

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(11): 886-893
www.biochemjournal.com
Received: 01-09-2025
Accepted: 05-10-2025

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Performance of chilli (*Capsicum annuum* L.) genotypes for yield and yield attributing traits under Southern Telangana conditions

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DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i11Sk.7186>

Abstract

The present investigation was carried out to evaluate the performance of diverse chilli (*Capsicum annuum* L.) genotypes for yield and yield attributing traits under the agro-climatic conditions of southern Telangana. A set of genetically diverse chilli genotypes, along with standard check varieties, was assessed during the *Kharif* season in a Randomized Block Design with three replications. Observations were recorded on growth, phenological, yield, and quality traits, including fruit yield per plant, fruit yield per plot, and important biochemical parameters. The analysis of variance revealed highly significant differences among genotypes for all the traits studied, indicating the presence of substantial genetic variability. Wide variation was observed for yield and its component characters, suggesting ample scope for selection of superior genotypes. Among the genotypes evaluated, Warangal chapata recorded the highest fruit yield per plant and fruit yield per plot, outperforming the standard checks, and also exhibited favourable quality attributes. Genotypes P.075 and EC-399574 were also identified as promising due to their consistent performance. The results demonstrate that per se performance evaluation is an effective approach for identifying high-yielding and locally adapted chilli genotypes. The superior genotypes identified in this study can be recommended for cultivation in southern Telangana and can serve as valuable parental material in future chilli improvement programmes aimed at enhancing yield and quality.

Keywords: Chilli, *Capsicum annuum*, per se performance, genetic variability, fruit yield, quality traits

Introduction

Chilli (*Capsicum annuum* L.), a member of the family Solanaceae with a diploid chromosome number of $2n = 2x = 24$, is one of the most important spice-cum-vegetable crops cultivated across tropical and subtropical regions of the world. It originated in South and Central America, with Mexico recognized as a primary centre of domestication, and later spread to Asia, Africa, and Europe through early trade routes [1]. In India, chilli occupies a prominent position due to its extensive culinary, nutritional, medicinal, and industrial uses, contributing significantly to farm income and export earnings. India is the largest producer, consumer, and exporter of chilli globally, accounting for more than half of the world's export share, with major production concentrated in states such as Telangana, Andhra Pradesh, Karnataka, and Maharashtra [2]. Chilli fruits are rich sources of bioactive compounds such as capsaicin, capsanthin, oleoresin, ascorbic acid, and chlorophyll, which impart pungency, colour, flavour, and antioxidant properties, making the crop valuable for food, pharmaceutical, and cosmetic industries [3-5]. Despite its economic importance, chilli productivity in several regions remains low due to the cultivation of genetically inferior genotypes, narrow genetic base, and limited exploitation of available variability [6]. Southern Telangana, in particular, represents a distinct agro-climatic zone where yield instability is frequently observed owing to genotype $\times$ environment interactions, highlighting the need for region-specific evaluation of chilli germplasm [7].

Genetic improvement of chilli for yield and yield attributing traits largely depends on the availability and effective utilization of diverse germplasm resources [8]. Yield in chilli is a complex quantitative trait governed by multiple component characters such as plant height, branching pattern, flowering behaviour, fruit size, fruit number, and fruit weight, all of which

are influenced by both genetic and environmental factors [9]. Therefore, direct selection for yield alone is often inefficient, necessitating a comprehensive assessment of per se performance of genotypes for yield and its contributing traits under specific agro-ecological conditions [10]. Previous studies have demonstrated substantial variability among chilli genotypes for growth, phenology, yield, and quality traits, suggesting ample scope for identifying superior genotypes suited to local conditions [11-13]. However, systematic evaluation of diverse chilli genotypes under the southern Telangana conditions remains limited, particularly with respect to simultaneous assessment of yield and quality attributes [14]. The lack of region-specific information on genotype performance poses a major constraint in formulating effective breeding strategies and recommending suitable cultivars to farmers [15].

In this context, the present investigation was undertaken to address the problem of low and unstable chilli productivity in southern Telangana by evaluating the performance of diverse chilli genotypes for yield and yield attributing traits under local environmental conditions. The specific objective of the study was to assess the per se performance of selected chilli genotypes for growth, phenological, yield, and quality traits, and to identify high-performing and stable genotypes suitable for cultivation and use in breeding programmes [16-18]. The underlying hypothesis of the study was that significant genetic variability exists among the evaluated chilli genotypes, and that certain genotypes possess superior combinations of yield and yield contributing traits that can be effectively exploited for enhancing chilli productivity under southern Telangana conditions.

