Evaluation of chilli varieties for growth, yield and thrips incidence in Central Telangana Zone

ABSTRACT

Aim: To know the performance of chilli varieties for growth, yield and its attributing characters, incidence of thrips and leaf curl index at Central Telangana Zone.
Study design: Randomized Block Design with three replications.
Place and Duration of Study: Regional Agricultural Research Station, Warangal, Central Telangana Zone, Professor Jayashankar Telangana State Agricultural University, *Kharif* 2019-20 and 2020-21.
Methodology: Ten chilli varieties namely Surajmukhi, Muchia, LCA-616, Bullet, Bor, Byadgi Kaddi, LCA-625, LCA-960, LCA-620, and Teja were sown in raised bed nursery and transplanted in the main field by following all the recommended package of practices. Observations were made on five randomly selected tagged plants from each variety and replicated for evaluation of characters like plant height, canopy spread, number of branches per plant, number of leaves per plant, chlorophyll content, fruit length, fruit width, ripe fruit colour, fruit shape at pedicel attachment, fruit position, fresh fruit weight, dry fruit weight, number of fruits per plant, dry fruit yield, mean thrips population and upward leaf curl index.
Results:
Out of ten chilli varieties, the dry chilli yield was found to be significantly higher in Teja (26.13 q/a) and on par results were noticed in Surajmukhi (25.12 q/a), whereas lowest dry chilli yield was observed in variety Bor (4.47 q/a). Thrips incidence and leaf curl index was found to be significantly lowest in Muchia. The trend indicates that the higher yield depends on the average fruit weight and number of fruits per plant.
Conclusion: Teja and Surajmukhi yielded more dry chilli. Whereas the variety Muchia has shown lowest incidence of thrips and leaf curl index. Hence, these varieties have scope for future crop improvement programme.

Keywords: Dry chilli yield, leaf curl index, leaf chlorophyll, mean thrips population, evaluation of chilli varities.

1. INTRODUCTION

Chilli (*Capsicum annum* L.) is the most common and important spice crop of India that belongs to the family Solanaceae. Chillies are rich in proteins, minerals like Ca, Mg, P, K, Cu and S and vitamins like Thiamine, Riboflavin and Vitamin C. It is a major ingredient in curry powder. Chilli is a good source of oleoresin and natural color extracts of chilli are also finding their increased value in place of artificial colors in the food items. The pungency of chilli is due to white crystalline acrid volatile alkaloid called capsaicin, present dominantly in the placenta of fruit [1].

Chilli is an important valuable commercial spice-cum-vegetable crop grown in India under diversified climatic conditions [2]. It is cultivated in all the states and union territories of the country. India is a leading producer, consumer and exporter of chilli in the world. In India, the area and production of chilli was found to be 7.42 lakh ha and 19.14 lakh tons respectively for the year 2020-21 [3]. Telangana State stands second in area and production with 433.12 metric tons which accounts to 23.11% of share [4]. In India, only two species of genus *Capsicum* are well known i.e., *C. annum* and *C. frutescens*. Majority of the cultivated varieties belongs to *C. annum* [5].

Large variability was observed in chilli with respect to fruit size, shape and growth among the varieties which were evaluated for the study under Central Telangana Zone of Telangana state. These varieties were collected from different states with varying characters. Hence, there is a need to evaluate these chilli varieties under Telangana condition for their growth, yield, yield attributing characters and resistance to thrips to using in breeding programme.

Thrips is a major pest of chilli plants. Thrips attacks on chilli plants can cause upward leaf curling. Thrips are mainly seen on the lower surface of the leaves and they suck the sap from the leaves and make them curl upwards. Thrips attack in the early stages of the crop leads to stunted growth and can also affect flower and fruit production. The affected fruits become malformed and reduced in size which leads to reduction in the yield.

2. MATERIAL AND METHODS

The experiment was conducted on ten different chilli varieties namely Surajmukhi, Muchia, LCA-616, Bullet, Bor, Byadgi Kaddi, LCA-625, LCA-960, LCA-620, and Teja during the year 2019-20 and 2020-21 at the Regional Agricultural Research Station, Warangal, Professor Jayashankar Telangana State Agricultural University, Central Telangana Zone of Telangana State, India. In Central Telangana Zone, annual rainfall ranges from 779 mm to 1213 which was received mostly from south west-monsoon. During this season maximum temperature ranges between 29^0 C and 39^0 C. The predominant soils of the zone are red shallow gravelly soils (12.4%). All the recommended package of practices and plant protection measures were followed to raise a healthy crop. A raised bed nursery was prepared and the seeds of ten chilli varieties were sown separately in the lines. For healthy growth of the seedlings in the nursery bed 19:19:19 was sprayed at the rate of 3 grams per litre of water. Thirty (30) days after sowing, the healthy and uniform seedlings were selected for transplanting. In order to prevent the damage to the seedlings light irrigation was given before uprooting.

