



Studies On Heterosis For Yield And Yield Contributing Characters In Chilli (*Capsicum annuum* L.)

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ABSTRACT

Hingoli Local x G-4 (-26.49%) recorded highest significant was carried out during summer- 2018 at Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to study the heterosis per cent for yield and yield contributing characters. The 21 F₁ hybrids along with their seven parent were evaluated. Observations were recorded on five randomly selected tagged plants from each treatment for yield and yield attributing characters viz. Plant height, plant spread, Weight of fruit, length of fruit, fruit diameter, No. of fruits per plant, Wt. of fruits per plant, Wt. of fruit per plot and fruit yield per ha. The values of F₁ averaged over replications were used for estimating heterosis. Manifestation of heterosis of higher order for, length of fruit, weight of fruit, and fruit yield ha. The maximum heterosis over better parent for fruit yield ha was observed to be 34.62% and that over useful heterosis was found 104.93%. Three potential heterosis cross combinations viz. Hingoli Local x G-4, DCC-25 x G-4 and Pusa Jwala x DCC-25 were identified as promising for fruit yield per hectare.

Key words : chilli (*Capsicum annuum* L.), genotype, heterosis.

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is one of the valuable cash crop grown in India for its fruit and spice commerce. It belongs to the solanaceae family with chromosome number 2n=24. It is native of Tropical America. It is an indispensable spice essentially used in every Indian cuisine due to its pungency, spice, taste appealing colour and flavour. Chilli contribute about 33% of total spice export from India and share about 16% of the world spice trade. Chilli fruit are rich source of Vitamin A, C and E. Pungency of chilli is due to a crystalline acrid volatile alkaloid capsaicin, present in placenta of fruit.

The main goal of most of the plant breeding programme is to increase the yielding ability of crop plants. Information on various quantitative traits, particularly of those that contribute to yield will be useful in planning and successful implementation of the breeding programme. Hybridization is one of the means to increase yield and exploitation of heterosis is an efficient approach for improvement in chilli. This calls for taking stock of earlier work on the crop improvement aspect of chilli especially on heterosis breeding on which the present investigation is concerned.

Heterosis for yield and yield contributing characters has been reported in chilli by [1-6].

MATERIALS AND METHODS

The inbred lines of seven genotypes namely Pusa Jwala (P₁), Phule Jyoti (P₂), Hingoli Local (P₃), DCC-25 (P₄), BD-I (P₅), BD-II (P₆), G-4 (P₇) were selected for the purpose of crossing programme and sown in crossing block at Instructional-Cum Research Farm, Department of Horticulture, College of Agriculture, Latur. The 21 F₁ hybrids along with their seven parent were evaluated. Observations were recorded on five randomly selected tagged plants from each treatment for yield and yield attributing characters viz. plant height, plant spread, No. of primary branches per plant, days to first flowering, days to 50% flowering, Wt. of fruit, length of fruit, fruit diameter, pedicel length, number of fruits per plant, weight of fruit per plant, weight of fruit per plot, fruit yield per hectare. The values of F₁ averaged over replications were used for estimating heterosis. The magnitude of heterosis was calculated as percentage increase or decrease of F₁

mean over the mean of better parent (BP) and *per cent* superiority over standard hybrid check were calculated. The analysis of variance, for all traits under study, was carried out the method.

RESULT AND DISCUSSION

Analysis of variance for yield and yield component in Table 1. The treatment means were further sub divided in to parents, crosses and parent versus crosses. The parents showed significant differences for all the characters.

Negative heterosis was considered as desirable for days to first flowering, days to 50 *per cent* flowering and pedicel length. For the rest of characters positive heterosis was considered desirable.

The crosses DCC-25x BD-II (6.67%), PhuleJyotixBD-I (6.16%), PhuleJyotix DCC-25 (6.08%), and PhuleJyoti x BD-II (6.00%) exhibited positively significant heterosis over better parent. The highest percentage significant heterosis recorded by the cross PusaJwala x Hingoli Local(2.81%), PusaJwala x G-4(2.50%) and PusaJwala x PhuleJyoti(1.25%) over standard hybrid check for plant height [4].