Materials and Methods

Materials

The experimental material for the present investigation comprised a diverse set of chilli (*Capsicum annuum* L.) genotypes collected from different sources to represent a broad genetic base. A total of forty chilli genotypes, including indigenous collections, advanced breeding lines, released varieties, and local landraces, were used in the study. The genotypes were primarily obtained from the ICAR-National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Hyderabad, Regional Agricultural Research Stations (RARS), Lam, Guntur, and local collections from Warangal district of Telangana. The experiment was conducted during the *Kharif* season under southern Telangana conditions at the Post Graduate Research Block, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad, which lies in a semi-arid tropical zone at an altitude of approximately 542.6 m above mean sea level. The experimental field had red soil with coarse texture and uniform fertility status. Standard agronomic practices recommended for chilli cultivation in the region were followed to ensure optimum crop growth and to minimize non-genetic variation among genotypes [2, 6, 15].

Methods

The experiment was laid out in a Randomized Block Design (RBD) with three replications, considering each genotype as a treatment, to evaluate the performance of chilli genotypes for yield and yield attributing traits. Healthy seedlings were raised in pro trays using a growth medium consisting of vermicompost, farmyard manure, and red earth in a 2:1:1 ratio and transplanted to the main field at six weeks of age.

Each genotype was planted in rows with recommended spacing, and all cultural operations such as irrigation, weeding, and plant protection measures were carried out uniformly. Observations were recorded on five randomly selected competitive plants from each genotype in every replication for growth, phenological, yield, and quality traits, including plant height, number of primary branches per plant, days to first flowering, days to 50% flowering, days to first and last harvest, fruit length, fruit diameter, number of fruits per plant, fruit weight, fruit yield per plant, and fruit yield per plot. Quality parameters such as ascorbic acid content, chlorophyll content, capsaicin content, and capsaanthin content were estimated following standard biochemical procedures [4, 5]. The data collected were subjected to analysis of variance (ANOVA) appropriate for RBD to test the significance of differences among genotypes, as described by Panse and Sukhatme [16], and the significance of mean squares was tested using the F-test as suggested by Fisher and Yates [17]. The evaluation of per se performance was used to identify superior genotypes suitable for cultivation and further use in chilli improvement programmes under southern Telangana conditions, in line with established approaches for genetic evaluation of chilli germplasm [8-11, 18].

Table 1: 40 genotypes of chilli under study obtained from different sources

Tr. No.	Genotype	Source
T ₁	SR-6514	NBPGR, Hyderabad
T ₂	IC-528454	NBPGR, Hyderabad
T ₃	IC-255896	NBPGR, Hyderabad
T ₄	AAT-2	NBPGR, Hyderabad
T ₅	SINDHUR	RARS, Lam, Guntur, AP
T ₆	NIC-23923	NBPGR, Hyderabad
T ₇	WARANGAL CHAPATA	Landrace, Warangal, Telangana
T ₈	PSR-7075	NBPGR, Hyderabad
T ₉	HIRKANI	PDKV, Akola
T ₁₀	IC-572469	NBPGR, Hyderabad
T ₁₁	SD-5335	NBPGR, Hyderabad
T ₁₂	ST-13874	NBPGR, Hyderabad
T ₁₃	IC-214966	NBPGR, Hyderabad
T ₁₄	PSR-13944	NBPGR, Hyderabad
T ₁₅	PSR-7074	NBPGR, Hyderabad
T ₁₆	EC-402101	NBPGR, Hyderabad
T ₁₇	PSR-13968	NBPGR, Hyderabad
T ₁₈	SRS-13578	NBPGR, Hyderabad
T ₁₉	EC-391087	NBPGR, Hyderabad
T ₂₀	AVPP-9813	AVRDC, Taiwan
T ₂₁	LCA-620	RARS, Lam, Guntur, AP
T ₂₂	LCA-625	RARS, Lam, Guntur, AP
T ₂₃	LCA-334	RARS, Lam, Guntur, AP
T ₂₄	IC-572480	NBPGR, Hyderabad
T ₂₅	EC-399565	NBPGR, Hyderabad
T ₂₆	EC-399574	NBPGR, Hyderabad
T ₂₇	EC-378688	NBPGR, Hyderabad
T ₂₈	EC-391083	NBPGR, Hyderabad
T ₂₉	EC-402109	NBPGR, Hyderabad
T ₃₀	EC-399567	NBPGR, Hyderabad
T ₃₁	PSR-13976	NBPGR, Hyderabad
T ₃₂	NIC-19969	NBPGR, Hyderabad
T ₃₃	ST-13837	NBPGR, Hyderabad
T ₃₄	NIC-19967	NBPGR, Hyderabad
T ₃₅	PBC-80	NBPGR, Hyderabad
T ₃₆	EC-399572	NBPGR, Hyderabad
T ₃₇	SR-3429	NBPGR, Hyderabad
T ₃₈	EC-399575	NBPGR, Hyderabad
T ₃₉	EC-401105	NBPGR, Hyderabad
T ₄₀	ST-13875	NBPGR, Hyderabad

