International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(7): 956-959
www.biochemjournal.com
Received: 22-04-2024
Accepted: 30-05-2024

Shubham Patel
M.Sc. Scholar, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Anil Kumar
Assistant Professor, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Trisha Das
M.Sc. Scholar, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Lokesh Yadav
Ph.D. Scholar, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Vipin
Ph.D. Scholar, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Virendra Kumar
Ph.D. Scholar, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Anil Kumar
Assistant Professor, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Mean performance of yield and its attributing characters in germplasm of chilli (*Capsicum annuum* L.)

Shubham Patel, Anil Kumar, Trisha Das, Lokesh Yadav, Vipin and Virendra Kumar

DOI: https://doi.org/10.33545/26174693.2024.v8.i7l.1636

Abstract
The present study was conducted at the College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya during the rainy season of 2022-23. Plant material consisted of 40 genotypes of chilli including 1 check namely Kashi Anmol in randomized block design of 3x1.8m^2 with three replications. Evaluation was done for different yield and quality traits. Among the test entries, range for marketable yield *per* plant varied from 134.67 to 692 and it was highest in NDC-21-8 followed by NDC-21-1, NDC-21-13, NDC-20-5 and other 14 more performed better over the checks and lowest in (NDC-20-10) (134.67 g/plant). Number of fruits per plant, fruit length, fruit weight.

Keywords: Chilli, *Capsicum annuum*, marketable yield, earliness

Introduction
Chilli/ hot pepper (*Capsicum annuum* L.) is one of the important vegetable crops in India. It has chromosome number 2n=2x=24 and is a member of the Solanaceae family. It is grown for both the domestic market as well as exports. one of the most significant and widely grown spices in Asia is the chilli. India, China, Ethiopia, Myanmar, Mexico, Peru, Vietnam, Pakistan, Ghana, and Bangladesh are the top countries in the world for chilli production. India is one of the leading countries in terms of area and production, and also tops among all of these in exporting chilies. It contributes over 33% of India's total spice exports and accounts for 16% of global spice trade (Anony., 2022-23) [1]. In India chilli ranked first among spice crops in terms of production *i.e.*, green chilli is cultivated in 852.413 thousand hectares area and production is 19576.35 thousand metric tons. production (Anony., 2022-23) [1]. The major chilli growing states are Karnataka, Madhya Pradesh, Bihar, Andhra Pradesh, Maharashtra, Jharkhand, Chhattisgarh, Telangana and Haryana. These states account for nearly 80% of area under this crop in India (Anonymous, 2022-23) [1].
Chilli and capsicum both belong to same genus 'Capsicum, and the family Solanaceae, which also includes brinjal, tomato and potato. It consists of about 22 wild species and five domesticated species: *Capsicum annuum*, *Capsicum baccatum*, *Capsicum chinense*, *Capsicum frutescens* and *Capsicum pubescens*. Hot peppers have been shown to he domesticated more than 6000 years ago and the most economically important species in the world is *C. annuum* (Greenleaf, 1986) [9].
The various nutrients and bioactive chemicals found in chilli are recognized to have anti-inflammatory, antiviral, antibacterial, antioxidant, and anticancer activities (Bosland and Votava, 2000; Crosby 2005) [4]. Vitamin C and A concentrations in fresh chilli are 120–130 mg and 280–290 IU/100 g, respectively. It also contains a high number of proteins, calcium, magnesium, potassium, copper, and Sulphur.
Before implementing any breeding strategy, it is mandatory to determine the genetic diversity present in the available genotypes for yield and its components. The degree of diversity in germplasm can be determined by using genotypic and phenotypic coefficients of variation. Heritability and genetic variation influence both the impact of the environment on character expression and the extent to which improvement can be achieved after selection. (Datta and Das, 2014) [5].