The best performing hybrid PusaJwala x Hingoli Local (17.39%) exhibited highest positive significant heterosis followed by BD-I x G-4 (12.50%), PhuleJyoti x DCC-25(10.74%) and PusaJwala x G-4 (8.33%) over better parent. The cross combinations Hingoli Local x BD-II (5.77%) and PhuleJyoti x DCC-25 (5.77%) showed significantly highest *per cent* of positive heterosis over standard hybrid check for plant spread.

The crosses DCC-25 x G-4 (44.58%) exhibited highest positive significant heterosis Followed by Hingoli Local x BD-II (40.00), PusaJwala x PhuleJyoti (32.00%) and Jwala x Hingoli Local (30.00%), showed significantly highest *per cent* of positive heterosis better parent. The cross combination Hingoli Local x BD-I(7.69%), showed significantly highest *per cent* of positive heterosis over standard hybrid check for the number of primary branches.

PhuleJyoti x DCC-25 (-32.58%) recorded highest significant negative heterosis followed by PhuleJyoti x Hingoli Local (-23.81%) and Hingoli Local x DCC-25(-21.35%), over better parent. Whereas, the cross combination PhuleJyoti x Hingoli Local (-4.48%) recorded highest significant negative heterosis followed by PhuleJyoti x DCC-25 (-10.45%), over standard hybrid check [5].

negative heterosis followed by DCC-25 x G-4 (-20.53%), BD-IIx G-4 (-17.88%) and PhuleJyoti x G-4(-17.88%) over better parent. Whereas, the cross combination DCC-25 x BD-I (-5.00%) and Hingoli Local x BD-II (-4.17%), recorded highest significant negative heterosis over standard hybrid check for days to 50 *per cent* flowering [5].

The crosses Hingoli Local x BD-II (30.77%) exhibited highest positive significant heterosis followed by PusaJwala x Hingoli Local(23.08%), Hingoli Local x G-4 (21.67%) and DCC-25 x G-4(20.00%) showed significantly highest *per cent* of positive heterosis better parent. The cross combination Hingoli Local x G-4(21.67%) and DCC-25 x G-4 (20.00%), showed significantly highest *per cent* of positive heterosis over standard hybrid check for the weight of fruit.

The cross combination PhuleJyoti x Hingoli Local (16.71%) exhibited significantly highest positive heterosis followed by BD-I x G-4 (11.43%), over better parent. Whereas, the cross combination BD-I x G-4 (14.04%), DCC-25 x BD-I (11.11%), showed significantly positive heterosis over standard hybrid check for length of fruit.

The cross combination PhuleJyoti x DCC-25 (50.00%) exhibited significantly highest positive heterosis followed by PhuleJyoti x Hingoli Local(36.05%) and PhuleJyoti x G-4 (23.53%), over better parent. Whereas, the cross combination PhuleJyoti x DCC-25 (25.58%) and PhuleJyoti x BD-I (20.93%), showed significantly positive heterosis over standard hybrid check for diameter of fruit [2, 3].

For pedicel length the cross combination DCC-25 x BD-II (-58.29%) and DCC-25 x BD-I (-50.57%) showed significantly negative heterosis over better parent. Whereas, the cross combination PusaJwala x BD-I (-37.73%), PusaJwala x DCC-25 (-33.44%), BD-I x G-4 (-32.21%) and BD-I x BD-II (-31.60%) recorded significant heterosis over standard hybrid check. Similar result were obtained byKamble*et al.* (2009).

For number of fruits per plantThe cross combination Hingoli Local x DCC-25 (46.15%) recorded highest significant heterosis followed by the crosses PhuleJyoti x G-4(42.95%) and Hingoli Local x BD-I(42.86%) over better parent. Similar result reported by Rohini and Lakshmanan (2017).

