# Studies on Heterosis and Combiing Ability for Yield and Quality Attributing Traits in Chilli (Capsicum Annum L.) 

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#### Abstract

Seven lines and four testers were crossed in line $x$ tester mating design to evolve twenty-eight hybrids. These hybrids were studied along with their eleven parents for estimation of relative heterosis, heterobeltiosis and standard heterosis for Fruififteen characters. Observations were recorded on fifteen economically important traits viz., days to 50 percent flowering, plant height at maturity, plant spread, fruit length, fruit width, fruit pedicel length, placenta length, number of fruits per plant, fruit weight, number of seeds per fruit, 1000 seed weight, fruit yield per plant, ascorbic acid content, capsaicin content and capsanthin content. The hybrids $L_{4} \times T_{3}(L C A 625 \times G-4)$ is the best hybrids followed by $L_{7} \times T_{4}$ (Pant C-1 $\times L C A 678$ ) and $L_{7} \times T_{2}$ (Pant C-1 $\times$ K1) recorded significant standard heterosis for fruit yield per plant. Selection of hybrids for heterosis breeding based on per se performance, sca effects and standard heterosis will be more effective. It may be concluded that based on all the three criteria, the following three hybrids $L_{4} \times T_{3}(L C A 625 \times$ $G-4)$ and $L_{7} \times T_{4}($ Pant $C-1 \times L C A 678)$ and $L_{7} \times T_{2}($ Pant $C-1 \times K 1)$ were identified as the superior hybrids, among the twenty-eight hybrids evaluated.


Keywords: Heterosis, Hybrids, Fruits

## 1. Introduction

Chilli is one of the important spices and vegetable crops of the Solanaceae family. The species that comes under the Capsicum genus have been widely used in food as well as pharmaceutical industries. Chilli is valued for its pungency and colour aspects in food industries. Pungency is due to crystalline alkaloid called capsaicin present in placenta of fruits. The red colour of fruit is due to capsanthin. The occurrence of high cross pollination and adaptation to micro climatic condition has led do the formation of variants and land races within the species (Kehie et al. 2012). It is important to note that chilli peppers are a crop that thrives in warm weather conditions and are extremely vulnerable to frost. (Rodriguez-Rey et al. 2000).

Heterosis refers to the phenomenon that the two genetically dissimilar gametes or individuals are crossed, the resulting F1 hybrid may exhibit increased or decreased vigour compared to the better parent or mid-parental values. Shull (1908) referred to this phenomenon as the stimulus of heterozygosis and has interpreted it as increased "vigour", "size", "fruitfulness", "speed of development", and "resistant to disease and insect pests', manifested by the outbreeding organisms as compared with the corresponding inbreds and as specific results of the differences in the constitution of the uniting parental gametes.

## 2. Materials And Methods

The study entitled "Heterotic Studies in Chilli (Capsicum Annum L.) for Yield and Quality Attributing Traits" was conducted at the experimental fields of the Department of Genetics and Plant Breeding farm, Faculty of Agriculture, Annamalai University, Annamalainagar. This study took place between 2019 and 2021, at an altitude of 5.79 m above sea level and at the geographical coordinates of $11^{\circ} 24^{\prime} \mathrm{N}$ latitude and $79^{\circ} 41^{\prime} \mathrm{E}$ longitude.

Seven genotypes were used as lines (LCA 705-2( $\mathrm{L}_{1}$ ), Co-1 ( $\mathrm{L}_{2}$ ), Arka Lohit ( $\mathrm{L}_{3}$ ), LCA 625 ( $\mathrm{L}_{4}$ ), LCA $620\left(\mathrm{~L}_{5}\right)$, Pusa Jwala $\left(\mathrm{L}_{6}\right)$ and Pant C1 $\left(\mathrm{L}_{7}\right)$ and four genotypes were used as testers LCA 334( $\left.\mathrm{T}_{1}\right)$, K1
$\left(\mathrm{T}_{2}\right)$, G4 $\left(\mathrm{T}_{3}\right)$ and LCA $678\left(\mathrm{~T}_{4}\right)$ were crossed in a line x tester mating design resulting in twenty-eight $\mathrm{F}_{1}$ hybrids.

The observations were recorded for fifteen characters on randomly selected plants viz., days to 50 percent flowering, plant height at maturity, plant spread, fruit length, fruit width, fruit pedicel length, placenta length, number of fruits plant ${ }^{-1}$, fruit weight, number of seeds fruit ${ }^{-1}$, 1000 seed weight, fruit yield plant ${ }^{-1}$, ascorbic acid content, capsaicin content and capsanthin content.