Direct selection can't improve yield because it is a complex attribute dependent on several genetic and environmental factors. Yield is affected by the expression and interaction of various plant growth factors. It is essential for any crop improvement program to closely examine the relationship between yield and the factors which affect it. Studies such as correlation and path analysis can help us understand the relationship between different variables and yield. Study of correlation revealed the type and degree of distinct relationships between attributes. The path coefficient analysis differentiates between both indirect and direct effects by dividing the correlation coefficient using additional important variables.

Materials and Methods

The experimental plant material consists of 40 Genotypes of chilli. These genotypes were evaluated in a Randomized block design of 3x1.8 m^2 with three replications during spring summer season of 2022-23. Twelve plants of each entry per replication were transplanted in 1st week of September on raised beds of width 60 cm at plant to plant spacing 50 cm. The crop will be raised using recommended Package of Practices of Vegetables by Department of vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya.

The data were collected on the days to 50% flowering, days to first fruit harvest at mature green stage, days to first fruit harvest at red ripe stage, plant height (cm), primary branches per plant, secondary branches per plant, no. of fruit per plant, fruit length (cm), pedicel length (cm), fruit circumference (mm), average fruit weight (g), ascorbic acid (mg/100 g), fruit yield per plant (g). The data were analysed by windostat 9.2 data analysis software.

Results and Discussion

Days to 50% flowering ranged from 42.67 days (NDC-21-8) to 56.00 days (2020 CHIVAR-10). Days to 50% flowering were minimum in the genotype NDC-21-8 (42.67) followed by NDC-21-4 (43.00) and NDC-21-1 (44.67) and highest in the genotype 2020 CHIVAR-10 (56.00) with the grand mean of 50.53 days. A similar result was found by Hulagannavar *et al.,* (2024) [10] for days to 50% flowering which ranges between 43.00 (GPM 33-1) to 63.00 days.

The days to maturity (MGS) ranged from 63.33 days (NDC-21-8) to 76.67 days (NDC-21-2). Days to first harvest at the mature green stage was recorded as a minimum in the genotype NDC-21-8 (63.33) followed by NDC-21-4 (64.00), NDC-25 (66.00) and the maximum in the genotype NDC-21-2 (76.67 days) with the grand mean of 71.67 days. A similar result was reported by Islam *et al.,* 2020 [11] for days to the first harvest (mature green stage), they observed maximum days to first harvest 96.00 was recorded in PP-12 and PP-13 and lowest days to 1st harvest is counted in genotype Shikha (59.00).

The days to maturity (RRS) varied from 84.33 days (NDC-21-8) to 102.67 days (NDC-22-7), and the grand mean value was 94.19 days. Days to first harvest at red ripe stage was minimum found in NDC-21-8 (84.33) followed by NDC-21-4 (84.67), NDC-22-4 (85.00). A similar result was found by Singh *et al.,* (2024a) for day to first harvest (red ripe stage), which ranges from 90.00 (CS-13) to 116.50 (CS-8) days.

Number of primary branches per plant at the time of final harvest ranged from 2.53 (NDC-22-5) to 4.07 (NDC-21-2). highest no of primary branches per plant was observed in NDC-21-2(4.07) followed by NDC-20-6, NDC-21-8 and NDC-25 (3.87) with a grand mean value of 3.27. a similar result was reported by Banyal *et al.,* (2024a) [3] for the Number of primary branches per plant, which ranges from 2.12 (DPCH 32-11) to 3.72 (DPCH 502).

The number of secondary branches per plant was highest found in 7.04 (NDC-21-2) closely followed by NDC-20-11 (6.73), NDC-20-7 (6.67) and lowest found in 4.93 (NDC-21-14) and the grand mean is 5.93. a similar result was revealed by Banyal *et al.,* (2024b) [3] for the Number of secondary branches per plant, which varies from 7.42 (2019/ CHIVAR 1) to 16.25 (DPCH 13-1).

