



# **Performance of Different Hybrids of Chilli (*Capsicum annuum* L) under Prayagraj Agro-Climatic Condition**

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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 experiment was conducted on Performance of hybrids of chilli with eight hybrids during 2023-2024 at the Vegetable Research Field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The observations were taken and recorded on various growth, yield and quality contributing parameters. The results from the present investigation revealed that based on the mean performance of eight hybrids of Chilli, hybrids 21CHIHBY-3 and 21CHIHBY-7 were found superior in terms of Fruit yield (q/ha). 21CHIHBY-1 was found to be best in terms of growth parameters (plant height, number of branches). However, on the basis of earliness parameters (flowering), hybrid 21CHIHBY-2 performed best. On the basis of Ascorbic

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Acid in Fruits, 21CHIHBY-1 is the best and the Total soluble solids was found best in 21CHIHBY-7. The highest gross return was found in the 21CHIHBY-3 and the B:C ratio was found in the same with 3.3. The experiment was laid out in Randomized Block Design with 3 replications and 8 varieties of Chilli.

**Keywords:** Chilli; hybrids; variability; quantitative; qualitative; economics.

## 1. INTRODUCTION

Chilli, scientifically known as *Capsicum annum* L., holds significant economic importance in India as one of its primary commercial crops. It falls within the *Capsicum* genus of the Solanaceae family. Renowned for its distinctive pungency, flavor, and vibrant color, chilli stands as an indispensable spice in global trade, ranking second only to black pepper (*Piper nigrum* L.). Within India, it plays a pivotal role in daily cuisine and finds extensive use in the preparation of various condiments such as pickles and chutneys. The characteristic pungency of chilli is attributed to capsaicin, a volatile alkaloid found predominantly in the fruit's placenta and pericarp. Capsaicin possesses diverse therapeutic and prophylactic properties valued both in allopathic and Ayurvedic medicine. India emerges as the leading producer, consumer, and exporter of chilli, boasting an annual production of 2.09 million tonnes from 0.84 million hectares. Notably, Andhra Pradesh, Telangana, Karnataka, Maharashtra, Orissa, and Tamil Nadu collectively contribute over 75% of the nation's chilli cultivation. Variability in chilli genotypes regarding flowering patterns, fruit set, and yield under different agro-climatic conditions underscores the need for comprehensive studies. Thus, this research aims to evaluate the growth, flowering behavior, and physical fruit attributes of diverse chilli genotypes in the region of Prayagraj.

## 2. MATERIALS AND METHODS

The experiment was conducted in the Experimental Research field of Department of Horticulture, Naini Agricultural institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, during the year 2023. The experimental site is located in Naini in the southern part of Prayagraj at a distance of about 6km from Prayagraj City. It is situated at 25.08°N Latitude and 81.05°E meters from sea level. Prayagraj has a sub-tropical climatic having peak temperatures during summer (in the month of May and June) with temperature reaching around 46°C with hot

blazing winds and in winter (December and January) the temperature may fall as low as 2-3°C. The average rainfall is around 1013.4 (mm) annually with maximum concentration during the months of July to September with rare showers during winters. The experiment was carried out with the help of 8 varieties of chilli and all the essential intercultural operations were carried out according to the needs of the crop. The aim of the experiment was to find out the best performing variety from the 8 varieties in terms of growth, yield and quality. The experiment was laid out according to a Randomized Block Design (RBD) with 8 varieties of chilli with 3 replications each.

## 3. RESULTS AND DISCUSSION

In the experiment, research was conducted to study the performance of chilli (*Capsicum annum*) under Prayagraj agro-climatic condition. The morphological growth parameters are as follows, days taken to germination, number of branches per plant, plant height (cm), days to 1st flowering, days to 50% flowering, and yield parameters were length of fruits(cm),fruits diameter(cm),number of fruits per plant, average weight of fruits(g), average weight of 10 fruits(g),fruits yield per plant(kg), fruits yield per plot(kg),fruits yield (t/ha), and quality parameters are ascorbic acid(mg/100g) of fruits juice, TSS and economics.

### 3.1 Growth Parameters

The ANOVA (Analysis of Variance) carried out for this experiment showed significant differences among the genotypes for all the 8 varieties studied indicating the presence of variability for various growth parameters. The seed germination and seedling growth parameters showed different variation in their performance with respect to the different hybrids taken. These results are in conformity with earlier reports of Nimnoi et al. [1].