Results

Analysis of variance

The pooled analysis of variance (ANOVA) carried out under a Randomized Block Design revealed highly significant differences ($p \leq 0.01$) among chilli genotypes for all yield and yield attributing traits, indicating the presence of substantial genetic variability within the experimental material. The significant mean sum of squares for genotypes

confirms that the observed variation was primarily genetic rather than environmental, validating the suitability of the germplasm for selection and improvement programmes [16, 17]. Similar observations of significant variability among chilli genotypes have been reported earlier, emphasizing the importance of evaluating diverse genetic resources for yield improvement [6, 11, 12].

Table 2: Mean performance of 40 chilli genotypes for 20 yield and yield attributing traits.

S. No	Genotypes	PH	NPBP	D50%	FN	FPA	DFS	DFF	DFH	DLH	DOC	AFW	FL	FD	FYPF	FYPPL	RP	AA	OLER	CPSN	CPSI	CLC	Fruit colour at ripe stage
1	SR-6514	43.90	4.24	44.67	1.00	49.00	75.00	87.00	143.33	177.67	6.32	9.60	1.47	0.237	3.78	34.00	95.15	8.66	188.58	0.34	2.05	Dark red	
2	IC-528454	42.37	4.44	49.67	1.83	53.00	79.00	92.00	122.67	160.33	7.56	10.27	1.40	0.303	4.83	34.00	93.12	8.95	210.32	0.43	2.22	Dark red	
3	IC-255896	55.00	5.67	54.00	1.47	58.33	84.00	93.67	137.67	176.00	6.44	11.00	1.44	0.243	3.89	33.67	83.35	6.25	231.14	0.31	1.92	Dark red	
4	AA T-2	56.21	5.30	41.67	1.93	45.00	73.00	87.00	126.00	163.33	5.37	9.13	1.25	0.250	3.94	34.00	72.77	14.73	186.69	0.53	2.18	Dark red	
5	NIC-23923	66.80	5.87	51.67	1.97	54.00	82.00	93.67	138.00	180.00	4.06	8.23	1.23	0.177	2.85	34.00	143.36	6.52	180.16	0.33	1.90	Red	
6	PSR-7075	84.13	5.53	61.33	1.00	66.00	93.00	107.00	137.33	179.67	10.57	9.17	2.15	0.543	8.73	38.11	125.47	12.57	276.59	0.45	2.19	Dark red	
7	IC-572469	82.25	5.14	71.33	1.43	75.00	100.00	110.00	169.67	204.33	5.24	8.27	1.35	0.183	2.90	32.00	128.67	7.60	192.53	0.26	2.09	Red	
8	SD-5335	36.84	3.94	42.33	1.93	46.00	73.00	84.67	163.67	201.67	1.82	3.80	1.39	0.127	2.04	35.33	128.69	6.99	188.17	0.47	1.94	Red	
9	ST-13874	67.70	6.33	51.67	1.93	55.00	83.00	97.00	134.33	177.33	1.77	4.53	1.19	0.130	2.04	36.00	129.25	10.64	190.21	0.82	0.00	Red	
10	IC-214966	59.49	4.36	62.67	1.37	66.00	94.00	105.67	142.67	181.33	4.14	11.27	1.15	0.303	4.72	36.00	68.70	8.24	192.84	0.19	2.08	Light red	
11	PSR-13944	54.23	6.93	57.67	1.83	61.00	88.00	101.67	140.33	180.67	8.40	16.08	1.62	0.393	6.30	35.00	129.67	9.62	232.51	0.64	2.09	Dark red	
12	PSR-7074	51.93	5.37	54.67	1.27	60.00	87.00	100.67	145.00	178.67	7.13	10.60	1.55	0.333	5.30	37.67	113.92	12.32	228.76	0.75	2.11	Dark red	
13	EC-402101	57.07	4.81	53.67	1.57	57.00	85.00	97.33	131.67	166.00	6.98	7.27	1.48	0.260	4.10	36.33	126.40	11.06	192.80	0.46	2.32	Red	
14	PSR-13968	44.10	3.88	50.00	1.43	54.00	81.00	91.33	128.00	160.00	5.96	5.33	0.70	0.207	3.34	37.07	120.11	9.34	196.74	0.65	1.76	Light red	
15	SRS-13578	53.29	5.27	49.67	1.30	52.00	81.00	92.67	132.67	171.67	3.88	5.37	1.15	0.193	3.76	40.00	100.30	8.70	202.41	0.34	2.03	Light red	
16	EC-391087	51.57	4.40	64.00	1.20	68.00	95.00	105.67	135.00	182.67	5.75	5.22	0.84	0.317	5.06	37.00	101.68	9.90	240.87	0.43	1.77	Light red	
17	AVPP-9813	60.50	5.86	49.67	1.80	53.33	81.00	95.33	130.67	149.00	8.44	11.80	0.80	0.353	5.60	37.00	141.36	10.65	255.64	0.27	2.12	Dark red	
18	IC-572480	57.53	3.14	51.67	1.20	55.00	83.00	96.33	138.00	178.67	3.93	19.14	0.26	0.273	4.37	35.33	117.64	5.81	126.65	0.33	1.09	Pale orange	
19	EC-399565	46.40	4.00	56.67	1.37	63.00	90.00	101.67	141.33	191.33	6.98	6.37	1.33	0.200	3.14	35.00	109.55	7.82	246.33	0.47	2.12	Red	
20	EC-399574	40.53	3.35	54.67	1.00	58.00	86.00	98.33	130.67	171.33	11.23	6.90	1.40	0.530	8.46	38.33	140.10	8.83	220.60	0.18	1.89	Red	
21	EC-378688	52.53	4.97	59.67	1.80	64.00	91.00	100.67	140.33	188.00	1.19	5.17	0.86	0.113	1.82	33.67	129.17	8.11	199.12	0.23	2.22	Orange	
22	EC-391083	50.73	5.11	60.33	1.37	64.00	91.67	104.00	148.67	189.67	8.49	12.61	1.47	0.260	4.13	35.33	61.45	8.20	255.41	0.43	1.69	Red	

