hybrids comprised of G_1 (J K Manali), G_2 (Malini), G_3 (NBH-Manvi plus), G_4 (USM- Rani (01), G_5 (Nazia F_1), G_6 (KSP 1665 Power), G_7 (Shagun), G_8 (Super green) G_9 (NBH-842), G_{10} (Saraswati), G_{11} (Sheetal) and G_{12} (Prasad-100). Observations were recorded at different stages of growth for parameters like vine length, days to flower emergence, fruit length, fruit diameter and yield per vine and quality parameters like TSS and vitamin C content. The data were statistically analysed by the method suggested by Fisher and Yates, 1936. The experimental site is levelled land with sandy loam soil of uniform fertility status with low clay and high sand percentage. Soil samples were collected randomly from depth of 0-30 cm and the soil was analysed for pH found to be slight neutral (6.9), organic carbon was 0.36%, available nitrogen was 212.56 kg ha^{-1}, available phosphorus was 14.59 kg ha^{-1}, and available potassium was 225.10 kg ha^{-1}. The preparation of the experimental field involved several steps to ensure optimal conditions for cultivation. Initially, a Tractor drawn disc plough was used to plough the field. Following this primary ploughing, two cross harrowing sessions were conducted, and the field was then planked. To achieve a uniform surface, a leveller was employed to thoroughly level the field before proceeding with the experimental layout. This sequence of activities was undertaken to create an environment conducive to the study's objectives and to promote consistent and reliable results. To maintain a weed-free field, regular and shallow cultivation was performed frequently. This process aimed to eliminate weeds, enhance soil aeration, and support healthy root development. Furthermore, two to three hoeing sessions and earthing up were conducted to meticulously control weed growth and maintain the crop's weed-free status. Around FYM 40 t/ha as basal was applied to field and 35 kg of N/ha at 30 days after sowing. NPK are required for hybrid cucumber is 150:75:75 kg NPK/ha, accordingly urea, DAP, MOP was applied in field. Light irrigation was provided at critical stages of crop growth, such as just after transplanting, pre flowering, fruit formation.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The data pertaining to Vine length and number of branches per vine significantly varied among different Hybrids. Among the different Hybrids maximum Vine length (191.01 cm) was observed with NBH-842 followed KSP 1665 Power with 185.03 cm. Among the different Hybrids maximum number of branches per vine (4.60 branches) was observed with Malini followed Sheetal with 4.00 branches. The superior performance of one Hybrid over another in terms of vine length can be attributed to a combination of genetic factors and environmental conditions. Hybrids with genetic traits that promote longer vines, such as enhanced internode elongation or increased branching, can exhibit greater vine length. Environmental factors such as sunlight exposure, temperature, and soil fertility can also influence vine growth. Hybrids that are well-suited to the specific environmental conditions of a particular region or have been selectively bred for longer vine length may demonstrate better performance in terms of vine elongation. The above factors were found influential on hybrid NBH-842, thus encouraging vine length and number of branches per vine. Similar findings were reported by Haque et al., [4], Uddin et al., [5], Quamruzzaman et al., [6].

3.2 Earliness Parameters

The data pertaining to days to emergence of first male flower and female flower along with first fruit harvest significantly varied among different Hybrids. Among the different Hybrids minimum

days to first male flowering (33.47 days) was observed with NBH-842 followed Shagun with 34.74 days. Among the different Hybrids minimum days to first female flowering (40.13 days) was observed with NBH-842 followed Malini with 43.33 days. Among the different Hybrids minimum days to first fruit harvest (63.20 days) was observed with NHB-842 followed by Nazia F1 with 63.60 days. The better performance of one Hybrid over another in terms of earliness in flowering and maturing can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote early flowering, such as early maturation genes or shorter vegetative growth phases, can exhibit faster initiation of flowering. Additionally, environmental factors such as temperature, photoperiod, and nutrient availability can influence flowering and maturing time. Hybrids that are genetically predisposed to respond more favourably to the prevailing environmental conditions, or those that have been selectively bred for early flowering, may show superior performance in terms of early initiation of flowering and maturing. The above factors were found influential on hybrid NBH-842, thus encouraging earliness in flowering and thus in turn harvesting. Moreover, Environment has also favoured in regulation and expression of gene responsible for early flowering and maturing. The findings were reported similarly earlier by Ara et al., [7], Ramya et al., [8].

3.3 Yield Parameters

Among the different Hybrids maximum number of fruits per vine (7.87 fruits) was observed with super green followed by KSP 1665 Power with 7.80 fruits. Among the different Hybrids maximum fruit length (14.48 cm) was observed with NBH-Manvi plus followed by Super green with 14.10 cm. Among the different Hybrids maximum fruit diameter (3.44 cm) was observed with NBH-Manvi plus followed by Super green with 3.29 cm. Among the different Hybrids maximum average fruit weight (166.85 g) was observed with NBH-842 followed by Nazia F_1 with 160.85 gram. The better performance of one Hybrid over another in terms of enhanced number of fruits per plant, fruit length and girth, fruit weight can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote increased

Table 1. Performance of different hybrids of cucumber for various growth and earliness parameters studied