The land was prepared into fine tilth by thorough ploughing and transplanted in the evening. The experiment was laid out in Randomized Block Design with three replications with spacing of 65 cm between the rows and 45 cm between the plants. A basal dose of 300 kg nitrogen, 60 kg phosphorous and 120 kg potash per hectare was applied. Half of the

nitrogen and full dose of phosphorus and potash were applied as a basal dose at the last ploughing.

Remaining half quantity of nitrogen was applied in two split doses at 30 and 60 days after transplanting. Micronutrient supplements were sprayed at 30 days interval. Observations were made on five randomly selected plants from each variety across the replications as per the guidelines given by National Bureau of Plant Genetic Recourses, New Delhi and The International Plant Genetic Resources Institute (IPGRI), Rome, Italy and detailed in Table 1 and 2.

Table 1. Quantitative characters of chilli varieties

Character	**Remarks**
Plant height (cm)	Measured from ground level (base) to tip of the plant for 5 plants each with the help of measuring tape.
Canopy spread (cm)	Taken 5 plants and measured the East west & North south directions of the crown.
Plant growth habit	Visual observation (Spreading/upright) as per NBPGR descriptors
Branches plant^{-1}	Total number of branches per plant was counted in 5 randomly selected plants.
Leaves plant^{-1}	Total number of leaves per plant were counted and the average was done for 5 randomly selected plants
Leaf chlorophyll (SPAD reading)	The average of 10 leaves per plant was obtained by using SPAD meter from 5 randomly selected plants based on which chlorophyll was calculated.
Leaf length (cm)	Entire leaf blade was measured from 10 mature leaves in 5 randomly selected plants
Leaf width (cm)	Width of 10 mature leaves from 5 randomly selected plants was measured at the broadest point of the leaf
Fruit position	Visual observation (downward/upward) as per NBPGR descriptors
Fruit shape at pedicle attachment	Visual observation (Acute/round) as per NBPGR descriptors
Fruit length (cm)	Length of 10 fruits each from 5 randomly selected plants was measured by using measuring scale
Fruit width (cm)	Width of 10 fruits each from 5 randomly selected plants was measured by using vernier calliper
Fresh fruit weight (g)	Weight of 10 fresh fruits each from 5 randomly selected plants was measured by using electronic weighing balance.
Dry fruit weight (g)	Weight of 10 randomly selected dry fruits from 5 randomly selected plants was measured by using electronic weighing balance.
Fruits plant^{-1}	The total number of fruits per plant from 5 randomly selected plants was counted and averaged.
Yield (tones acre^{-1})	Total number of fruits per plant were weighed in every picking from the 5 randomly selected plants in all the treatments and replications.
Mean thrips population	Counted number of thrips on top three young leaves of 5 randomly selected plants.

Table 2. Standard procedure for scoring leaf curl index (LCI) [6]

LCI	Category	Symptoms
0	Immune (I)	No symptom (No curling, completely healthy plant)
1	Resistant (R)	1 to 25% leaves plant^{-1} show curling, less damage.
2	Moderately Resistant (MR)	26 to 50% leaves plant^{-1} show curling, moderately damage.
3	Susceptible (S)	51 to 75% leaves plant^{-1} show curling, heavily damaged, malformed growing points and reduction in plant height.
4	Highly Susceptible (HS)	>76% leaves plant^{-1} show curling, severe and complete destruction of growing points, and drastic reduction in plant height, defoliation and severe malformation.

3. RESULTS AND DISCUSSION

3.1 Growth characters

The plant height (Table 3) ranged from 76.027 cm to 116.117 cm. Significantly maximum plant height was found in Bor (116.117 cm) followed by Kaddi (103.317cm) which is on par with LCA-620 (102.583 cm) and the least plant height was noticed in Muchia (76.027 cm) followed by LCA-616 (91.868 cm). Significantly highest canopy spread was found in Muchia (82.087 cm) followed by Teja (76.533 cm) which is on par with LCA-620 (75.717 cm) and Surajmukhi (72.805 cm) and the lowest canopy spread was observed in Bor chilli (60.448 cm) followed by LCA-616 (69.198 cm).