S. No	Genotypes	PH	NPBP	D50%	F	NFPA	DFS	DFF	DFH	DLH	DOC	AFW	FL	FD	FYPF	FYPPL	RP	AA	OLER	CPSN	CPSI	CLC	Fruit colour at ripe stage
23	EC-402109	55.57	3.35	63.67	1.37	68.00	95.00	105.33	133.67	175.33	7.22	10.26	1.11	0.380	6.06	36.67	112.21	9.55	262.72	0.36	2.27	Red	
24	EC-399567	58.30	4.57	57.67	1.37	61.00	89.00	110.33	15.33	191.67	6.32	5.28	0.96	0.347	5.54	36.33	63.35	8.63	234.74	0.33	2.03	Light red	
25	PSR-13976	56.47	4.45	54.67	1.20	59.00	86.00	95.33	136.67	178.33	5.11	12.33	1.60	0.290	4.74	37.00	74.28	10.52	248.77	0.41	1.91	Dark red	
26	NIC-19969	51.83	3.15	71.00	1.33	76.00	103.00	115.00	164.00	204.67	6.01	7.13	1.53	0.307	4.89	37.33	108.66	9.52	220.83	0.61	2.37	Red	
27	ST-13837	39.11	4.03	68.00	1.93	73.00	100.00	113.00	170.67	212.67	0.44	3.08	0.35	0.067	1.03	35.33	94.39	10.52	231.55	0.82	0.00	Light red	
28	NIC-19967	53.63	3.86	59.00	1.20	72.00	90.00	102.00	138.33	180.00	7.25	10.55	1.67	0.333	5.33	36.67	98.80	10.75	274.92	0.57	1.89	Light red	
29	PBC-80	57.08	5.42	54.33	1.77	59.33	86.00	95.67	131.67	174.67	9.67	8.02	1.65	0.360	5.74	36.33	126.24	6.08	185.16	0.74	2.02	Orange	
30	EC-399572	46.80	5.33	66.00	1.20	69.00	97.00	108.67	142.33	185.33	12.68	11.25	2.00	0.313	4.99	36.33	118.53	8.68	193.96	0.38	1.82	Red	
31	SR-3429	51.63	4.80	60.67	1.77	65.00	92.00	104.00	139.33	182.33	8.03	11.49	1.47	0.340	5.46	38.33	112.99	10.68	247.11	0.55	2.05	Red	
32	EC-399575	52.03	5.00	59.00	1.20	62.00	90.00	100.00	143.00	183.67	5.04	7.81	1.32	0.510	8.17	34.33	120.33	8.26	205.67	0.45	2.15	Red	
33	EC-401105	42.60	4.45	59.00	1.33	63.00	90.00	100.67	138.67	181.00	4.26	8.77	1.28	0.200	3.21	36.33	113.14	8.11	200.43	0.67	0.73	Red	
34	ST-13875	38.52	2.67	73.33	1.93	77.00	104.67	115.00	161.33	207.00	0.54	3.08	0.32	0.053	0.863	37.63	120.85	8.45	195.91	0.45	1.92	Red	
35	WARANGAL CHAPATA	85.03	5.71	64.67	1.93	68.00	96.00	107.67	163.33	206.00	17.11	9.37	3.28	0.690	11	40.33	150.13	14.30	264.50	0.147	2.21	Dark red	
36	HIRKANI	79.81	6.23	39.67	2.83	43.00	71.00	81.00	153.00	195.00	3.56	11.33	0.80	0.467	7.47	36.00	130.33	9.62	247.56	0.66	2.25	Dark Red	
37	SINDHUR	59.63	8.18	60.00	1.80	64.00	91.00	101.33	147.33	182.00	7.71	9.13	1.51	0.510	8.15	35.33	123.11	9.77	242.84	0.32	1.90	Dark red	
38	LCA-620	68.23	6.18	61.00	1.37	64.67	92.00	104.00	126.67	173.67	4.13	11.48	0.93	0.330	5.27	36.00	106.63	5.79	243.28	0.26	2.00	Red	