The plant height (cm) at the time of final harvest varied from 33.13 (NDC-21-1) to 75.40 (NDC-21-8) with a grand mean value of 57.27 cm. longest plant height was observed in NDC-21-8 and NDC-20-6 (75.14) and was statistically at par with NDC-20-8 (70.87), NDC-21-3 (70.77). a similar finding was also reported by Arisha *et al.,* (2024) [2] who found a significant difference between genotypes that varies from 26.33 to 95.67 cm. and also same result was reported by Singh *et al.,* (2024b) for plant height, which ranges from 63.92 (CS-3) – 102.71 (CS-10).

The range of fruit length (cm) showed significant variations, varying from 5.49 (NDC-25) to 13.08 (NDC-20-8), with an average fruit length of 9.47. The highest fruit length was noticed in NDC-21-8 (13.08) followed by NDC-22-4 (12.42), NDC-21-6 (12.19). a similar result was recorded by Gor *et al*., (2024) [8] for Fruit length (cm), which varied from 4.19 2011/ (CHIVAR-5) to 9.44 cm (2011/ CHIVAR-2).

Significant variations were recorded for fruit circumference (cm) which varied from 2.79 (NDC-20-10) to 5.39 (NDC-21-8). Significantly highest fruit circumference was observed in the genotype NDC-21-8 (5.39), which is statistically at par with NDC-21-1 (5.03), NDC-21-13 (4.85). and the grand mean is 4.08. a similar result was observed by Lata *et al.,* (2024a) for Fruit circumference (cm), which varies from 2.52 (DPCH MS 9-2) to 3.98 (Him Palam Mirch -2).

Maximum pedicel length (cm) was observed in 4.90 (NDC-21-3) followed by NDC-22-4 (4.34), NDC-21-13 (4.32) and the minimum is 2.62 (NDC-20-2) with the grand mean value of 3.44. a similar result was found by Lata *et al.,* (2024b) for pedicel length (cm), which ranged from 2.65 (DPCH MS11-2) to 3.78 (DPCH-40).

Result of average fruit weight (g) revealed significant variations among the population which ranged from 2.20 (NDC-20-10) to 10.67 (NDC-21-8) with an average fruit weight of 6.22. The genotype NDC-21-8 (10.67) followed by NDC-21-13 (10.40), NDC-20-5 (10.14), which were found significant for the higher number of average fruit weight than best check Kashi Anmol (5.70). a similar result was recorded by Elahi *et al.,* (2019) [7] for average fruit weight, which ranges from 4.70 (222-HYB) to 9.00 (HYB-2).

The variations in the number of fruits per plant ranged from 41.67 (NDC-22-7) to 76.33 (NDC-21-7), and the grand mean value was 57.77. The highest number of fruits per plant was noticed in NDC-21-7 (76.33) closely followed by NDC-21-14 (73.00), and NDC-21-10 (68.00). a similar result was recorded by Khan *et al.,* (2020a) [12], which varies from 37.1 (36652) to 298 (36616).

Ascorbic acid (mg) ranges from 53.67 (NDC-20-9) to 208.17 (NDC-20-11). Maximum ascorbic acid found in NDC-20-11 (208.17) followed by NDC-20-7 (205.57),

NDC-21-12 (184.67), with the grand mean value is 116.88. a similar result was recorded by Rashid *et al.*, (2024) for Ascorbic acid (mg), which varies from 51.11 (SKAU-340 X SKAU-398) to 288.9 (SKAU-374 X SKAU-395).

The result showed that a significant difference was observed between the genotypes for the fruit yield per plant, which ranged from 134.67 (NDC-20-10) to 692.34 (NDC-21-8) with a mean value of 355.29 gm. The highest amount of fruit yield per plant was observed in NDC-21-8 (692.34) followed by NDC-21-1 (525.67), NDC-21-13 (523.34), which were found significant over check variety Kashi Anmol (365.34). a similar result was recorded by Khan *et al.*, (2020b) [12], which varies from 175.94 (36652) to 780.3 (36616).