## 3. Results and Discussion

## Days to $\mathbf{5 0}$ percent flowering

Eleven out of twenty-eight cross combinations recorded negatively significant relative heterosis for this character. The maximum relative heterosis was recorded with the cross $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$ followed by $\mathrm{L}_{6} \times \mathrm{T}_{2}($ Pusa Jwala $\times \mathrm{K} 1)$ and $\mathrm{L}_{6} \times \mathrm{T}_{1}($ Pusa Jwala $\times$ LCA 334). Heterobeltiosis was negative and significant in twenty-eight cross combinations out of thirteen. It was maximum with the cross $\mathrm{L}_{6} \times \mathrm{T}_{1}$ (Pusa Jwala $\times$ LCA 334) followed by $\mathrm{L}_{6} \times \mathrm{T}_{2}\left(\right.$ Pusa $\mathrm{Jwala} \times \mathrm{K} 1$ ) and $\mathrm{L}_{3} \times \mathrm{T}_{3}$ (Arka Lohit $\times$ G-4). Standard heterosis for this character was negative and significant for twelve cross combination for days to 50 per cent flowering. It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{2}($ Pant $\mathrm{C}-1 \times$ K1) followed by $\mathrm{L}_{6} \times \mathrm{T}_{3}$ (Pusa Jwala $\times$ G-4) and $\mathrm{L}_{6} \times \mathrm{T}_{4}$ (Pusa Jwala $\times$ LCA 678). The observed direction and magnitudes of standard heterosis for this character added a scope for inclusion of this character in heterosis breeding programme of chilles. The results were in accord with the earlier findings of Tembhurne and Rao (2012), Kumar et al. (2013), Suryakumari et al. (2014).

