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Performance of Different F_1 Hybrids of Cucumber (*Cucumis sativus* L.) on Growth, Yield and Quality

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Authors' contributions

This work was carried out in collaboration between both authors. Both 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 *Kharif* season 2022-2023 with a view to check performance of different Hybrids of cucumber under Prayagraj agro climatic conditions and to estimate economics of different hybrids of cucumber. Hybrids comprised of V_1 (J K Manali), V_2 (Malini), V_3 (NBH-Manvi plus), V_4 (USM- Rani (01), V_5 (Nazia F1), V_6 (KSP 1665 Power), V_7 (Shagun), V_8 (Super green) and V_9 (NBH-842). Among different hybrids of cucumber hybrid super green performed best in terms of growth parameters like vine length, number of branches, flowering parameters like earliness in flowering and maturity, male female ratio and yield parameters like fruit length, fruit diameter, and fruit yield per vine. The hybrid super green also had high TSS and Vitamin C content. Maximum BC ratio was obtained in hybrid super green with value of 2.96.

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Keywords: T.S.S.; cucumber; hybrids; BC ratio.

1. INTRODUCTION

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]. Cucumber probably originated from Indo-Burma region of Hindustan centre [2]. It is mainly cultivated in China, India, Turkey, Iran, and other parts of south-east Asia. Progenitor of cucumber is "*Cucumis hardwickii".* Economic sex ratio is 15:1. The area under Cucumber production in India accounts to 94 million ha with production of 1608.29 million tonnes in year 2020-21 (*Source: NHB,* Ministry of Agriculture & Farmers Welfare, Government of India) [3]. West Bengal ranks first in area and production of Cucumber in year 2021-22 followed by Madhya Pradesh and Haryana. The production of Cucumber in Jammu & Kashmir is 20.68 million tonnes for year 2021-22.

The cucumber is used as salad, pickles, and as cooked vegetable. It has many uses in ayurvedic medicines. 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 [4].

It is considered as quality dietary food due to its excellent digestibility and rich water content (96.3 g/100 g). Cucumber is a dependable laxative for those who suffer constipation. The juice of cucumber is a valuable food in the treatment of hyper acidity, gastric and duodenal ulcers. Cucumber is well adapted crop for warm season crop, and it does not withstand even light frost. The crop performs well in temperature range between 18°C- 24°C and soil having pH ranging between 5.5-6.7 irrespective of its kind from sandy to heavy clay soil. It is grown as sole crop in India in *Zaid* and *Kharif* season. It is well suited to hot and warm climate with annual rainfall of 60-75 cm. However, cucumber cannot withstand water lodging [5].

Germplasm, the core material for a breeder's crop enhancement efforts, embodies genetic diversity in both quantitative and qualitative traits. A clear grasp of cowpea germplasm classification regarding these traits aids breeders in crop selection and enhancement. Yield, a multifaceted trait, relies on various quantitatively inherited components [6]. Thus, before commencing any breeding initiative, understanding the extent and nature of genetic variability, as well as the relationship between yield and its components, is crucial. Preliminary genotype evaluation to gauge existing variability is vital, along with recognizing environmental influences on plant traits. This information is pivotal for assessing potential improvements in crop yield.

Growing cucumbers in the Prayagraj region poses several challenges. 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 *Rabi* season of 2022-23. The experiment was laid in Randomized block design with 9 Hybrids and 3 replications. Hybrids comprised of V_1 (J K Manali), V_2 (Malini), V_3 (NBH-Manvi plus), V_4 (USM- Rani (01), V_5 (Nazia F1), V_6 (KSP 1665 Power), V_7 (Shagun), V_8 (Super green) and V_9 (NBH-842). 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. TSS was calculated using refractometer. Vitamin C content was taken out by titration method suggested by Rangana, [7]. The data were statistically analysed by the method suggested by Fisher and Yates, [8].

3. RESULTS AND DISCUSSION

3.1 Vine Length (m) and Number of Branches Per Vine

The data pertaining to Vine length and number of branches per vine significantly varied among different Hybrids (Table 1). Among the different Hybrids maximum Vine length (190.75 cm) was observed in with NBH-832 followed KSP 1665 Power with 184.30 cm. Minimum Vine length (122.35 cm) was observed in J K Manali. Among the different Hybrids maximum Number of branches per vine (3.93 branches) was observed in with Malini followed Super green with 3.40 branches. Minimum Number of branches per vine (2.73 branches) was observed in J K Manali. 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. Similar findings were reported by Haque et al. [9], Uddin et al. [10]; Quamruzzaman et al. [11].