The data recorded on days taken to germination are shown in Table 1. From the data it was observed that days taken to germination differ

significantly in chilli genotypes ranging from 7 to 11 days. The maximum number of days was recorded in chilli hybrids 21CHIHBY-8 (11) followed by 21CHIHBY-4(8.67). The minimum was recorded in chilli hybrid 21CHIHBY-2 (7). According to the findings of Chaudhary et al. [2] Arshia Debbarma et al., Veerendra et al. [3], Ch. Inao Khaba et al. D. Balasankaret et al. variations in the days taken to germination may be due to characteristic of genotypes, their interaction with environment and soil factors.

The number of branches produced per plant at 90 days after transplanting in all the varieties are presented in Table 1. From the table it was observed that the number of branches produced per plant varied significantly in chilli genotypes after 90 days. The maximum number of branches was recorded in chilli hybrids 21CHIHBY-3 (18.20) followed by 21CHIHBY-1 (17.80) and minimum number of branches per plant was recorded in chilli hybrid 21CHIHBY-5(12.00). The function of a plant's growing tips or primary meristems includes lengthening through cell division and elongation organizing the development of leaves along the stem. Similar findings were reported by Versha et al. Mopidevi et al. [4], Prasad et al. (2019) in Chilli. Therefore, variations in the number of branches per plant may be due to genotypic characteristics of genotypes, their interaction with environment and soil factors.

The plant height at 90 days after transplanting in all the varieties are presented in Table 1. The maximum plant height was recorded in chilli

hybrids 21CHIHBY-1 (57.73) followed by 21CHIHBY-7 (56.13) and minimum plant height was recorded in chilli hybrid 21CHIHBY-5(48.20). The variations in the results may be due to genetics characters, local conditions or nutrient utilization and are in agreement with the finding of Saravaiya et al. and Patil et al.

The number of days to first flower initiation of the chilli hybrids are shown in table 1. Significantly the minimum days to 1<sup>st</sup> flowering emergence was recorded in the hybrids 21CHIHBY2(34.67) and maximum days to first flower initiation (39.00) were reported in the hybrid 21CHIHBY5. The Days of first flower initiation play an important role in deciding the earliness or lateness of crop in general. The variation in the first flower emergence might have been due to intermodal length, number of inter nodal and vigour of the crop. The results are in conformity with the findings of Manju and Sreelathakumary and Amit et al. [5].

The number of days to 50% flower initiation of the chilli hybrids are shown in Table 1. The minimum days of 50% flowering emergence was recorded in the hybrids 21CHIHBY-2(43.33) maximum days to 50% flowering (49.33) reported in the hybrid 21CHIHBY-3. The variation in the days to 50% flowering may be due to the high genetic makeup of genotypes. The variation in the days of 50% flowering emergence might also have been due to internodal length, number of internodal and vigour of the crop. Similar results were also observed by Shiva et al., Chattopadhyay [6], Devi et al. [7].

**Table 1. Growth parameters of different chilli hybrids**

Hybrids	No. of days to germination	No. of branches	Plant height(cm)	No. of days to 1 <sup>st</sup> flower initiation	No. of days to 50% flowering	Length of fruits(cm)	Diameter of fruits (mm)
21CHIHBY-1	8.00	17.80	57.73	35.67	43.67	10.70	4.27
21CHIHBY-2	7.00	14.13	51.67	34.67	43.33	9.97	3.83
21CHIHBY-3	7.67	18.20	52.67	36.33	49.33	11.17	4.70
21CHIHBY-4	8.67	15.53	55.53	34.67	44.67	10.20	3.37
21CHIHBY-5	8.33	12.00	48.20	39.00	47.33	7.10	3.10
21CHIHBY-6	8.33	15.73	58.00	35.67	46.00	10.27	3.77
21CHIHBY-7	7.67	16.53	56.13	38.00	43.67	10.07	4.50
21CHIHBY-8	11.00	14.33	50.73	35.67	43.67	10.47	4.13
<b>F test</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
S.E(d)	0.76	0.39	1.16	0.61	0.63	0.22	0.16
C.D (5%)	1.64	0.83	2.48	2.76	1.91	0.48	0.37
C.V.	11.22	3.04	2.63	2.08	2.41	2.76	4.9

The length and diameters of fruits of different chilli hybrids are shown in Table 1. The maximum fruit length (11.17) reported in the hybrid 21CHIHBY-3 and the minimum fruits length were recorded in the hybrid 21CHIHBY-5(7.10). The maximum fruits diameter (4.70) was reported in the hybrid 21CHIHBY-3 and the minimum fruits diameter was recorded in the hybrid 21CHIHBY-5(3.10). The length of fruits is one of the major factors for deciding the yield of the crop. The variation in fruits length might have been due to the internodal length, sex ratio, fruit set percentage, genetic nature and their response to varying environment condition and higher uptake nutrient. Similar results have been found in Rupali and Rajesh, Yatagiri et al., in chilli. Hybrid vigour and adaptability to Allahabad agro-climatic condition may contribute to the variations in fruit diameter. Similar findings have been reported by Ridwan and Dean, Kiran et al., Pallerla et al., Sushmita et al.,[8], Yatung et al., [9] in chilli.