39	LCA-625	86.30	6.30	63.67	1.30	67.00	95.00	106.00	133.67	180.67	4.71	11.05	0.73	0.333	5.35	34.00	95.51	6.26	210.69	0.40	2.17	Red
40	LCA-334	75.03	3.34	61.67	1.57	66.00	93.00	103.33	150.67	189.00	3.34	8.37	1.06	0.317	5.04	36.67	120.45	6.33	243.86	0.35	1.80	Red
	MEAN	56.82	4.87	57.26	1.54	61.38	88.44	100.30	142.06	182.32	6.12	8.92	1.28	0.302	4.84	36.06	111.25	9.08	219.76	0.45	1.88	
	C.D(5%)	4.86	0.42	6.06	0.22	5.51	7.19	9.33	9.55	12.93	1.21	0.35	0.17	0.017	0.39	2.15	2.42	0.31	3.75	0.02	0.14	
	SEM	1.73	0.15	2.15	0.08	1.96	2.56	3.32	3.39	4.59	0.43	0.13	0.06	0.006	0.14	0.76	0.86	0.11	1.33	0.01	0.05	

Table 3: Top performing chilli genotypes for yield and quality traits in southern telangana conditions

Character	Warangal chapata	PSR 7075	EC 399574	EC 399575	Sindhur	LCA 625
Fruit image						
PH	85.03	84.13	40.53	52.03	59.63	86.30
NPBP	5.71	5.53	3.35	5.00	8.18	6.30
DS0%F	64.67	61.33	54.67	59.00	60.00	63.67
NEPA	1.93	1.00	1.00	1.20	1.80	1.30
DFS	68.00	66.00	58.00	62.00	64.00	67.00
DFP	96.00	93.00	86.00	90.00	91.00	95.00
DFH	107.67	107.00	98.33	100.00	101.33	106.00
DLH	163.33	137.33	130.67	143.00	147.33	133.67
DOC	206.00	179.67	171.33	183.67	182.00	180.67
AFW	17.12	10.57	11.23	5.04	7.71	4.71
FL	9.37	9.17	6.90	7.81	9.13	11.05

Interpretation

Among the evaluated genotypes, Warangal chapata recorded the highest fruit yield per plant (0.690 kg) and fruit yield per plot (11.00 kg), clearly outperforming the commercial checks Sindhur and LCA-625 (Table 1). The superior yield performance of this genotype was associated with favourable fruit diameter, higher recovery percentage, and enhanced biochemical attributes such as ascorbic acid and

oleoresin content. These results corroborate earlier findings that yield superiority in chilli is often the cumulative effect of fruit size, fruit number, and quality traits rather than a single component character [6, 9, 10]. Genotypes P.075 and EC-399574 also exhibited consistently high yield performance, suggesting their adaptability to southern Telangana conditions and their potential utility in breeding programmes [7, 8].