The number of branches per plant was found to be significantly higher in Teja (40.233) followed by LCA-620 (36.233) which is on par with Muchia (36.050) and the lowest number of branches was observed in bor (24.983) which is on par with LCA-960 (25.633), LCA-616 (26.567), bullet (27.067) and Surajmukhi (27.667). Number of leaves per plant (Table 3) was found to be significantly highest in LCA-625 (358.510) which is followed by Surajmukhi (335.50) and lowest number of leaves per plant was observed in LCA-960 (116.967). The chlorophyll readings ranged from 53.340 to 68.425 (SPAD values). Significantly highest chlorophyll content was recorded in LCA-625 (68.425) followed by LCA - 616 (63.997) where as the lowest chlorophyll content was recorded in Bor (53.340) which is on par with Khaddi (54.636) and Muchia (55.967).

The leaf length readings ranged from 6.683 cm to 9.835 cm. The leaf length was significantly highest in the Kaddi (9.835 cm) which is on par with Teja (9.732 cm). Significantly the leaf length was found to be lowest in Bullet (6.683 cm) which is on par with Surajmukhi (6.900 cm).The width of leaf was found to be significantly highest in Khaddi (4.753 cm) and narrowest leaf was observed in Surajmukhi (2.978 cm) which is on par with LCA-625 (3.163 cm), LCA-616 (3.325 cm), Bullet (3.387 cm) and Muchia (3.438 cm).

Spreading habit was observed in the varieties of Surajmukhi, Muchia and Bullet and upright plant growth was observed in remaining all other varieties. The fruit position was found to be upward in the variety Surajmukhi and downward in all other remaining varieties. The fruit shape at pedicle attachment was observed acute in the varieties like Muchia, LCA-625, Teja and round in remaining other varieties.

There is a lot of variation in growth of chilli plants which has influence on its final performance. The difference observed in growth parameters in all the genotypes is due to genetic makeup of genotypes with environment, genetic variability, environment and type of soil in Telangana region. These findings are in accordance with earlier findings of [7], [8], [9].

Table 3. Growth characters of chilli varieties under Central Telangana Zone.

Varieties	Plant height (cm)	Canopy spread (cm)	No. of branches	No. of leaves	Chlorophyll (SPAD reading)	Leaf length (cm)	Leaf width (cm)
Surajmukhi	94.083	72.805	27.667	335.500	58.729	6.900	2.978
Muchia	76.027	82.087	36.050	187.883	55.967	7.578	3.438
LCA-616	91.868	69.198	26.567	282.867	63.997	7.550	3.325
Bullet	92.181	71.700	27.067	226.950	57.539	6.683	3.387
Bor	116.117	60.448	24.983	162.610	53.340	8.593	3.882
Khaddi	103.317	71.400	33.067	135.550	54.636	9.835	4.753
LCA-625	93.028	70.783	31.767	358.510	68.425	7.388	3.163
LCA-960	96.377	71.125	25.633	116.967	59.701	8.138	3.617
LCA-620	102.583	75.717	36.233	172.183	57.196	7.817	3.855
Teja	95.708	76.533	40.233	215.350	57.598	9.732	4.112
CD(P=.05)	5.923	3.493	2.922	8.174	3.005	0.447	0.608
SEM ±	1.978	1.167	0.976	2.730	1.004	0.149	0.203

3.2 Yield and yield contributing characters

The longest fruit was noticed in Khaddi (8.249 cm) followed by Teja (7.493cm) which is on par with LCA-960 (7.142 cm). Fruit width (Table 4) was significantly highest in Bor (2.385 cm) which is followed by Khaddi (1.737 cm) and the lowest fruit width was observed in LCA-625 (0.627 cm). Significantly maximum fresh fruit weight (17.337 g) and dry fruit weight (2.22 g) was recorded in Kaddi followed by LCA-960 with a fresh fruit weight of 9.787 g and dry fruit weight of 2.045 g. The minimum fresh fruit weight (Table 4) was recorded in Bullet (3.582 g) and dry fruit weight was observed in Teja (0.683 g) which is on par with Muchia (0.790 g). The significantly highest number of fruits per plant was observed in Teja (99.65) followed by Muchia (91.733) and lowest number was observed in Bor (16.033) followed by Khaddi (26.032) which is on par with LCA-960 (27.200). The highest yield per acre (26.133 q) was observed in Teja which is on par with Surajmukhi (25.120 q) and lowest yield per acre was observed in Bor (4.473 q) which is followed by Khaddi (11.750 q).