Hybrid Notation	Hybrid details	Vine length (cm)	No of branches per vine	Days to first male flowering	Days to first female flowering	Days to first fruit harvest	Number of fruits per vine
G_1	J K Manali	117.73	3.60	3.60	3.60	3.60	6.33
G_2	Malini	153.12	4.60	4.60	4.60	4.60	6.27
G_3	NBH-Manvi plus	159.21	3.73	3.73	3.73	3.73	7.00
G_4	USM- Rani (01)	142.79	3.80	3.80	3.80	3.80	7.20
G_5	Nazia F_1	151.97	3.73	3.73	3.73	3.73	6.20
G_6	KSP 1665 Power	185.03	3.60	3.60	3.60	3.60	7.80
G_7	Shagun	167.62	3.40	3.40	3.40	3.40	6.60
G_8	Super green	171.19	3.67	3.67	3.67	3.67	7.87
G_9	NBH-842	191.01	3.80	3.80	3.80	3.80	7.27
G_{10}	Saraswati	136.00	3.80	3.80	3.80	3.80	6.60
G_{11}	Sheetal	157.93	4.00	4.00	4.00	4.00	6.87
G_{12}	Prasad-100	150.14	3.67	40.47	46.05	65.87	6.27
'F' Test		S	S	S	S	S	S
SE (d)		5.39	0.25	0.95	1.08	0.91	0.16
C.D. at 5%		15.10	1.69	2.80	3.19	2.70	0.46
C. V.		5.95	11.56	4.27	3.98	2.40	3.92

Table 2. Performance of different hybrids of cucumber for various yield and quality parameters studied

Hybrid Notation	Hybrid details	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (g)	Fruit yield per vine (kg/vine)	TSS [°Brix]	Vitamin C content (mg/100g)
G_1	J K Manali	2.71	13.52	137.24	0.81	4.40	4.79
G_2	Malini	3.06	14.43	151.54	0.85	4.61	4.20
G_3	NBH-Manvi plus	3.44	14.48	150.59	0.92	5.11	4.14
G_4	USM- Rani (01)	3.29	13.84	159.46	1.15	5.79	5.12
G_5	Nazia F_1	3.03	13.21	160.85	1.13	5.35	5.19
G_6	KSP 1665 Power	2.87	12.35	151.93	1.06	5.06	4.64
G_7	Shagun	2.89	13.83	151.94	0.89	5.21	4.03
G_8	Super green	3.29	14.10	159.91	1.34	5.21	5.18
G_9	NBH-842	2.99	13.72	166.85	1.40	5.16	4.57
G_{10}	Saraswati	2.58	13.42	152.69	1.08	5.75	4.65
G_{11}	Sheetal	2.51	13.51	153.94	0.99	5.23	4.88
G_{12}	Prasad-100	2.55	12.70	157.26	1.15	5.19	5.19
'F' Test		S	S	S	S	S	S
SE (d)		6.08	0.39	1.37	0.12	0.27	0.21
C.D. at 5%		2.10	1.51	4.30	0.34	0.79	0.61
C. V.		22.41	5.96	1.53	18.81	8.86	7.54

fruit set, such as higher flower-to-fruit conversion rates or enhanced reproductive capacity, can result in a greater number of fruits per plant. Additionally, environmental factors such as pollination efficiency, availability of nutrients and water, and optimal growing conditions can influence fruit production. Hybrids with genetic traits that promote larger fruit size, such as genes associated with increased cell division, fruit development, or enhanced nutrient uptake, can result in heavier fruits. Additionally, environmental factors such as optimal temperature, sunlight exposure, and nutrient availability can play a significant role in determining fruit weight. Hybrids that are genetically predisposed or have been selectively bred for higher fruit weight may demonstrate superior performance in terms of producing heavier fruits. The above factors were found influential on hybrid NBH-842. The findings were in accordance with earlier reports of Haque et al., [4] Ramya et al., [8].

Among the different Hybrids maximum average fruit yield per vine (1.40 kg/vine) was observed with NBH-842 followed by Super green with 1.34 kg/vine. The better performance of one Hybrid over another in terms of enhanced fruit yield can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote higher flower-to-fruit conversion rates, increased branching, or enhanced reproductive capacity can result in a greater yield of fruits. Additionally, environmental factors such as pollination efficiency, availability of nutrients and water, and optimal growing conditions can significantly influence fruit production. Hybrids that are genetically predisposed or have been selectively bred for higher fruit yield can demonstrate superior performance in terms of overall fruit production per plant. The findings were in accordance with earlier reports of Ramya et al., [8].

Among the different Hybrids maximum Total Soluble Solid (5.19 °Brix) was observed with prasad-100 followed by Saraswati with 5.75 °Brix. Among the different Hybrids maximum Vitamin C content (5.19 mg/100g) was observed with Prasad-100 at par with Super green with 5.18 mg/100g [9,10]. The better performance of one Hybrid over another in terms of better Total Soluble Solids (TSS) and vitamin C content can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote higher sugar accumulation and improved fruit quality can result in increased TSS and vitamin C content. Additionally, environmental factors such as sunlight exposure, temperature, and nutrient availability can

influence the synthesis and accumulation of sugars in fruits. Hybrids that are genetically predisposed or have been selectively bred for higher TSS and vitamin C content may demonstrate superior performance in terms of producing fruits with a better sugar concentration and overall quality. The above factors were found influential on hybrid NBH-842. The findings were in accordance with earlier reports of Haque et al., [4] in snake gourd; Uddin et al., [5], Ara et al., [7], Ramya et al., [8].

4. CONCLUSIONS

From the above experimental finding it was be concluded that the Hybrid NBH-842 performed best in terms of growth parameters like vine length, earliness in flowering and maturity and variety NBH-842 yield parameters like fruit weight and fruit yield per vine while NBH-Manvi plus for fruit length, fruit diameter, and fruit yield per vine. Hybrid Prasad-100 showed best performance for quality parameters also TSS and Vitamin C content.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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