Table 2: Range of variation for yield and quality traits among chilli genotypes

Trait	Observed range
Fruit yield per plant (kg)	0.11-0.82
Fruit yield per plot (kg)	1.52-11.54
Ascorbic acid (mg/100 g)	44.71-191.80
Chlorophyll (%)	1.13-2.24
Capsaicin (%)	0.21-0.83

Extent of variability observed for major yield and biochemical traits.

Interpretation

The wide range of variation recorded for yield and quality traits (Table 2) indicates the presence of genetically diverse genotypes with contrasting performance. Such variability provides ample scope for selection of superior genotypes and confirms earlier reports on the existence of broad genetic diversity in chilli germplasm [6, 11, 13, 14]. The large variation in ascorbic acid, capsanthin, and capsaicin content further highlights the possibility of simultaneous improvement of yield and quality traits through appropriate selection strategies [3, 4, 5].

Figures 1 and 2 clearly demonstrate the yield superiority of Warangal chapata over the standard checks, indicating its better adaptation and higher yield potential under the agro-climatic conditions of southern Telangana. The clear separation among genotypes further supports the effectiveness of per se performance evaluation in identifying promising genotypes for direct cultivation and as parents in breeding programmes [7, 8, 15].

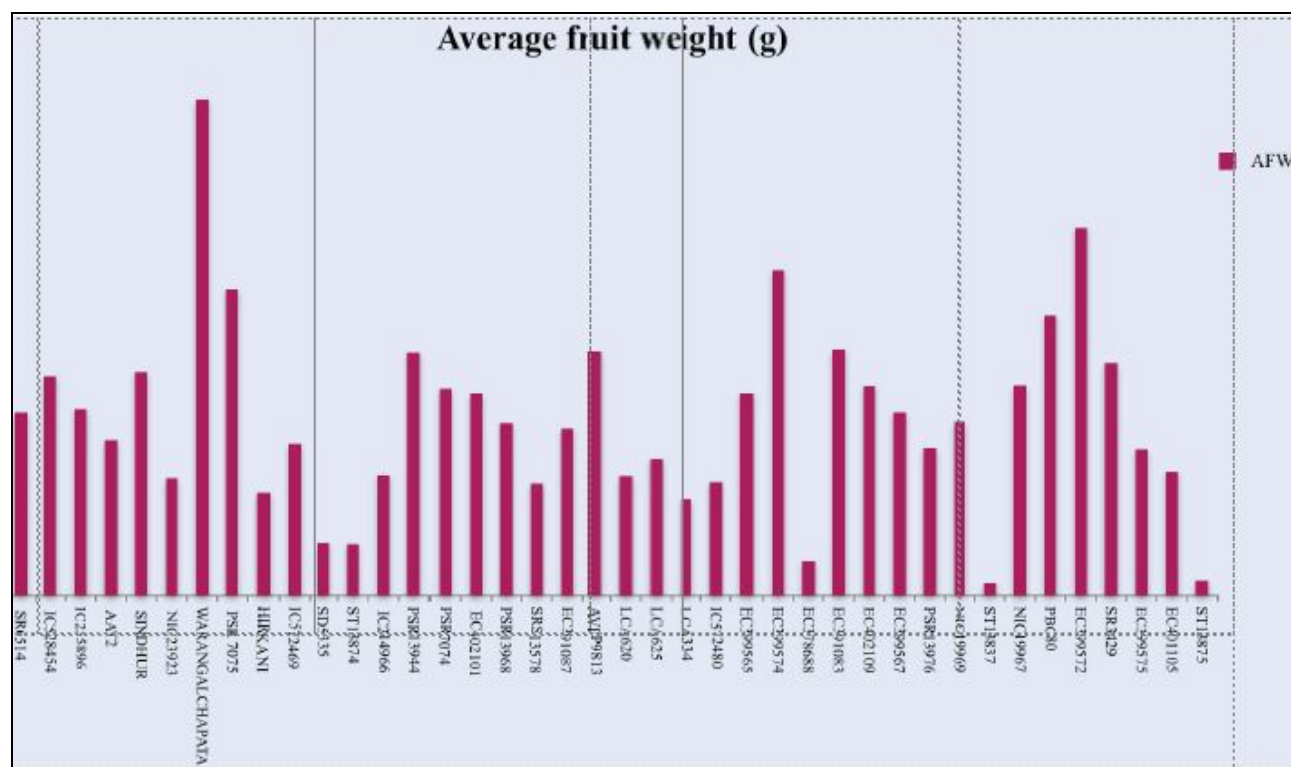


Fig 1: Graph representing the average fruit weight of 40 chilli (*Capsicum annuum* L.) genotypes and checks