### 3.2 Yield and Quality Parameters

The number of fruits per plant of different chilli hybrids are shown in Table 2. The maximum number of fruits per plant (86.83) was reported in the hybrid 21CHIHBY-8 and the minimum number of fruits per plant was recorded in the hybrids 21CHIHBY-5(71.80). The results are in conformity with finding of Ratna et al., (2018), Kiran et al., Sarita et al. [10] and Vani et al. [11] in chilli. The inherent characters and genetic makeup of the hybrids, higher uptake of nutrient and environmental conditions play a huge role in inducing variations among the hybrids the maximum average fruit weight (9.70) was

reported in the hybrid 21CHIHBY3 and the minimum average fruit weight (3.60) was reported in hybrid 21CHIHBY5.

The Average weight of fruit of different chilli hybrids is shown in Table 2. The maximum average fruit weight (9.70) was reported in the hybrid 21CHIHBY-3, and the minimum average fruit weight (3.60) was reported in hybrid 21CHIHBY-5. Fruit set percentage, fruit length, number of fruits per vine and fruits width, genetic nature, environmental factors and vigour of the crops and higher uptake of nutrient may contribute to the variations in the average fruit weight. The results are in conformity with the findings of Sarita et al. in chilli.

The fruit yield per plant of different chilli hybrids is shown in Table 2. The maximum fruit yield per plant (781.82) reported in the hybrid 21CHIHBY-3 and the minimum fruit yield per plant was recorded in the hybrid 21CHIHBY-5(258.48). Increasing of number of fruits per plant is mostly influenced by genetic factor, environmental factor, hormonal factor vigour of the crop the fruit plant is one of the major factors for deciding the yield of the crop. The variation in fruit yield per plant may be due to sex ratio and fruit set percentage. The results are in agreement with the finding of Ridwan, Kiran et al., Pallerlan et al., and Mathew et al. [12] in chilli.

The Average weight of 10 fruits of different chilli hybrids is shown in Table 2. The maximum average fruit weight (100.36) of 10 fruits were reported in the hybrid 21CHIHBY-3 and the minimum average fruit weight (36.30) of 10 fruits was reported in hybrid 21CHIHBY-5.

**Table 2. Yield parameters of different chilli hybrids**

Hybrids	Total no. of fruits/plant	Avg fruit weight(g)	Fruit yield/plant(g)	Avg. wt. of 10 fruits (g)	Fruit yield/plot (kg)	Fruit yield (tonne/heactare)
21CHIHBY-1	78.47	7.47	580.80	74.70	21.70	20.33
21CHIHBY-2	75.07	8.10	608.04	86.31	24.50	22.17
21CHIHBY-3	81.07	9.70	781.82	100.36	30.50	26.63
21CHIHBY-4	77.33	6.73	518.13	63.89	20.69	19.13
21CHIHBY-5	71.80	3.60	258.48	36.30	8.77	9.30
21CHIHBY-6	73.20	6.67	483.12	65.60	18.43	17.73
21CHIHBY-7	82.47	8.93	733.95	90.95	28.60	24.67
21CHIHBY-8	86.83	7.43	642.57	70.98	24.58	19.87
<b>F test</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>
S.E(d)	0.42	0.22	3.11	1.9	0.5	1.09
C.D (5%)	0.89	0.47	6.68	4.08	1.07	2.34
C.V.	0.65	3.64	0.66	3.16	2.76	6.7

The fruit yield per plot of different chilli hybrids is shown in Table 2. The maximum fruit yield/plot (30.50) reported in the hybrid 21CHIHBY-3 and the minimum fruit yield/plot was recorded in the hybrid 21CHIHBY-5(8.77).

The fruit yield (tonne/hectare) of different chilli hybrids are shown in Table 2. The maximum fruit yield t/ha (26.63) reported in the hybrid 21CHIHBY-3 and the minimum fruit yield t/ha was recorded in the hybrid 21CHIHBY-5(9.30). The higher yield plant is due to the crop's inherent characteristics, better adaptability for the environmental conditions and efficiently all available factors viz. water, nutrient, light and CO<sub>2</sub> influences the yield of the plant. The result are in agreement with the finding of Chakrabarty and Aminul, Dahan et al., (2018), Mopidevi et al. [4] and Yatagiri et al. [13] in Chilli.