The crosses DCC-25 x G-4 (97.91%) followed by Hingoli Local x G-4 (96.46%) and PusaJwala x DCC-25(82.92%) exhibited highest positive significant heterosis over better parent. Whereas, over standard hybrid check, the crosses DCC-25 x G-4 (17.31%), Hingoli Local x BD-I (10.58%), Hingoli Local x G-4 (8.75%) and PusaJwala x DCC-25 (8.43%), exhibited highest positive heterosis for yield of fruit per plant. Similar result are reported by Mopidevi *et al.* [1].

The crosses DCC-25x G-4(98.07%) followed by Hingoli Localx G-4(94.97%) and PusaJwalax DCC-25(83.43%), showed highest positive significant heterosis over better parent. The crosses DCC-25 x G-4

(17.16%), PusaJwala x DCC-25 (8.50%) and BD-Ix G-4(5.56%) showed positive superiority of heterosis over standard hybrid check for fruit yield per plot. Similarly result obtained by Mopidevi *et al.* [1]. The crosses Hingoli Local x G-4 (104.93%) followed by DCC-25 x G-4 (98.20%) and PusaJwala x DCC-25 (83.35%) exhibited highest positive significant heterosis over better parent. The crosses DCC-25 x G-4 (15.98%), Hingoli Local x G-4(12.40%), Hingoli Local x BD-II (9.90%) exhibited positive superiority of heterosis over standard hybrid check for fruit yield per hectare.

Table: 1 Analysis of variance for different characters in 7x7 half diallel of chilli.

Source	d.f.	Plant height(cm)	Plant spread (cm ²)	Number of primary branches / plant	Days to first flowering	Days to 50 per cent flowering	Fruit wt. (g)	Fruit length (cm)	Fruit diameter (mm)
Treatment	27	72.04**	126.01**	1.05*	32.26**	49.53**	0.058**	1.62**	5.55**
Parent	6	43.57**	1.2.16**	0.66	28.40**	54.66**	0.034*	3.42**	5.28**
Crosses	20	83.40**	134.82**	0.57	34.21**	48.32**	0.057**	1.04**	5.16**
P x C	1	15.79	93.00**	13.09**	16.40	43.00	0.23**	2.53**	15.03**
Error	27	7.86	7.22	0.46	5.28	3.11	0.01	0.27	0.86

Source	d.f.	Pedicle length (cm)	Number of fruits/ plant	Yield / plant (kg)	Yield / plot (kg)	Yield / ha (q)	% incidence of thrips	% incidence of leaf curl
Treatment	27	0.36**	1527.37**	7847.71**	2.56**	1022.56**	36.46**	51.31**
Parent	6	0.40**	703.97**	1954.49*	0.16	118.63	37.40**	84.11**
Crosses	20	0.31**	912.01**	2871.57**	1.41**	438.87**	37.97**	44.01**
P x C	1	0.93**	18774.86**	1142730.10**	39.89**	18119.96**	0.72	0.48
Error	27	0.03	177.59	704.46	0.24	69.49	3.63	4.90

* and ** significance at 5% and 1% level

Table: 2 Per cent heterosis over better parent and standard hybrid check for different characters in 7x7 half diallel of chilli.