Discussion

The present investigation revealed substantial variability among chilli (*Capsicum annuum* L.) genotypes for yield and yield attributing traits under southern Telangana conditions, highlighting the scope for genetic improvement through selection. The significant differences observed among genotypes for all characters in the pooled analysis of variance confirm that the experimental material possessed adequate genetic diversity, which is a prerequisite for effective selection and crop improvement [6, 11, 12]. Similar findings have been reported earlier, indicating that chilli germplasm collections often harbor wide variability for growth, yield, and quality traits due to their diverse genetic background and adaptation to different agro-climatic conditions [7, 8, 14].

The superior performance of Warangal chapata for fruit yield per plant and fruit yield per plot suggests its better adaptation to the local environment and its inherent genetic potential for higher productivity. Yield in chilli is a complex character influenced by the combined effect of several component traits, and the higher yield recorded in this genotype may be attributed to favourable fruit size, recovery percentage, and improved biochemical traits such as ascorbic acid and oleoresin content. Earlier studies have also emphasized that genotypes exhibiting a balanced combination of yield components generally outperform those excelling in a single trait [6, 9, 10]. The consistent performance of genotypes P.075 and EC-399574 further supports the importance of per se evaluation for identifying stable and high-yielding genotypes suited to specific regions [7, 15].

The wide range of variation observed for fruit yield per plant and fruit yield per plot indicates the presence of both low- and high-yielding genotypes within the population. Such variation is advantageous for breeders, as it allows the selection of superior genotypes and the identification of potential parents for hybridization programmes aimed at

yield enhancement [6, 8]. The results also corroborate earlier reports that regional evaluation of chilli genotypes is essential due to the significant influence of genotype $\times$ environment interactions on yield performance [14, 15]. Therefore, the identification of locally adapted genotypes is critical for achieving stable yield gains in chilli cultivation. Quality traits such as ascorbic acid, capsanthin, capsaicin, and chlorophyll content exhibited considerable variation among genotypes, suggesting the possibility of simultaneous improvement of yield and quality. High ascorbic acid content observed in certain genotypes is particularly desirable from a nutritional standpoint, as chilli is an important dietary source of vitamin C [3, 4]. Likewise, variability in capsanthin and capsaicin content is of significant industrial relevance, as these compounds determine colour value and pungency, respectively, which are key quality parameters in spice and pharmaceutical industries [3, 5]. The observed variation in these biochemical traits aligns with previous reports emphasizing the genetic control of quality attributes in chilli and their responsiveness to selection [6, 13].

Overall, the findings of the present study reaffirm that evaluation of chilli genotypes based on per se performance under specific agro-climatic conditions is an effective approach for identifying superior genotypes with high yield and desirable quality traits. The results support earlier conclusions that genetic variability, when properly assessed using appropriate experimental designs and statistical tools, can be effectively exploited for varietal improvement and development of high-yielding chilli cultivars adapted to regional conditions [8, 16, 17]. The identified superior genotypes from this study therefore hold promise for direct cultivation and for use as valuable parental material in future chilli breeding programmes aimed at enhancing productivity and quality under southern Telangana conditions.