The ascorbic content (mg/100g) and Total soluble Solids content (brix) is shown in Table 3. The maximum ascorbic acid (105.27) reported in the hybrid 21CHIHBY-1 and the minimum ascorbic acid (mg/100g) was recorded in the hybrid 21CHIHBY-8(83.98). The maximum total soluble solid (7.14) were reported in the hybrid

21CHIHBY8 and the minimum total soluble solid was recorded in the hybrids 21CHIHBY7(5.11). Mudasir and Anju observed a significant increase in TSS irrespective of treatment and reported that the increase in TSS could be due to the conversion of starch and other insoluble carbohydrates into sugars which was similar to the result obtained. The results are in agreement with the findings of Yogesh et al. [14].

The fruit colour and pungency of various varieties of chilli was recorded at different pickings and represented in Table 3. The colour of fruit was judged with the help of visual outer colour of the fruit and the pungency was judged on the basis of taste and smell after breaking the fruit [15].

### 3.3 Economics of Different Chilli Hybrid Genotypes

The economics of the chilli hybrids, which is the money earned and used in the cultivation of chilli hybrids was calculated by including the cost of all agronomical practices, protection measures, land etc including labour and farm machinery. The total cost of cultivation is 117950 INR. The total yield of a particular hybrid is multiplied by marked

**Table 3. Quality parameters of different chilli hybrids**

Hybrids	Ascorbic acid (mg/100g)	T.S.S. [°Brix]	Fruit colour	Pungency
21CHIHBY-1	105.27	6.14	Dark green	High Pungency
21CHIHBY-2	95.93	6.48	Light green	Mild Pungency
21CHIHBY-3	97.55	6.24	Light green	Less Pungency
21CHIHBY-4	94.40	6.78	Dark green	Medium Pungency
21CHIHBY-5	88.10	6.37	Dark green	High Pungency
21CHIHBY-6	86.05	6.48	Dark green	High Pungency
21CHIHBY-7	95.89	5.11	Light green	Mild Pungency
21CHIHBY-8	83.98	7.14	Light green	Very less Pungency
F test	S	S		
S.E(d)	2.31	0.5		
C.D (5%)	4.96	1.07		
C.V.	3.03	9.66		

**Table 4. Benefit Cost ratio of different Chilli hybrids**

Hybrids	Fruit yield (t/ha)	Selling Rate (Rs/kg)	Gross return (rs/ha)	Cost of Cultivation (rs/ha)	Net return (rs/ha)	Benefit cost Ratio
21CHIHBY1	20.33	15	304950	117950	187000	2.6
21CHIHBY2	22.17	15	332550	117950	214600	2.8
21CHIHBY3	26.63	15	399450	117950	221500	<b>3.3</b>
21CHIHBY4	19.13	15	286950	117950	169000	2.4
21CHIHBY5	9.30	15	139500	117950	21550	1.1
21CHIHBY6	17.73	15	265950	117950	148000	2.2
21CHIHBY7	24.67	15	370050	117950	252100	3.1
21CHIHBY8	19.87	15	298050	117950	180100	2.5

price of chilli at a time to get the gross income [16,17]. The total cost of cultivation is subtracted from total income, all the middleman margin and market charge were subtracted from total income for determining the net return.

The highest gross return per hectare was achieved by 21CHIHBY-3, totalling 399,450 INR, closely followed by 21CHIHBY-7 with 370,050 INR, while the lowest gross return per hectare was recorded for 21CHIHBY-5 at 139,500 INR. Similarly, the maximum net return per hectare was observed for 21CHIHBY-3 at 281,500 INR, followed by 21CHIHBY-7 at 252,100 INR, whereas the minimum net return per hectare was registered for 21CHIHBY-5, amounting to 21,550 INR. Among the different chilli hybrids 21CHIHBY-3 has the highest cost benefit ratio of 3.3 followed by 21CHIHBY-7 i.e., 3.1 and the minimum cost benefit ratio was obtained in 21CHIHBY-5 i.e., 1.1.

#### 4. CONCLUSION

From the above experimental findings, it has been concluded that 21CHIHBY-1 was found to be best in terms of growth parameters (plant height, number of branches). However, based on earliness parameters (flowering), hybrid 21CHIHBY-2 performed best. On the basis of Yield Parameters, 21CHIHBY-3 was found to be the best, on the basis of Ascorbic Acid in Fruits, 21CHIHBY1 is the best and the Total soluble solids was found best in 21CHIHBY-7.

The highest gross return was found in the 21CHIHBY-3 and the B:C ratio was found in the same with 3.3.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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