3.2 Days to First Male and Female Flowering and Days to First Fruit Harvest

The data (Table 1) 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 (31.47 days) was observed in with Nazia F1 followed Super green with 33.00 days. Maximum days to first male flowering (44.47 days) was observed in USM-Rani (01). Among the different Hybrids minimum days to first female flowering (41.00 days) was observed in with Nazia F1 followed Super green with 42.93 days. Maximum days to first female flowering (56.07 days) was observed in USM-Rani (01). Among the different Hybrids minimum days to first fruit harvest (61.53 days) was observed in with NHB-842 and J K Manali followed Super green with 61.73 days. Maximum days to first fruit harvest (68.60 days) was observed in USM-Rani (01). 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 findings were reported similarly earlier by Ara et al. [12], Ramya et al. [13].

3.3 Number Fruits Per Plant, Fruit Length, Fruit Diameter and Fruit Weight

Table 2 depicts the data pertaining to number of fruits per plant, fruit length, diameter and fruit weight. Among the different Hybrids maximum number of fruits per plant (6.87 fruits) was observed in with super green followed KSP 1665 Power with 6.80 fruits. Minimum Number of fruits per plant (5.20 fruits) was observed in Nazia F1. Among the different Hybrids maximum fruit length (13.59 cm) was observed in with Super green followed Malini with 13.57 cm. Minimum fruit length (11.07 cm) was observed in KSP 1665 Power. Among the different Hybrids

maximum fruit diameter (3.28 cm) was observed in with NBH-Manvi plus followed Super green with 2.95 cm. Minimum fruit diameter (2.41 cm) was observed in Nazia F1. Among the different Hybrids maximum average fruit weight (165.90 g) was observed in with NBH-842 followed Super green with 161.73 g. Minimum average fruit weight (132.50 g) was observed in J K Manali. The better performance of one Hybrid over another in terms of enhanced number of fruits

Table 1. Performance of different Hybrids of cucumber in terms of growth and flowering parameters

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
V_1	J K Manali	122.35	2.73	36.47	45.87	61.53
V_2	Malini	148.35	3.93	35.00	44.87	62.73
V_3	NBH-Manvi plus	156.05	2.80	40.93	52.93	64.13
V_4	USM- Rani (01)	133.92	3.27	44.47	56.07	68.60
V_5	Nazia F1	160.75	3.33	31.47	41.00	58.00
V_6	KSP 1665 Power	184.30	2.80	40.67	53.47	66.40
V_7	Shagun	157.36	2.93	34.20	47.53	65.27
V_8	Super green	172.79	3.40	33.00	42.93	61.73
V_9	NBH-842	190.75	3.13	33.80	44.60	61.53
‘F’ Test		S	S	S	S	S
SE (d)		0.41	0.17	0.14	0.21	0.30
C.D. at 5%		1.23	0.51	0.41	0.63	0.92
C. V.		0.44	9.19	0.64	0.76	0.83

Table 2. Performance of different Hybrids of cucumber in terms of yield and quality parameters

Hybrid Notation	Hybrid details	Number of fruits per vine	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield per vine (kg/vine)	TSS [°Brix]	Vitamin C content (mg/100g)
V_1	J K Manali	5.33	12.16	2.93	132.50	0.71	4.45	4.38
V_2	Malini	5.27	13.57	2.65	146.14	0.77	4.07	3.93
V_3	NBH-Manvi plus	6.00	12.64	3.28	147.12	0.88	5.57	4.42
V_4	USM-Rani (01)	6.20	11.16	2.74	153.52	0.96	5.42	4.99
V_5	Nazia F1	5.20	12.10	2.41	161.82	0.84	5.41	5.65
V_6	KSP 1665 Power	6.80	11.07	2.82	146.89	1.00	5.67	4.53
V_7	Shagun	5.60	12.50	2.62	147.73	0.83	5.30	4.13
V_8	Super green	6.87	13.59	2.95	161.73	1.11	5.08	5.12
V_9	NBH-842	6.27	12.55	2.65	165.90	1.04	4.76	4.48
‘F’ Test		S	S	S	S	S	S	S
SE (d)		0.09	0.14	0.06	1.32	0.02	0.05	0.03
C.D. at 5%		0.26	0.43	0.19	3.98	0.05	0.14	0.19
C. V.		2.46	1.97	3.84	1.50	3.30	1.62	1.74

per plant, fruit length and girth, fruit weight can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote increased 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 findings were in accordance with earlier reports of Haque et al. [9]; Ramya et al. [13].