Estimation of relative heterosis for fifteen characters

| hyb rids | $\begin{gathered} \text { Days } \\ \text { to } \\ \text { 50pe } \\ \mathbf{r} \\ \text { cent } \\ \text { flowe } \\ \text { ring } \\ \hline \end{gathered}$ | Pla nt heig ht | Pla nt spre ad | $\begin{gathered} \text { Fru } \\ \text { it } \\ \text { leng } \\ \text { th } \end{gathered}$ | Fru it wid th | $\begin{gathered} \text { Fru } \\ \text { it } \\ \text { ped } \\ \text { icel } \\ \text { leng } \\ \text { th } \end{gathered}$ | Plac enta leng th | $\begin{gathered} \text { No. } \\ \text { of } \\ \text { frui } \\ \text { ts } \\ \text { per } \\ \text { pla } \\ \text { nt } \\ \hline \end{gathered}$ | Fru <br> it <br> wei <br> ght | No. of see ds per frui $\qquad$ | $\begin{gathered} 100 \\ 0 \\ \text { see } \\ \text { d } \\ \text { wei } \\ \text { ght } \end{gathered}$ | $\begin{gathered} \hline \text { Fru } \\ \text { it } \\ \text { yiel } \\ \text { d } \\ \text { per } \\ \text { pla } \\ \text { nt } \\ \hline \end{gathered}$ | Ascor bic acidco ntent | Caps aicin conte nt | capsanthi ncontent |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{array}{\|c} \mathrm{L}_{1} \mathrm{x} \\ \mathrm{~T}_{1} \end{array}$ | $12.43$ | $6.14$ | $\begin{aligned} & 11.6 \\ & 9 * * \end{aligned}$ | $\begin{gathered} 5.9 * \\ * * \end{gathered}$ | $\begin{gathered} 15.8 \\ 7 \end{gathered}$ | $\begin{aligned} & 10.1 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 37.6 \\ & 8^{* *} \end{aligned}$ | $3.91$ | $\underset{* *}{8.12}$ | $1.78$ | 0.82 | $11.0$ | 1.76** | $7.43 *$ $*$ | 0.77 |
| $\begin{gathered} \mathrm{L}_{1} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $6.73 *$ $*$ | $2.77$ | $\begin{gathered} 3.19 \\ * * \end{gathered}$ | $\begin{gathered} 11.3 \\ 1^{* *} \end{gathered}$ | 9.77 | $2.80$ | $5.13$ | $\underset{* *}{5.51}$ | $\begin{aligned} & 14.8 \\ & 3^{* *} \end{aligned}$ | $\begin{gathered} - \\ 11.4 \\ 2 * * \end{gathered}$ | 2.39 | $\begin{gathered} 7.44 \\ * * \end{gathered}$ | 0.99 | 2.64* $*$ | 1.26 |
| $\begin{gathered} \mathrm{L}_{1} \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $\begin{gathered} 13.86 \\ * * \end{gathered}$ | 0.03 | $\begin{aligned} & 12.4 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 8.87 \\ * * \end{gathered}$ | $\begin{gathered} 10.2 \\ 7 \end{gathered}$ | $2.38$ | $\begin{gathered} 8.27 \\ * * \end{gathered}$ | $\underset{* *}{9.78}$ | 0.96 | $1.19$ | $\begin{aligned} & 10.7 \\ & 2^{* *} \end{aligned}$ | $\stackrel{-}{2.41}$ | -1.35* | $\underset{* *}{13.49}$ | 1.15 |
| $\begin{array}{\|c} \mathrm{L}_{1} \mathrm{x} \\ \mathrm{~T}_{4} \end{array}$ | $\begin{gathered} 18.73 \\ * * \end{gathered}$ | 0.89 | $\begin{aligned} & 22.4 \\ & 0^{* *} \end{aligned}$ | 0.69 | 3.56 | $\begin{aligned} & 20.3 \\ & 3^{* *} \end{aligned}$ | $2.58$ | 0.06 | $\begin{aligned} & 11.7 \\ & 7^{* *} \end{aligned}$ | $9.34$ | $9.13$ | $\begin{aligned} & 16.7 \\ & 8 * * \end{aligned}$ | $2.30^{-}$* | $\underset{* *}{13.43}$ | 3.54** |
| $\begin{gathered} \mathrm{L}_{2} \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | $\underset{* *}{11.54}$ | $\begin{aligned} & 14.0 \\ & 8 * * \end{aligned}$ | $\begin{aligned} & 10.1 \\ & 5^{* *} \end{aligned}$ | $5.80$ | $4.40$ | 1.73 | $\underset{*}{6.82}$ | $\begin{gathered} 4.33 \\ * * \end{gathered}$ | 0.26 | $2.28$ | - <br>  <br> ** <br> * | $0.78$ | 1.29* | 6.67* $*$ | 5.99** |
| $\begin{gathered} \mathrm{L}_{2} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\underset{* *}{11.16}$ | $\begin{gathered} 20.4 \\ 2^{* *} \end{gathered}$ | $\begin{aligned} & 11.6 \\ & 6 * * \end{aligned}$ | $\begin{aligned} & 12.1 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 28.0 \\ & 8 * * \end{aligned}$ | $\underset{*}{6.83}$ | $5.95$ | $4.83$ | $6.49$ | $6.79$ | $0.89$ | $1.14$ | $2.22 * *$ | $\underset{* *}{10.12}$ | 5.70** |
| $\begin{array}{\|c} \mathrm{L}_{2} \mathrm{x} \\ \mathrm{~T}_{3} \end{array}$ | 3.11* | $\begin{gathered} 5.10 \\ * * \end{gathered}$ | 1.82 | $\begin{gathered} 3.59 \\ * * \end{gathered}$ | $\begin{gathered} 18.2 \\ 8^{*} \end{gathered}$ | $\begin{gathered} 20.2 \\ 9^{* *} \end{gathered}$ | $5.41$ | 0.01 | $3.40$ | 0.82 |  | $5.59$ | -0.29 | $\underset{* *}{14.96}$ | 1.0 |
| $\begin{gathered} \mathrm{L}_{2} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | 14.72 $* *$ | $\stackrel{3.21}{*}$ | $\underset{* *}{8.37}$ | $\begin{aligned} & 11.4 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 29.3 \\ 1^{* *} \\ \hline \end{gathered}$ | $3.08$ |  | $\begin{gathered} 3.61 \\ * * \end{gathered}$ | 3.79 $*$ | $3.88$ | 0.58 | $1.66$ | $3.06^{* *}$ | $\underset{*}{8.2 *}$ | 3.42** |
| $\begin{array}{\|c} \mathrm{L}_{3} \mathrm{x} \\ \mathrm{~T}_{1} \end{array}$ | 1.94 | $\begin{aligned} & 14.0 \\ & 8 * * \end{aligned}$ | $\begin{aligned} & 16.1 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 14.9 \\ & 8 * * \end{aligned}$ | $\begin{gathered} 12.5 \\ 8 \end{gathered}$ | $1.85$ | $\begin{gathered} 23.3 \\ 8 * * \end{gathered}$ | $\begin{aligned} & 11.3 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 14.3 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 4.59 \\ * * \end{gathered}$ | $0.63$ | $0.79$ | 3.49** | $\underset{*}{8.68 *}$ | $-2.58 * *$ |
| $\begin{gathered} \mathrm{L}_{3} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{gathered} 14.77 \\ * * \end{gathered}$ | $\begin{aligned} & 12.9 \\ & 3 * * \end{aligned}$ | $\begin{gathered} 7.64 \\ * * \end{gathered}$ | $\begin{aligned} & 11.3 \\ & 0^{* *} \end{aligned}$ | $\begin{gathered} 18.8 \\ 1^{*} \end{gathered}$ | $1.13$ | $\begin{aligned} & 10.6 \\ & 9 * * \end{aligned}$ | $5.73$ | $\begin{gathered} - \\ 13.9 \\ 0^{* *} \end{gathered}$ | 1.58 | $\begin{aligned} & 10.5 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 1.68 \\ * \end{gathered}$ | -1.26* | $\underset{* *}{11.66}$ | 2.40** |
| $\begin{array}{\|c} \mathrm{L}_{3} \mathrm{x} \\ \mathrm{~T}_{3} \end{array}$ | 9.01* | $\stackrel{5.02}{* *}$ | $1.55$ | $\begin{aligned} & 10.5 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 13.3 \\ 2 \\ \hline \end{gathered}$ | $\begin{gathered} 17.8 \\ 7 * * \end{gathered}$ | 2.94 | $9.94$ | $\underset{* *}{8.52}$ | $\underset{* *}{6.41}$ | $\begin{gathered} 4.13 \\ * * \end{gathered}$ | $0.77$ | $2.99^{* *}$ | $\underset{* *}{18.21}$ | -1.81* |
| $\begin{gathered} \mathrm{L}_{3} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $3.91^{*}$ | 0.81 | $\begin{aligned} & 10.4 \\ & 6 * * \\ & \hline \end{aligned}$ | 1.13 | $\begin{array}{\|l\|l\|} \hline 36.5 \\ 9 * * \\ \hline \end{array}$ | $\begin{gathered} 9.39 \\ * * \end{gathered}$ |  | $5.94$ | $5.05$ | $\underset{*}{2.36}$ | 2.08 | $8.10$ | -0.54 | 11.34 $* *$ | -1.73* |
| $\begin{array}{\|c} \hline \mathrm{L}_{4} \mathrm{x} \\ \mathrm{~T}_{1} \\ \hline \end{array}$ | -1.06 | $\begin{aligned} & 27.1 \\ & 0 * * \end{aligned}$ | $7.95$ | $\begin{aligned} & 17.0 \\ & 0^{* *} \\ & \hline \end{aligned}$ | $\begin{array}{\|l\|} \hline 51.5 \\ 3 * * \\ \hline \end{array}$ | $\begin{aligned} & 11.3 \\ & 2 * * \end{aligned}$ | $\begin{aligned} & 13.6 \\ & 5 * * \end{aligned}$ | $7.94$ | $\begin{aligned} & 16.6 \\ & 4 * * \end{aligned}$ | $\begin{aligned} & 12.6 \\ & 8^{* *} \\ & \hline \end{aligned}$ | $0.37$ | $1.74$ | 0.52 | $\underset{*}{7.54 *}$ | 1.70* |