Table: Mean performance of 40 genotypes for 13 characters in Chilli

Genotypes	Days to 50% flowering	Days to First Harvest at Mature Green Stage	Days to First Harvest Red Ripe Stage	No. of Primary Branches Per Plant	No. of Secondary Branches Per Plant	Plant Height (cm)	Fruit Length (cm)	Fruit Circumference (cm)	Pedicel Length (cm)	Average Fruit Weight (g)	No. of Fruits Per Plant	Ascorbic Acid (mg/100 g)	Fruit Yield Per Plant (g)
NDC-20-1	51.67	73.00	94.67	3.20	5.00	40.37	8.78	3.72	2.93	6.20	55.67	63.67	347.67
NDC-20-2	54.00	70.33	93.00	3.27	6.47	56.87	9.57	4.17	2.63	3.80	62.33	92.00	238.67
NDC-20-3	47.33	70.67	91.67	3.47	6.20	65.13	9.31	3.97	3.28	7.60	62.67	148.33	478.00
NDC-20-4	49.33	75.00	94.00	3.00	5.80	60.07	11.00	4.04	3.69	8.82	48.00	178.67	424.33
NDC-20-5	51.67	70.67	93.00	3.33	6.13	70.07	11.27	4.53	2.66	10.13	45.33	126.67	484.67
NDC-20-6	48.67	68.33	94.67	3.87	6.20	75.40	8.45	4.15	3.59	6.67	48.00	154.50	320.00
NDC-20-7	51.33	71.33	91.00	2.93	6.67	64.80	10.11	3.79	3.69	7.03	54.00	205.57	378.00
NDC-20-8	48.67	66.67	94.00	3.80	6.20	70.87	11.79	3.90	2.87	7.53	48.00	84.83	362.33
NDC-20-9	52.67	75.00	95.67	2.80	5.13	58.80	10.93	3.83	2.85	7.77	51.00	53.67	395.00
NDC-20-10	56.00	75.67	95.00	3.40	5.80	52.47	5.71	2.79	2.80	2.20	61.00	57.83	134.67
NDC-20-11	48.67	73.67	95.33	3.47	6.73	62.63	9.51	3.90	2.65	6.00	64.00	128.83	383.33
NDC-20-12	54.00	76.00	96.00	3.33	6.47	66.87	8.41	3.63	2.79	5.62	65.67	183.33	369.00
NDC-20-13	51.33	73.67	99.33	3.60	6.33	57.33	7.91	3.52	3.24	3.63	51.00	93.33	188.00
NDC-21-1	44.67	67.67	89.67	3.27	5.27	33.13	8.43	5.03	3.71	7.75	67.67	74.00	525.67
NDC-21-2	55.33	76.67	96.33	4.07	7.40	58.00	9.35	4.08	3.80	4.47	63.67	95.33	285.00
NDC-21-3	47.67	68.33	92.00	3.53	6.40	70.77	9.73	4.07	4.91	5.47	57.67	82.33	316.00
NDC-21-4	43.00	64.00	84.67	3.07	5.97	54.40	11.36	4.29	3.35	6.87	61.00	123.67	421.33
NDC-21-5	55.67	73.00	94.33	3.20	6.33	61.50	11.29	4.42	3.87	6.70	61.00	114.00	408.33
NDC-21-6	53.00	70.33	92.67	3.13	5.47	56.27	12.19	4.23	3.66	6.48	64.33	153.50	384.67
NDC-21-7	56.00	76.33	94.67	3.27	5.87	56.53	7.67	3.99	3.47	3.58	76.33	56.67	276.33
NDC-21-8	42.67	63.33	84.33	3.87	6.00	75.40	13.08	5.39	4.24	10.67	67.00	69.83	692.33