A lot of variation was observed in number of fruits per plant among the different genotypes. Such variation in chilli genotypes for number of fruits per plant was also noticed by [10], [9], [11], [8], [12 -14].The variation in chilli fruit length was also reported by [15], [16], [14], [17-21]. Variation in fruit yield per acre might be due to number of fruits per plant and fruit weight. Similar results were reported by [14], [22]. Indirect effect on yield by number of branches per plant and plant spread were reported by [8]. The yield variations occurred among the genotypes, varieties and hybrids under varying field conditions have been reported by [23].

Table 4. Yield and yield contributing characters of chilli varieties under Central Telangana Zone.

Varieties	Fruit length (cm)	Fruit width (cm)	Fresh fruit weight (g)	Dry fruit weight (g)	No. of fruits plant^{-1}	Yield (q/acre)
Surajmukhi	3.686	1.557	4.027	1.052	82.050	25.120
Muchia	4.107	1.245	4.183	0.790	91.733	22.200
LCA 616	5.606	1.577	7.465	0.990	40.782	19.243
Bullet	2.518	1.695	3.582	1.073	75.167	22.313
Bor	2.637	2.385	5.432	1.318	16.033	4.473
Khaddi	8.249	1.737	17.337	2.220	26.032	11.750
LCA 625	6.642	0.627	4.047	0.990	90.867	22.217
LCA 960	7.142	1.663	9.787	2.045	27.200	12.060
LCA 620	6.005	0.937	4.545	1.608	35.333	17.240
Teja	7.493	0.873	4.073	0.683	99.650	26.133
CD(P=.05)	0.457	0.218	0.292	0.110	5.567	2.547
SEM±	0.153	0.073	0.098	0.037	1.859	0.851

3.3 Mean thrips population and leaf curl index

Minimum thrips population (Table 5) was noticed in Muchia (2.978) and maximum thrips population was observed in LCA-960 (8.765) which is on par with LCA-616 (8.523). Leaf curl index was low (21.920) in Muchia (represents Resistance to Leaf curl) followed by Surajmukhi (28.523) (Represents moderately tolerant to leaf curl). Highest leaf curl index was observed in LCA-616 (84.080) followed by LCA-960 (77.777) indicating that the varieties are highly susceptible to leaf curl.

Table 5. Mean thrips population and leaf curl index of chilli varieties

Varieties	Mean thrips population	Leaf curl index
Surajmukhi	4.363	28.523
Muchia	2.978	21.920
LCA 616	8.523	84.080
Bullet	4.347	39.582
Bor	7.075	76.537
Khaddi	5.628	55.243
LCA 625	6.097	46.717
LCA 960	8.765	77.777
LCA 620	6.845	73.277
Teja	5.395	46.130
CD(P=.05)	0.346	2.827
SEM±	0.115	0.944

The variation in thrips attack may be due to differential load of thrips population on different genotypes based on the morphological and biochemical variations in plants. The genotypes which are highly susceptible may be more preferred by the thrips due to thin leaf, low chlorophyll and phenol content might have favored more thrips population and thrips feeding damages the leaves, reducing the photosynthetic capacity, resulting in reduced fruit size and production [24]. Other factors beyond the scope of the investigations might also be the key factors of resistance to the thrips.

4. CONCLUSION

The performance of different chilli genotypes showed wide variation in plant height, number of branches plant^{-1}, number of fruits plant^{-1}, fruit length, fruit width, fresh fruit weight, dry fruit weight, and yield under Central Telangana Zone climatic conditions. Among the genotypes evaluated two of them viz., Teja and Surajmuki were found to be promising based on yield and yield attributes whereas Muchia was found to be promising as it is resistant to thrips. Hence, they may be used in future breeding programme.

REFERENCES

1. Katheek R, Bharadwaza, Prasad VM, Adinarayana M, Narayana Swamy G. Evaluation of chilli (*Capsicum annuum* L.) genotypes for yield and yield attributes in Allahabad agro-climatic conditions. *International Journal of Current Microbiology and Applied Sciences*. 2018, (Special Issue-7):773-776.

2. Hazra P, Chattopadhyay A, Karmakar K and Dutta S. Modern Technology in Vegetable Production, New India Publishing Agency, New Delhi, India. 2011. p. 478.