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| $\begin{gathered} \mathrm{L}_{4} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | -0.03 | 9.97 | $\begin{aligned} & 11.6 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} 9.52 \\ * * \end{gathered}$ | $\begin{aligned} & 33.2 \\ & 2 * * \end{aligned}$ | $\begin{aligned} & 20.6 \\ & 9 * * \end{aligned}$ | $\begin{gathered} 7.40 \\ * * \end{gathered}$ | $\begin{aligned} & 21.8 \\ & 7 * * \end{aligned}$ | 0.85 | $\begin{gathered} 3.33 \\ * * \end{gathered}$ | $\begin{aligned} & 10.2 \\ & 3 * * \end{aligned}$ | $\begin{gathered} 7.99 \\ * * \end{gathered}$ | $3.30 * *$ | $5.11 *$ | 3.86** |
| $\begin{gathered} \mathrm{L}_{4} \mathrm{X} \\ \mathrm{~T}_{3} \end{gathered}$ | $9.66^{*}$ | $1.37$ | $\begin{aligned} & 11.3 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 13.4 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 39.7 \\ 4 * * \end{gathered}$ | $\begin{aligned} & 16.5 \\ & 0 * * \end{aligned}$ | $\begin{aligned} & 14.0 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 10.2 \\ & 8^{* *} \end{aligned}$ | $\begin{aligned} & 15.7 \\ & 9^{* *} \end{aligned}$ | 2.47 | $\begin{aligned} & 14.7 \\ & 1 * * \end{aligned}$ | $\begin{aligned} & 16.4 \\ & 8 * * \end{aligned}$ | $5.57 * *$ | $\begin{gathered} 19.38 \\ * * \end{gathered}$ | 2.97** |
| $\begin{gathered} \mathrm{L}_{4} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{gathered} 21.34 \\ * * \end{gathered}$ | $4.64$ | $\begin{aligned} & 13.5 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 4.30 \\ * * \end{gathered}$ | 7.28 | $\begin{gathered} 8.30 \\ * * \end{gathered}$ | $\begin{gathered} 7.65 \\ * * \end{gathered}$ | $\begin{aligned} & 11.3 \\ & 5 * * \\ & \hline \end{aligned}$ | $3.93$ | $\begin{gathered} 9.55 \\ * * \end{gathered}$ | $1.52$ | $\begin{gathered} \hline- \\ 7.66 \\ * * \end{gathered}$ | -1.09 | 4.04* * | 2.43** |
| $\begin{gathered} \hline \mathrm{L}_{5} \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | $14.45$ | $\begin{aligned} & 19.6 \\ & 4^{* *} \\ & \hline \end{aligned}$ | 1.31 | $\begin{aligned} & 12.7 \\ & 0^{* *} \\ & \hline \end{aligned}$ | $4.82$ | $\begin{aligned} & 14.5 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 23.0 \\ & 3 * * \end{aligned}$ | $\begin{gathered} \hline 4.60 \\ * * \end{gathered}$ | 0.60 | 1.67 | 0.77 | $\begin{gathered} 2.46 \\ * * \end{gathered}$ | 0.86 | -1.62 | 2.02** |
| $\begin{gathered} \mathrm{L}_{5} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{gathered} 15.37 \\ * * \end{gathered}$ | $\begin{aligned} & 16.3 \\ & 7 * * \end{aligned}$ | $6.54$ | $\begin{aligned} & 16.4 \\ & 8^{* *} \end{aligned}$ | 2.41 | $\begin{gathered} 8.37 \\ * * \end{gathered}$ | $\begin{aligned} & 14.8 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 3.75 \\ & * * \end{aligned}$ | $7.66$ | 1.24 | $\begin{aligned} & 10.0 \\ & 8 * * \end{aligned}$ | $2.76$ | $3.71 * *$ | $2.55^{*}$ | 3.81** |
| $\begin{gathered} \mathrm{L}_{5} \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | 0.77 | $1.30$ | $\begin{gathered} 24.2 \\ 5 * * \\ \hline \end{gathered}$ | $\underset{* *}{9.38}$ | $\begin{aligned} & 28.7 \\ & 2 * * \\ & \hline \end{aligned}$ | 4.51 | $9.60$ | $6.43$ | $\begin{aligned} & 10.9 \\ & 6^{* *} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.0 \\ & 0^{* *} \\ & \hline \end{aligned}$ | $7.11$ | $7.49$ | 2.14** | $11.55$ | -1.53* |
| $\begin{gathered} \mathrm{L}_{5} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | 5.76* | $9.82$ | $\begin{aligned} & 25.8 \\ & 9 * * \end{aligned}$ | 6.58 $* *$ | $\begin{gathered} 28.0 \\ 3 * * \end{gathered}$ | $\begin{gathered} 6.09 \\ * \end{gathered}$ | 1.27 | $1.07$ | $\begin{aligned} & 12.8 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 4.48 \\ * * \end{gathered}$ | $\begin{gathered} 7.25 \\ * * \end{gathered}$ | $\begin{gathered} 1.33 \\ * * \end{gathered}$ | $4.42 * *$ | $\begin{gathered} 6.73 * \\ * \end{gathered}$ | 3.19** |
| $\begin{gathered} \mathrm{L}_{6} \mathrm{x} \\ \mathrm{~T} 1 \end{gathered}$ | $9.09^{*}$ | $\begin{aligned} & 14.3 \\ & 2 * * \end{aligned}$ | $\begin{gathered} 8.07 \\ * * \end{gathered}$ | $\begin{gathered} 8.27 \\ * * \end{gathered}$ | $\begin{aligned} & 43.6 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 4.92 \\ & * \end{aligned}$ | $\begin{aligned} & 16.9 \\ & 5 * * \end{aligned}$ | $0.87$ | $\begin{aligned} & 12.1 \\ & 7 * * \end{aligned}$ | - <br>  <br> $* *$ | $4.56$ | 7.10 $* *$ | 8.09** | $8.64 *$ $*$ | 8.98** |