NDC-21-9	47.33	68.33	88.33	2.73	5.20	56.80	10.95	4.32	4.10	6.50	55.67	61.00	356.00
NDC-21-10	51.00	68.67	87.67	3.80	5.93	42.20	11.96	4.43	3.87	6.93	68.00	112.00	474.67
NDC-21-11	53.33	76.00	102.33	3.67	5.87	47.87	7.43	3.73	3.44	3.50	55.33	208.17	197.33
NDC-21-12	51.33	72.33	98.33	3.13	5.60	52.93	7.87	4.53	3.46	4.52	49.00	184.67	216.67
NDC-21-13	50.00	71.33	101.67	2.87	6.07	51.27	11.45	4.85	4.32	10.40	50.67	170.00	523.33
NDC-21-14	47.33	71.33	93.00	2.67	4.93	63.77	9.44	4.24	3.72	6.35	73.00	158.00	462.00
NDC-22-1	48.67	71.00	92.67	3.20	6.60	54.70	8.65	3.93	2.93	3.53	65.33	89.00	231.33
NDC-22-2	52.67	72.00	93.33	2.80	6.20	56.60	9.25	4.49	3.66	5.87	53.67	155.50	315.00
NDC-22-3	54.00	75.00	97.00	3.07	6.13	56.27	5.87	3.55	2.95	3.27	50.00	174.00	162.67
NDC-22-4	48.67	67.67	85.00	3.20	5.73	52.47	12.42	4.46	4.33	9.13	53.00	101.33	483.67
NDC-22-5	54.33	71.33	93.00	2.53	4.93	40.07	10.91	4.57	3.14	7.90	44.67	89.00	351.67
NDC-22-7	53.00	75.00	102.67	2.60	5.33	44.40	7.79	3.79	2.95	5.40	41.67	119.00	232.67
NDC-22-8	51.67	73.00	97.00	3.07	6.27	61.40	8.07	3.40	3.19	3.60	56.33	77.33	203.33
NDC-22-9	47.67	69.00	95.67	3.27	5.67	59.67	9.90	4.08	3.56	6.27	64.00	101.67	386.67
NDC-22-10	47.33	74.67	101.67	3.40	5.73	44.67	9.52	4.23	4.28	7.00	50.33	113.33	348.00
NDC-22-11	49.00	72.00	95.00	2.67	5.87	46.20	8.69	3.77	3.25	6.33	59.67	125.67	379.00
NDC-25	46.00	66.00	89.67	3.87	5.73	63.07	5.49	3.21	3.11	4.05	55.00	93.67	225.33
NDC-26	55.67	76.00	97.67	3.67	5.87	63.13	8.44	4.21	3.92	7.37	65.67	123.33	483.67
Kashi Anmol (Check)	48.67	76.33	100.00	3.67	5.80	65.60	8.80	3.96	2.85	5.70	64.33	78.00	365.33
Mean	50.53	71.67	94.19	3.27	5.93	57.27	9.47	4.08	3.44	6.22	57.77	116.88	355.29
C.V.	6.16	6.21	6.05	9.06	7.53	9.35	8.84	9.87	9.42	9.17	7.20	3.10	10.52
S.E.	1.80	2.57	3.29	0.17	0.26	3.09	0.48	0.23	0.19	0.33	2.40	2.09	21.57
C.D. 5%	5.06	7.23	9.26	0.48	0.73	8.71	1.36	0.65	0.53	0.93	6.76	5.88	60.74
C.D. 1%	6.71	9.59	12.28	0.64	0.96	11.55	1.81	0.87	0.70	1.23	8.96	7.80	80.55
Range Min.	42.67	63.33	84.33	2.53	4.93	33.13	5.49	2.79	2.63	2.20	41.67	53.67	134.67
Range Max.	56.00	76.67	102.67	4.07	7.40	75.40	13.08	5.39	4.91	10.67	76.33	208.17	692.33