Parent/ Crosses	Plant height (cm)		Plant spread (cm ²)		Number of primary branches / plant		Days to first flowering	
	BP	SH	BP	SH	BP	SH	BP	SH
PusaJwala x PhuleJyoti	2.21*	1.25*	5.80*	-6.41	1.94	0.00	-4.88	16.42*
PusaJwala x Hingoli Local	3.79*	2.81*	17.39**	3.85*	30.00*	0.00	-4.76	19.40**
PusaJwala x DCC-25	1.26	0.31	2.01	-2.56	30.00*	-7.69	-14.61**	13.43
PusaJwala x BD-I	-2.21	-3.13	-6.25	-3.85	7.14	-20.77	-2.44	19.40**
PusaJwala x BD-II	-2.21	-3.13	4.11*	-2.56	3.00	-7.79	-3.66	17.91*
PusaJwala x G-4	3.47*	2.50*	8.33*	0.00	20.00*	-7.69	-12.20*	7.46
PhuleJyoti x Hingoli local	0.64	-1.25	-25.20**	-41.03**	16.50	-7.69	-23.81**	-4.48*
PhuleJyoti x DCC-25	6.08*	-1.88	10.74**	5.77*	16.50	-5.38	-32.58**	-10.45*
PhuleJyoti x BD-I	6.16*	-3.13	-3.75	-1.28	9.92	0.00	-8.33	-1.49*
PhuleJyoti x BD-II	6.00*	-0.83	0.00	-6.41	26.21*	-6.15	0.00	4.48
PhuleJyoti x G-4	-13.51**	-20.00**	5.56*	-2.56	18.45*	-15.38	-10.00*	7.46
Hingoli Local x DCC-25	-0.64	-2.50	-2.01	-6.41	10.00	-15.38	-21.35**	4.48
Hingoli Local x BD-I	-3.18	-5.00	-5.00	-2.56	-1.79	7.69*	-16.67**	4.48
Hingoli Local x BD-II	-1.91	-3.75	13.01**	5.77*	40.00**	-2.31	-4.76	19.40**
Hingoli Local x G-4	-28.66**	-3.00**	2.08	-5.77	27.00	-19.23	3.57	29.85**
DCC-25 x BD-I	-6.76	-13.75**	-28.13**	-26.28**	-6.25	-16.15	-3.37	28.36**
DCC-25 x BD-II	6.67*	0.00	0.67	-3.85	21.11*	-7.69	-2.25	29.85**
DCC-25 x G-4	-5.41	-12.50**	-10.07**	-14.10**	44.58*	-6.15	2.81	36.57**
BD-I x BD-II	-4.00	-10.00**	-11.25**	-8.97**	8.93	-17.69	11.11	19.40**
BD-I x G-4	1.35	-8.75*	12.50*	-1.26**	-4.46	-23.08*	-12.50*	4.48
BD-II x G-4	-4.00	-10.00**	0.68	-5.77	11.11	-19.23	-12.50*	4.48
S.E.D. _±	2.80	2.80	2.68	2.68	0.84	0.84	2.29	2.29
C.D at 5%	5.84	5.84	5.60	5.60	1.42	1.42	4.79	4.79
C.D. at 1%	7.76	7.76	7.44	7.44	1.89	1.89	6.36	6.36

Table 3. Per cent heterosis over better parent and standard hybrid check for different characters in 7x7 half diallel of chilli.