| $\begin{gathered} \mathrm{L}_{6} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | 9.34* | $\begin{aligned} & 10.2 \\ & 2 * * \end{aligned}$ | $\begin{aligned} & 10.7 \\ & 4 * * \end{aligned}$ | $\begin{aligned} & 14.7 \\ & 3^{* *} \end{aligned}$ | $\begin{gathered} 10.3 \\ 7 \end{gathered}$ | $\begin{aligned} & 21.0 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 12.4 \\ & 9 * * \end{aligned}$ | $\stackrel{-}{5.51}$ | $7.95$ | 1.23 | $3.28$ | $\begin{gathered} 8.54 \\ * * \end{gathered}$ | -0.49 | -0.74 | 13.50** |
| $\begin{gathered} \mathrm{L}_{6} \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $5.70^{*}$ | $4.02$ | $\begin{aligned} & 13.3 \\ & 3 * * \end{aligned}$ | $\begin{gathered} 8.18 \\ * * \end{gathered}$ | 0.80 | $\begin{aligned} & 15.3 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 15.2 \\ & 9 * * \end{aligned}$ | $\begin{gathered} 3.90 \\ * * \end{gathered}$ | $\begin{gathered} 6.96 \\ * * \end{gathered}$ | $\begin{gathered} 2.96 \\ * \end{gathered}$ | $\begin{gathered} 4.15 \\ * * \end{gathered}$ | $2.74$ ** | -1.55* | 2.36* | 4.87** |
| $\begin{gathered} \mathrm{L}_{6} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | - 5.52* * | $4.52$ | $\begin{gathered} 7.92 \\ * * \end{gathered}$ | ¢ <br> - <br> $* *$ | $\begin{gathered} 26.1 \\ 6^{* *} \end{gathered}$ | $\begin{gathered} 7.65 \\ * * \end{gathered}$ | $\begin{aligned} & 18.3 \\ & 3^{* *} \end{aligned}$ | 11.4 <br> 9** | 4.45 | $2.18$ | - <br>  <br>  <br> $* *$ | $\begin{gathered} 3.29 \\ * * \end{gathered}$ | 1.55* | 4.10* * | -1.24 |
| $\begin{gathered} \mathrm{L}_{7} \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | $\begin{gathered} 13.78 \\ * * \end{gathered}$ | $\begin{aligned} & 25.0 \\ & 6 * * \end{aligned}$ | $\begin{aligned} & 11.9 \\ & 9 * * \end{aligned}$ | $\underset{* *}{7.38}$ | $\begin{gathered} 20.1 \\ 5 * \end{gathered}$ | $2.08$ | $\begin{aligned} & 26.0 \\ & 6^{* *} \end{aligned}$ | $1.69$ | $\begin{aligned} & 16.4 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 11.7 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 15.5 \\ & 8 * * \\ & \hline \end{aligned}$ | $\begin{gathered} \hline- \\ 10.8 \\ 9 * * \end{gathered}$ | 0.66 | $3.17 *$ $*$ | 1.29 |
| $\begin{gathered} \mathrm{L}_{7} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | - $6.22 *$ $*$ | $\begin{aligned} & 20.4 \\ & 3 * * \end{aligned}$ | $5.25$ | $\begin{aligned} & 22.3 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 25.2 \\ 5 * * \end{gathered}$ | $\begin{aligned} & 22.4 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 11.4 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} 8.92 \\ * * \end{gathered}$ | $2.85$ | - 3.07 $*$ | $\begin{aligned} & 19.7 \\ & 6^{* *} \end{aligned}$ | $\begin{aligned} & 10.2 \\ & 0 * * \end{aligned}$ | $9.76 * *$ | 7.24* * | 15.25** |
| $\begin{gathered} \mathrm{L}_{7} \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $6.34^{*}$ | $\begin{aligned} & 17.3 \\ & 0 * * \end{aligned}$ | $\begin{aligned} & 12.8 \\ & 3 * * \end{aligned}$ | $\begin{aligned} & 19.9 \\ & 3 * * \end{aligned}$ | $\begin{gathered} 21.4 \\ 5 * \end{gathered}$ | $\begin{aligned} & 15.5 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 17.3 \\ & 2^{* *} \end{aligned}$ | $7.46$ | $\begin{gathered} 6.88 \\ * * \end{gathered}$ | $\begin{gathered} 3.24 \\ * \end{gathered}$ | $\begin{gathered} 6.69 \\ * * \end{gathered}$ | $\begin{gathered} 6.46 \\ * * \end{gathered}$ | $5.53 * *$ | $6.70 *$ $*$ | 12.81** |
| $\begin{gathered} \mathrm{L}_{7} \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | - $4.35 *$ $*$ | $\begin{gathered} 1.67 \\ \mathrm{~ns} \end{gathered}$ | $\begin{aligned} & 10.5 \\ & 2 * * \end{aligned}$ | $\begin{aligned} & 13.6 \\ & 5^{* *} \end{aligned}$ | $\begin{aligned} & 34.6 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 10.3 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 10.5 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 11.1 \\ & 8^{* *} \end{aligned}$ | 3.28 | $\begin{gathered} 4.47 \\ * * \end{gathered}$ | $\begin{aligned} & 13.9 \\ & 9 * * \end{aligned}$ | $\begin{gathered} 4.74 \\ * * \end{gathered}$ | -8.34 | $\underset{* *}{11.01}$ | 14.52** |