3. www.Indiastats.com

4. NHB, National Horticulture Board- Area and production. http://www.nhb.gov.in.2021

5. Yatagiri N, Telugu RK, Shafiqurrahaman M and Sanap PB. Evaluation of chilli genotypes for yield attributing and incidence of leaf curl and white fly traits in coastal Maharashtra, *India. International Journal of Current Microbiology and Applied Sciences*. 2017, 6(9): 3140-3148

6. Vijayalaksmi P, Singh TVK, Shashibhushan V, Reddy RVSK., Bharati N.Bhat. Survey on insect pests of capsicum (*Capsicum annum* L. var. grossum Sendt.) and management of thrips under polyhouse conditions. The *Journal of Research ANGRAU*. 2017, 45(3): 36-45

7. Nandadevi and Hosamani RM. Variability correlation and path analysis in *Kharif* grown chilli (*Capsicum annuum* L.). Capsicum and Eggplant Newsletter. 2003, 22:43-46.

8. Tembhurne BV, Revenappa and Kuchanur, PH. Varietal performance genetic variability and correlation studies in chilli (*Capsicum annum* L.). *Karnataka Journal of Agricultural Sci*ences. 2008, 21 (4): 541-543.

9. Smitha RP, Basavaraja N. Variability and correlation studies in chilli (*Capsicum annum* L.). *Journal of Agricultural Sci*ences*.* 2006, 19(4):888-891.

10. Sreelathakumary I and Rajamony L. Variabity heritability and genetic advance in chilli (*Capsicum annum* L.). *Journal of Tropical Agriculture.* 2004, 42(1-2): 35-37.

11. Sandeep DP, Bidari BI, Shashidhara GB and Hanamashetti SI. Evaluation of chilli genotypes for ghataprabha left bank command area in karnataka. *The Asian Journal of Horticulture*. 2008, 3(2): 356-360.

12. Ajjappalavara PS and Channagoudra RF. Studies on variability, heritability and genetic advance in chilli (*Capsicum annuum* L.). *Asian Journal of Horticulture.* 2009, 4(1): 99-101.

13. Pramila, Singh DK and Jain SK. Evaluation of exotic and indigenous genotypes of chilli (*Capsicum annuum* L.) under foot hills of Himalayas during summer season. Pantnagar *Journal of Research*. 2009, 7(1),

14. Chattopadhyay AA., Sharangi AA., Dai N and Dutta S. Diversity of genetic resources and genetic association analyses of green and dry chillies of eastern India. *Chilean journal of Agricultural Research*. 2011 : 71(3)

15. Dahal KC, Sharma MD, Dhakal D and Shakya SM. Evaluation of heat tolerant chilli (*Capsicum annuum* L.) genotypes in Western terai of Nepal. *Journal of Institute of Agriculture and Animal Sciences.* 2006, 27:59-64.

16. Cheema DS,Jindal SK, Dhaliwal MS., Evaluation of chilli hybrids developed by using genetic male sterility. *Haryana Journal of Horticultural Sciences.* 2010, 39 (3&4): 321-325.

17. Saravaiya SN., Koladiya PB., Patel PB., Patel DA., Parmar VL and Patel J.B. Evaluation of different genotypes of chilli through IET under South Gujarat conditions. *The Asian Journal of Horticulture*, 2011, 6(1): 71-73

18. Shiva KN, Zachariah TJ, Leela NK and Mathew PA. Performance of paprika and paprika alike chillies (*Capsicum annuum* L.). *Journal of Spices and Aromatic Crops*. 2013, 22(2): 222-227.

19. Dhaliwal MS, Garg N, Jindal SK, Cheema DS. Growth and yield of elite genotypes of chilli (*Capsicum annum*.L.) in diverse agro climatic zones of Punjab. *Journal of Spices and Aromatic crops*. 2015, 24(2): 83-91.

20. Rohini N and Lakshmanan V. Evaluation of chilli hybrids for yield and related traits. *Trends in Biosciences*. 2014, 7(22): 3635-3638

21. Vijaya H.M, Gowda A.P.M, Nehru S.D, Jyothi K. Performance of chilli (*Capsicum annum* L.) genotypes for growth and Yield parameters in eastern dry zone of Karnataka. *Journal of spices and Aromatic Crops*. 2014, 23(2): 250-253

22. Sharma VK, Semwal CS and Uniyal SP. Genetic variability and character association analysis in bell pepper (*Capsicum annum*.L.). *Journal of horticulture and forestry*. 2010, 2 (3): 058-065.

23. Mishra TS, Mishra NK, Singh AK, Singh ND and Tripathi AN. Performance of different genotypes of chilli (*Capsicum annum* L.) under Allahabad agro-climatic condition. *Journal of Krishi Vigyan*. 2017, 6(1): 141-144.

24. Shipp JL, Hao, X, Papadopoulos AP,Binns MR. Impact of western flower thrips (Thysanoptera: Thripidae) on growth, photosynthesis and productivity of green house sweet pepper. *Scientia Horticulturae*.1998; 72: 87-102.