3.4 Fruit Yield Per Vine (Kg/vine)

Among the different Hybrids maximum average fruit yield per vine (1.11 kg/vine) was observed in with Super green followed NBH-842 with 1.04 kg/vine. Minimum average fruit yield per vine (0.71 kg/vine) was observed in J K Manali (Table 2) 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. [13].

Table 3. Cost of cultivation of cucumber

Sr	Particular	Unit	Quantity	Rate/Unit	Cost (Rs/ha)
A.	Land Preparations	Hrs.	5	900	4,500
1	Ploughing	Hrs.	4	800	3,200
2	levelling with cultivars	Labour	10	300	3,000
B.	Fertilizers, manures, and seed				
1	Cost of seed	kg	1.5	3500	5,250
2	Farmyard Manure	Tonnes	25	800	2,0000
3	Urea	kg	458	6.5	2,977
4	DAP	kg	217	24.4	5,294.8
5	MOP	kg	166	18.5	3,071
6	Labour for Seed Sowing	Mandays	10	300	3,000
7	Labour for fertilizer application	Mandays	15	300	4,500
8	Gap filling	Mandays	10	200	2,000
C.	Intercultural Operations				
1	Weeding and Hoeing	Mandays	15	300	4,500
2	Insecticides and Pesticides		8	800	6,400
3	Neem Oil		4	400	1,600
4	Spraying of Chemicals 6 times	Mandays	15	300	4,500
D.	Irrigation				
1	Irrigation	Labour	24	300	7,200
2	Tuber well Charges	Irrigation	8	500	4,000
F.	Harvesting				
1	Mandays	Labour	30	300	9,000
2	Transportation		L.S		8,000
3	Rental value of land	Months	3	2000	6,000
4	Supervision charges	Days	90	150	13,500
			Total Cost of Cultivation		1,21,493

Table 4. Economics of different hybrids of cucumber

Hybrids		Fruit yield t/ha	Cost of Cultivation (INR/ha)	Gross Return (INR/ha)	Net Return (INR/ha)	Benefit Cost Ratio
V_1	J K Manali	9.15	1,21,493	2,28,822	1,07,329	1.88
V_2	Malini	10.00	1,21,493	2,49,991	1,28,498	2.06
V_3	NBH-Manvi plus	11.44	1,21,493	2,85,919	1,64,426	2.35
V_4	USM- Rani (01)	12.38	1,21,493	3,09,402	1,87,909	2.55
V_5	Nazia F1	10.91	1,21,493	2,72,686	1,51,193	2.24
V_6	KSP 1665 Power	12.94	1,21,493	3,23,455	2,01,962	2.66
V_7	Shagun	10.73	1,21,493	2,68,188	1,46,695	2.21
V_8	Super green	14.40	1,21,493	3,60,038	2,38,545	2.96
V_9	NBH-842	13.49	1,21,493	3,37,221	2,15,728	2.78

3.5 T.S.S. [°Brix] and Vitamin C Content (mg/100g)

Among the different Hybrids maximum Total Soluble Solid (5.67 °Brix) was observed in with KSP 1665 Power followed NBH-Manvi plus with 5.57 °Brix. Minimum Total Soluble Solid (4.07 °Brix) was observed in Malini. Among the different Hybrids maximum Vitamin C content (5.65 mg/100g) was observed in with Nazia F1 followed Super green with 5.12 mg/100g. Minimum Vitamin C content (3.93 mg/100g) was observed in Malini (Table 2). 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 findings were in accordance with earlier reports of Haque et al. [9] in snake gourd; Uddin et al. [1]; Ara et al. [12]; Ramya et al. [13].

3.6 Economics of Different Hybrid of Cucumber

Maximum gross returns were recorded in hybrid super green with Rs. 3,60,038 followed by NBH-842 with Rs.3,37,221 and the minimum Rs. 2,28,822 was recorded in hybrid J K Manali. Maximum net returns were recorded in hybrid super green with Rs. 2,38,545 followed by NBH-842 with Rs.2,15,728 and the minimum Rs. 1,07,329 was recorded in hybrid J K Manali. Maximum BC ratio were recorded in hybrid super green with 2.96 followed by NBH-842 with 2.78 and the minimum 1.88 was recorded in hybrid J K Manali depicted in Table 4 [14].

4. CONCLUSION

From the above experimental finding it is concluded that the Hybrid super green performed best in terms of growth parameters like vine length, earliness in flowering and maturity and yield parameters like fruit length, fruit diameter, and fruit yield per vine. It showed best performance for quality parameters also TSS and Vitamin C content. Maximum BC ratio was obtained in hybrid super green with value of 2.96.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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