## Plant height at maturity

The relative heterosis was positively significant in sixteen cross combinations. It was maximum with the cross $\mathrm{L}_{4} \times \mathrm{T}_{1}\left(\mathrm{LCA} 625 \times\right.$ LCA 334) followed by $\mathrm{L}_{7} \times \mathrm{T}_{1}$ (Pant C-1 $\times \mathrm{LCA} 334$ ) and $\mathrm{L}_{7} \times \mathrm{T}_{2}$ (Pant $\mathrm{C}-1 \times \mathrm{K} 1)$. Heterobeltiosis exhibited positive and significant in eleven cross combinations. It was maximum with the cross $L_{2} \times T_{2}(C O-1 \times \mathrm{K} 1)$ followed by $L_{7} \times T_{3}($ Pant $\mathrm{C}-1 \times \mathrm{G}-4)$ and $\mathrm{L}_{2} \times \mathrm{T}_{1}(\mathrm{CO}-$ $1 \times$ LCA 334). Standard heterosis was positive and significant in twenty-seven cross-combinations. It was registered maximum with the cross $\mathrm{L}_{4} \times \mathrm{T}_{1}$ (LCA $625 \times$ LCA 334) followed by $\mathrm{L}_{7} \times \mathrm{T}_{3}$ (Pant C-1 $\times$ G-4) and $\mathrm{L}_{7} \times \mathrm{T}_{1}$ (Pant C-1 $\times$ LCA 334). These results of heterosis for plant height confirm the earlier findings of Tembhurne and Rao (2012), Kumar et al. (2013), Savitha et al. (2015).

Estimation of heterobeltiosis for fifteen characters

| hyb rids | Days to 50 per cent flow erin g | Pla <br> nt <br> hei <br> ght | Pla nt spr ead | Fru <br> it <br> len <br> gth | Fru <br> it <br> wid <br> th | Fru <br> it <br> ped <br> icel <br> len <br> gth | Plac <br> enta <br> leng <br> th | No. of frui ts per pla nt | Fru <br> it <br> wei <br> ght | No. of see ds per frui t | $\begin{gathered} 100 \\ 0 \\ \text { see } \\ \text { d } \\ \text { wei } \\ \text { ght } \end{gathered}$ | Fru it yiel d per pla nt | Ascor bic acidc onten t | Caps aicin cont ent | capsanthi ncontent |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | 1.90 | $\begin{aligned} & 4.7 \\ & 2^{*} \end{aligned}$ | $\begin{aligned} & 9.1 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} 2.1 \\ 1 \end{gathered}$ | $\begin{gathered} 11 . \\ 11 \end{gathered}$ | $\begin{gathered} 7.7 \\ 7 * * \end{gathered}$ | $\begin{gathered} 34.2 \\ 8^{* *} \end{gathered}$ | $\begin{gathered} 0.0 \\ 7 \end{gathered}$ | - <br> .5 <br> $3 * *$ | $\begin{aligned} & 4.4 \\ & 4^{* *} \end{aligned}$ | $\begin{gathered} 5.9 \\ 2^{* *} \end{gathered}$ | - 14. $20 *$ $*$ | 1.35 | -1.75 | -0.38 |
| $\begin{gathered} \hline \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | 0.98 | 3.5 6 | 1.6 9 | $\begin{gathered} 9.3 \\ 7 \\ * \end{gathered}$ | $\begin{gathered} 9.2 \\ 8 \end{gathered}$ | 5.5 3 | $\begin{aligned} & 14.4 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 10 . \\ & 65 * \end{aligned}$ | $\begin{gathered} 22 . \\ 80^{*} \end{gathered}$ | $\begin{gathered} - \\ 17 . \end{gathered}$ | 2.3 2 | $\begin{aligned} & 11 . \\ & 96^{*} \end{aligned}$ | 0.27 | $\underset{\text { 6.14* }}{\text { - }}$ | 0.76 |