Parent/ Crosses	Days to 50 per cent flowering		Fruit weight (g)		Length of fruit (cm)		Diameter of fruit (mm)	
	BP	SH	BP	SH	BP	SH	BP	SH
Pusajwala x Phulejyoti	-4.65	2.50	-9.09	0.00	-7.50	-13.45*	-2.37	-23.26*
Pusajwala x Hingoli Local	-5.38	2.50	23.08**	6.67	0.00	-6.43	12.43*	-11.63
Pusajwala x DCC-25	-4.65	2.50	14.29	6.67	-0.59	-1.17	6.94	-10.47
Pusajwala x BD-I	6.20*	14.17**	-7.14	-13.33	-18.29**	-16.37*	-11.02	-2.33
Pusajwala x BD-II	9.30**	17.50**	7.69	-6.67	21.36	-16.37*	-21.54*	-28.84**
Pusajwala x G-4	-9.93**	13.33**	-16.67*	-16.67*	10.63	3.51	11.76	-11.63
Phulejyoti x Hingoli local	-10.00**	-2.50*	3.03	13.33*	16.71*	-5.26	36.05**	-6.98
Phulejyoti x DCC-25	-7.81**	-1.67	0.00	10.00*	-7.06	-7.60	50.00**	25.58**
Phulejyoti x BD-I	-4.03	-0.83	-3.03	6.67	-8.57	-6.43	10.17	20.93*
Phulejyoti x BD-II	10.74**	11.67**	0.00	10.00*	-12.25*	-7.02	2.56	-6.98
Phulejyoti x G-4	-17.88**	3.33	-15.15*	-6.67	1.90	-5.85	23.53*	-2.33
Hingoli Local x DCC-25	-3.85	4.17	14.29	6.67	-4.71	-5.26	22.22*	2.33
Hingoli Local x BD-I	-6.92*	0.83	0.00	-6.67	-5.71	-3.51	1.69	11.63*
Hingoli Local x BD-II	-11.54**	-4.17*	30.77**	13.33	-7.28	-1.75	-23.08*	-30.23**
Hingoli Local x G-4	-26.49**	07.50*	21.67**	21.67**	-8.23	-15.20*	0.00	-20.93*
DCC-25 x BD-I	-10.94**	-5.00*	-7.14	-13.33	8.57*	11.11*	-29.66**	-22.79*
DCC-25 x BD-II	17.19**	25.00**	0.00	-6.67	-3.42	2.34	-7.18	-15.81
DCC-25 x G-4	-20.53**	0.00	20.00**	20.00**	5.88*	5.26*	20.56*	0.93
BD-I x BD-II	5.65	9.17**	14.29**	6.67	-6.73	-1.17	-5.08	4.19*
BD-I x G-4	21.85**	-1.67	13.33*	13.33*	11.43*	14.04*	-8.90	0.00
BD-II x G-4	-17.88**	3.33	13.33*	13.33*	0.44	6.43*	-5.64	-14.42
S.E.D.±	1.76	1.76	0.10	0.10	0.51	0.51	0.92	0.92
C.D. at 5%	3.68	3.68	0.21	0.21	1.45	1.45	1.93	1.93
C.D. at 1%	4.88	4.88	0.28	0.28	1.08	1.08	2.57	2.57

Table 4. Per cent heterosis over better parent and standard hybrid check for different characters in 7x7 half diallel of chilli.

Parent/ Crosses	Pedicel length (cm)		Number of fruits per plant		Fruit yield per plant(g)		Fruit yield per plot (kg)		Yield/ha (q)	
	BP	SH	BP	SH	BP	SH	BP	SH	BP	SH
Pusajwala x Phulejyoti	-6.44	-15.34*	-3.23	-28.57**	22.57	-20.64*	26.26	-18.30*	14.00	-26.93**
P. Jwala x Hingoli Local	-8.77	-20.25**	3.23	-23.81**	46.31**	-19.011	48.97**	-17.48*	45.90**	-19.98*
Pusajwala x DCC-25	-38.00**	-33.44**	38.71**	2.38	82.92**	8.43**	83.43**	8.50*	83.35**	7.29*
Pusajwala x BD-I	-25.64**	-37.73**	22.58*	-9.52	31.46*	-16.07	38.28	-11.76	26.71	-20.31**
Pusajwala x BD-II	-0.73	-16.87**	5.41	-11.90	69.20**	1.89	25.45	-18.46*	34.62**	-16.26*
Pusajwala x G-4	-12.82	-26.99**	23.87**	-8.57	42.92	-21.59*	44.41**	-15.52	50.16**	-22.37**
P. Jyoti x Hingoli Local	-13.56	-21.78**	7.69	-33.33**	20.13	-22.22*	20.08	-22.30*	19.80	-23.21**
Phulejyoti x DCC-25	-29.43**	-24.23**	19.23	-26.19**	41.24	-8.56	25.00	-19.12*	24.84	-19.98*
Phulejyoti x BD-I	-6.10	-15.03*	28.57**	-14.29*	20.55	-21.95*	45.96**	-5.56	45.76**	-6.57
Phulejyoti x BD-II	-12.54	-20.86**	11.11	-7.14	62.30**	5.08*	57.91**	5.15*	62.29**	4.02
Phulejyoti x G-4	-10.85	-19.33**	42.95**	1.43	34.88*	-12.67	41.41**	-8.50	41.22	-9.48
Hingoli Local x DCC-25	-20.57**	-14.72*	46.15**	-9.52	67.49**	-0.72	68.37**	-0.41	76.04**	3.01
Hingoli Local x BD-I	-16.49*	-26.99**	42.86**	-4.76	73.20**	10.58**	8.96	-30.47**	43.65	-9.65
Hingoli Local x BD-2	-12.98	-23.93**	13.96	-4.76	71.15**	3.07	66.87**	11.11	76.67**	9.90*