Conclusion

Chilli/ hot pepper (*Capsicum annuum* L.) is one of the important vegetable crops of Solanaceae family. The present investigation was undertaken to evaluate 40 genotypes of chilli for horticultural traits. The genotypes *viz*. NDC-21-8 followed by NDC-21-1, NDC-21-13, NDC-20-5 and other 14 more genotypes performed better over the checks (Kashi Anmol) in terms of marketable fruit yield. It can be concluded that, as a wide range of variation for almost all the economically important traits was present in this crop, so there is a vast scope for improvement through different breeding procedure.

Acknowledgement
I express my wholehearted gratitude and sincere thanks to my Major Advisor Dr. Anil Kumar, Department of Vegetable Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, for suggesting this interesting research work and for all her scholarly guidance, keen interest, support and suggestive criticism throughout the course of this investigation and preparation of this research. Despite her multidimensional responsibilities, the most affectionately extended kind cooperation and encouragement.

References

1. Anonymous. Data base National Horticulture Board. 85, Gurgaon, Haryana, India; c2022-23.
2. Arisha MH, Bardisi EA, Taha HS, Zyada HG. Assessing combining ability of diverse chili pepper genotypes to develop high yield and quality adopted hybrids under Egyptian conditions. Zagazig J Agri Res. 2024;51(1):19-29.
3. Banyal N, Sharma A, Lata H. Genetic variability and trait relationship in green chilli (*Capsicum annuum* L.) under high altitude conditions. Electron J Plant Breed. 2024;15(1):185-193.
4. Bosland PW, Votava EJ. Peppers, Vegetables and spices Capsicum. New York: CABI Publishing; c2000. p. 198.
5. Datta S, Das LR. Characterization and genetic variability analysis in *Capsicum annuum* L. germplasm. SAARC J Agri. 2014;11:91-103.
6. Dayal R, Yadav GC, Singh H, Maurya HK, Singh P, Kumar D. Estimation of Response to Selection in Chilli (*Capsicum annuum* L.). Int J Plant Sci. 2023;35(20):1370-1373.
7. Elahi Z, Nawab NN, Khan TN, Ramzan A, Qasim MU, Noor T, et al. Assessment of genetic variability and association between yield and yield components in indigenously developed chilli hybrids (*Capsicum annuum* L.). J Anim Plant Sci. 2019;29(5):1318-1324.
8. Gor D, Singh D, Patel G, Bagadiya P, Balar V, Yadav A. Assessment of genetic diversity in different Chilli (*Capsicum annuum* L.) genotypes using morphological, biochemical and molecular characters; c2024.
9. Greenleaf WH. Pepper breeding. In: Bassett MJ, editor. Breeding Vegetable crops. New York: CABI Publishing; c1986. p. 67-134.
10. Hulagannavar P, Lakshmidevamma TN, Shet R, Ryavalad S, Tatagar MH. Assessment of Genetic Variability in Chilli (*Capsicum annuum* L.) Genotypes for Growth and Yield Traits. J Ad in Biol Biotech. 2024;27(3):140-148.
11. Islam MS, Akter N, Jui S. Variability of chilli (*Capsicum annuum* L.) genotypes for yield and yield attributes. Asian J Res Bot. 2020;3(4):33-37.
12. Khan N. Morphological and agronomic characterization of (*Capsicum annuum* L.) germplasm in Pakistan. Pure Appl Biol. 2020. doi:10.19045/bspab.2020.90168.
13. Koka ST, Sharma H, Dogra R. Genetic Variability Studies in Chilli (*Capsicum annuum* L.) Genotypes under the Mid Hill region of Himachal Pradesh, India. Ecol Environ Conserv. 2023;29:1802-1805.
14. Lata H, Sharma A. Evaluation, genetic variability, correlation and path analysis studies in chilli (*Capsicum annuum* L.) genotypes. Himachal J Agric Res. 2022;48(01):56-64.
15. Lata H, Sharma A. Evaluation, genetic variability, correlation and path analysis studies in chilli (*Capsicum annuum* L.) genotypes. Himachal J Agric Res. 2022;48(01):56-64.
16. Singh TN, Joshi AK, Vikram A, Yadav N, Prashar S. Mean performances, character associations and multi-environmental evaluation of chilli landraces in north western Himalayas. Sci Rep. 2024;14(1):769.