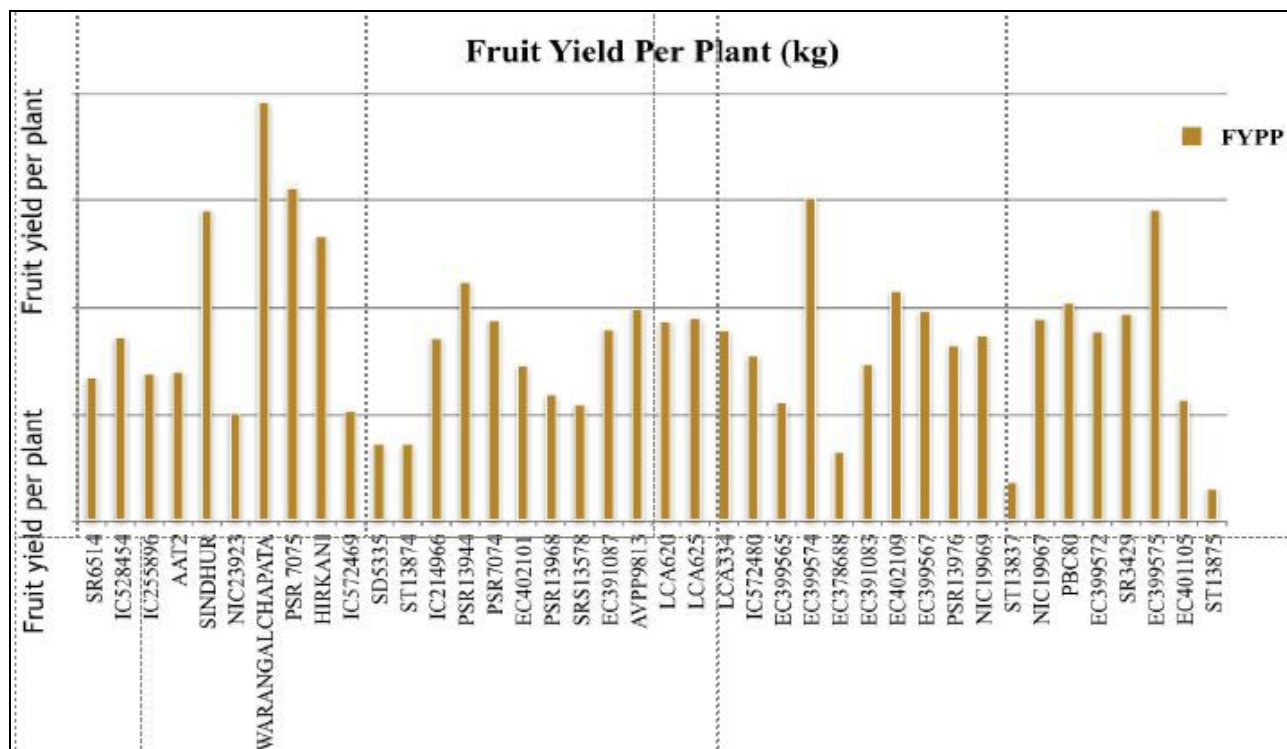


Fig 2: Fruit yield per plot (kg) of genotypes and checks

Conclusion

The present study clearly demonstrated the existence of wide genetic variability among the evaluated chilli (*Capsicum annuum* L.) genotypes for yield, yield attributing characters, and quality traits under the agro-climatic conditions of southern Telangana, indicating substantial scope for selection and genetic improvement. The significant differences observed among genotypes for all traits confirm that the germplasm used in this investigation is genetically diverse and suitable for identifying superior and locally adapted types. Among the genotypes evaluated, Warangal chapata consistently outperformed the standard checks with respect to fruit yield per plant and fruit yield per plot, indicating its superior adaptability and yield potential under the prevailing environmental conditions. The enhanced yield performance of this genotype was associated with favourable fruit traits and acceptable quality parameters, highlighting the importance of selecting genotypes based on a combination of yield and yield contributing traits rather than on yield alone. Other genotypes such as P.075 and EC-399574 also exhibited promising performance, suggesting their potential suitability for cultivation and further evaluation across locations. The wide range of variation recorded for biochemical traits such as ascorbic acid, capsanthin, capsaicin, and chlorophyll content further indicates the possibility of improving both nutritional and industrial quality along with yield. From a practical perspective, the superior genotypes identified in this study can be directly recommended for cultivation in southern Telangana after limited multilocation testing to confirm their stability and farmer acceptability. These genotypes may also be effectively utilized as parental lines in future breeding programmes aimed at developing high-yielding varieties with improved quality attributes. Farmers in the region can benefit from adopting high-performing genotypes such as Warangal chapata to achieve enhanced productivity and better economic returns. Plant breeders are advised to exploit the observed variability by using superior

genotypes in hybridization programmes to combine high yield potential with desirable quality traits, thereby addressing both market and consumer preferences. Furthermore, the results underscore the importance of region-specific evaluation of chilli genotypes, as locally adapted genotypes are more likely to exhibit stable performance under variable climatic conditions. Overall, the findings of this investigation provide a strong scientific basis for varietal selection, targeted breeding, and informed decision-making in chilli improvement programmes, contributing to sustainable productivity enhancement and quality improvement of chilli cultivation in southern Telangana.

Acknowledgement

The author is thankful to SKLTSHU, for providing financial assistance in the form of a fellowship for pursuing the PG program. Authors also thank the other authors for supporting the research work in relevant field and for proof reading the manuscript. Assistance received from ICAR-NBPGR, RS Hyderabad for providing germplasm is also acknowledged by the author. The studies were conducted with the help of financial support aided by SKLTSHU.

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