Hingoli Local x G-4	4.91	-8.28	24.16*	-11.90	96.46**	8.75**	94.97**	14.05	104.93**	12.40*
DCC-25 x BD-I	-50.57**	-46.93**	42.86**	-4.76	34.04*	-14.42	13.83	-27.37**	40.33	-11.74
DCC-25 x BD-II	-58.29**	-55.21	17.66*	-1.67	51.84**	-8.56	41.10**	-6.05	50.56**	-6.34
DCC-25 x G-4	-43.71**	-39.57**	34.23**	-4.76	97.91**	17.31**	98.07**	17.16*	98.20**	15.98*
BD-I x BD-II	-10.80	-31.60**	-3.13	-19.05**	47.06**	-6.11	33.50	-11.11	50.93**	-0.04
BD-I x G-4	11.60*	-32.21**	34.23**	-4.76	65.47**	5.65*	65.43**	5.56*	65.87**	4.32
BD-II x G-4	23.83**	-6.75	-8.83	-23.81**	49.67**	-9.86	33.50	-11.11	57.32**	-2.14
S.E.D.±	0.19	0.19	13.32	13.32	26.54	26.54	0.49	0.49	8.33	8.33
C.D at5%	0.40	0.40	27.79	27.79	55.36	55.36	1.02	1.02	17.38	17.38
C.D.at1%	0.54	0.54	36.92	36.92	73.53	73.53	1.36	1.36	23.09	23.09

* and ** significance at 5% and 1% level, BP-Better parent, SH-Standard hybrid check

CONCLUSION

From the above studies it can be concluded that the cross combination DCC-25 x G-4, PusaJwala x Hingoli Local, BD-I x G-4, recorded significant positive heterosis for most of the yield contributing characters.

REFERENCES

1. Mopidevi, M., Shreelathakumary and Celine, 2017. Heterosis studies for growth earliness, fruit yield and yield components in chilli (*Capsicum annum* L.). *Int. J. Curr. Microbiol. App. Sci*6(6):1330-1336.
2. Nandadevi and Hosamani, R. M., 2000. Estimation of heterosis, combining ability and per se performance in summer grown chilli (*Capsicum annum*L.) for yield and resistance to leaf curl complex. *Capsicum and Eggplant Newsletter*, 22: 59-62.
3. Narasimha Prasad, B. C., Madhavi Reddy, K. and Sadhasiva, A. T., 2003. Heterosis studies in chilli (*Capsicum annum*L.). *Ind. J. of Hort.* 60 (1): 69-74.
4. Nayaki, D. A. and Natarajan, S., 2002, Studies on heterosis for growth, flowering, fruit characters and yield in chilli (*Capsicum annum*L.). *South Indian Hort.* 50 (2): 78-81.
5. Prasath, D and Ponnuswami, V. 2008. Heterosis and combining ability for morphological, yield and quality characters in paprika type chilli hybrids. *Ind. J. of Hort.*65 (4):441-445.
6. Vaishnav, R.S., Shrivastava and Singh P.K.2010. Heterosis and combining ability in chilli for yield and yield contributing traits (*Capsicum annum* L.). *Asian J. of Bio Sci.* 4(2)244-248.

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