|  |  |  |  |  |  |  |  | * | * | * |  | * |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \hline \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\begin{aligned} & 11.1 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} - \\ 8.6 \\ 3 * * \end{gathered}$ | $\begin{aligned} & 6.9 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} - \\ 0.2 \\ 8 \\ \hline \end{gathered}$ | $\begin{gathered} - \\ 8.3 \\ 6 \\ \hline \end{gathered}$ | $\begin{aligned} & 6.3 \\ & 1^{*} \end{aligned}$ | $1.04$ | $\begin{aligned} & 7.2 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} -7.7 \\ 5 \\ \hline \end{gathered}$ | $\begin{gathered} - \\ 2.4 \\ 7 \end{gathered}$ | $\begin{aligned} & 9.3 \\ & 6 * * \end{aligned}$ | $\begin{aligned} & 6.9 \\ & 4 * * \end{aligned}$ | 2.88* | $9.31^{*}$ $*$ | 0.09 |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{aligned} & 15.9 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 12 . \\ 17^{*} \end{gathered}$ | $\begin{gathered} 13 . \\ 62^{*} \\ * \end{gathered}$ | $\begin{gathered} 9.3 \\ 3 \\ 3 \end{gathered}$ | 13. <br> 94 | $\begin{aligned} & 20 . \\ & 75^{*} \end{aligned}$ | $\begin{aligned} & 15.7 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 6.7 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} 17 . \\ 03^{*} \end{gathered}$ | 18. 84* * | 14. <br> 69* <br> * | $\begin{aligned} & 25 . \\ & 44^{*} \end{aligned}$ | ${ }_{\text {3.04* }}{ }^{-}$ | 7.04* $*$ | 2.97** |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | $\begin{gathered} 10.7 \\ 6^{* *} \end{gathered}$ | $\begin{gathered} 11 . \\ 61^{*} \\ * \end{gathered}$ | $\begin{aligned} & 2.4 \\ & 2^{*} \end{aligned}$ | $\begin{gathered} 9.2 \\ 2 \\ * * \end{gathered}$ | $\begin{aligned} & 18 . \\ & 43 \end{aligned}$ | 1.2 2 | 0.42 | $\begin{aligned} & 2.9 \\ & 2^{* *} \end{aligned}$ | - 6.4 $3^{*}$ | $\begin{gathered} - \\ 2.5 \\ 7 \end{gathered}$ | $\begin{gathered} - \\ 13 . \\ 85^{*} \end{gathered}$ | - 1.9 $7 * *$ | 0.64 | $\stackrel{\text { 5.26* }}{*}$ | 1.86* |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\underset{* *}{6.91}$ | $\begin{gathered} 18 . \\ 42^{*} \\ * \end{gathered}$ | $\begin{gathered} 11 . \\ 36 * \\ * \end{gathered}$ | $\begin{gathered} 6.0 \\ 7 \\ * * \end{gathered}$ | $\begin{gathered} 27 . \\ 65^{*} \\ * \end{gathered}$ | $\begin{aligned} & 6.6 \\ & 7 * \end{aligned}$ | 3.87 | $\begin{aligned} & 5.3 \\ & 3^{* *} \end{aligned}$ | $\begin{aligned} & 8.9 \\ & 9^{* *} \end{aligned}$ | $\begin{gathered} 11 . \\ 25^{*} \end{gathered}$ | $\begin{gathered} 1.6 \\ 4 \end{gathered}$ | $\begin{aligned} & 3.7 \\ & 4^{* *} \end{aligned}$ | ${ }_{\text {3.91* }}{ }^{-}$ | 2.19* | $3.22 * *$ |
| $\begin{gathered} \hline \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\stackrel{-}{3.85}$ | $\begin{aligned} & - \\ & 3.2 \\ & 3^{*} \end{aligned}$ | 1.6 9 | 1.8 5 | $\begin{aligned} & 17 . \\ & 06 \end{aligned}$ | $\begin{gathered} 18 . \\ 56^{*} \end{gathered}$ | 4.87 | $\begin{gathered} 2.8 \\ 0^{* *} \\ \hline \end{gathered}$ | $\begin{aligned} & 5.9 \\ & 5^{*} \\ & \hline \end{aligned}$ | $\begin{gathered} - \\ 0.3 \\ 4 \\ \hline \end{gathered}$ | $\begin{aligned} & - \\ & 3.7 \\ & 4^{*} \\ & \hline \end{aligned}$ | $\begin{array}{r} - \\ 7.8 \\ 2 * * \\ \hline \end{array}$ | -0.82 | $7.35 *$ $*$ | -2.77** |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\underset{* *}{6.97}$ | $\begin{gathered} 9.4 \\ 8^{* *} \end{gathered}$ | $\begin{gathered} 5.7 \\ 2^{* *} \end{gathered}$ | $\begin{gathered} 7.5 \\ 6 \\ * * \end{gathered}$ | $\begin{gathered} 30 . \\ 03 * \\ * \end{gathered}$ | $\begin{aligned} & 6.1 \\ & 5^{*} \end{aligned}$ | $\begin{aligned} & 13.9 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 5.6 \\ & 2^{* *} \end{aligned}$ | $\begin{aligned} & 4.9 \\ & 9^{*} \end{aligned}$ | $\begin{gathered} 12 . \\ 03^{*} \end{gathered}$ | $\begin{aligned} & 6.1 \\ & 8^{* *} \end{aligned}$ | $\begin{aligned} & 6.9 \\ & 1^{* *} \end{aligned}$ | 4.78* | -0.94 | -0.03 |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | -3.07 | $\begin{gathered} - \\ 1.0 \\ 3 \end{gathered}$ | $\begin{gathered} 5.8 \\ 7 * * \end{gathered}$ | $\begin{gathered} 5.2 \\ 2 \\ * * \end{gathered}$ | $\begin{gathered} 3.6 \\ 6 \end{gathered}$ | $\begin{gathered} - \\ 5.6 \\ 2 \end{gathered}$ | $\begin{gathered} 15.2 \\ 1^{* *} \end{gathered}$ | $\begin{aligned} & 13 . \\ & 36^{*} \end{aligned}$ | $\begin{aligned} & 22 . \\ & 07^{*} \end{aligned}$ | $\begin{gathered} - \\ 1.0 \\ 5 \end{gathered}$ | $\begin{gathered} - \\ 1.8 \\ 9 \end{gathered}$ | $\begin{gathered} 2.0 \\ 5^{* *} \end{gathered}$ | $3.08 *$ $*$ | ${ }_{\text {3.95* }}{ }^{-}$ | -4.51** |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{aligned} & 14.1 \\ & 9^{* *} \end{aligned}$ | $\begin{gathered} 1.6 \\ 0 \end{gathered}$ | $\begin{aligned} & 5.0 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 0.0 \\ 9 \end{gathered}$ | $\begin{gathered} 9.6 \\ 2 \end{gathered}$ | $\begin{gathered} - \\ 5.5 \\ 3 \end{gathered}$ | $\underset{* *}{9.30}$ | $\begin{aligned} & - \\ & 9.5 \\ & 4 * * \end{aligned}$ | $\begin{gathered} - \\ 13 . \\ 90^{*} \end{gathered}$ | $\begin{gathered} 0.6 \\ 0 \end{gathered}$ | $\begin{aligned} & 4.4 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 1.4 \\ & 9^{* *} \end{aligned}$ | $\underset{*}{2.74 *}$ | -1.32 | 2.02* |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $\begin{aligned} & 11.4 \\ & 6 * * \end{aligned}$ | 0.4 6 | $\begin{aligned} & 3.7 \\ & 8 * * \end{aligned}$ | $\begin{gathered} 6.5 \\ 0 \\ * * \end{gathered}$ | $\begin{aligned} & 19 . \\ & 51 \end{aligned}$ | $\begin{gathered} 11 . \\ 25^{*} \\ * \end{gathered}$ | 2.73 | - 10 $64 *$ $*$ | 2.9 1 | $\begin{gathered} - \\ 0.7 \\ 0 \end{gathered}$ | $\begin{aligned} & 2.7 \\ & 9^{*} \end{aligned}$ | $\begin{gathered} - \\ 0.8 \\ 5 \end{gathered}$ | 3.74* $*$ | $9.80 *$ $*$ | -3.67** |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\underset{* *}{6.51}$ | $\begin{gathered} - \\ 0.1 \\ 2 \end{gathered}$ | $\begin{gathered} 10 . \\ 73^{*} \end{gathered}$ | $\begin{gathered} 0.7 \\ 7 \end{gathered}$ | $\begin{gathered} 26 . \\ 83 * \\ * \end{gathered}$ | $\begin{aligned} & 8.0 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} - \\ 14.6 \\ 3 * * \end{gathered}$ | $\begin{aligned} & 11 . \\ & 09^{*} \end{aligned}$ | - <br> 8.7 <br> $2 * *$ | $\begin{gathered} - \\ 0.8 \\ 9 \end{gathered}$ | $\begin{gathered} 1.4 \\ 4 \end{gathered}$ | $13 .$ 88* | ${ }_{\text {2.08* }}^{*}$ | 1.41 | -3.11** |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | ${ }_{6.6}^{*}{ }_{*}{ }^{-}$ | $\begin{gathered} 7.2 \\ 7 * * \end{gathered}$ | $\begin{aligned} & 3.7 \\ & 1 * * \end{aligned}$ | $\begin{gathered} 4.8 \\ 1 \\ * * \end{gathered}$ | $\begin{gathered} 25 . \\ 24^{*} \\ * \end{gathered}$ | $2.0$ | 0.59 | $\begin{aligned} & 13 . \\ & 32 * \end{aligned}$ | $\begin{gathered} 5.2 \\ 6^{*} \end{gathered}$ | 11. $46 *$ $*$ | $\begin{aligned} & 4.1 \\ & 6 * * \end{aligned}$ | $\begin{aligned} & 3.7 \\ & 9^{* *} \end{aligned}$ | 0.48 | 3.07* $*$ | 1.23 |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | -1.30 | $\begin{aligned} & 6.7 \\ & 8^{* *} \end{aligned}$ | $\begin{aligned} & 6.4 \\ & 6 * * \end{aligned}$ | $\begin{gathered} - \\ 3.5 \\ 5 \\ * * \end{gathered}$ | $\begin{gathered} 27 . \\ 76^{*} \\ * \end{gathered}$ | $\begin{aligned} & 5.6 \\ & 4 * \end{aligned}$ | 2.61 | - <br> 27. <br> $73 *$ <br> $*$ | - 0.0 9 | $\begin{gathered} - \\ 0.3 \\ 0 \end{gathered}$ | $\begin{gathered} - \\ 0.7 \\ 1 \end{gathered}$ | $\begin{gathered} 3.5 \\ 7 * * \end{gathered}$ | $\underset{\text { 4.40* }}{-}$ | 14.47 $* *$ | 2.63** |
| $\begin{gathered} \hline \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\begin{aligned} & 11.4 \\ & 2^{* *} \\ & \hline \end{aligned}$ | $\begin{aligned} & 8.5 \\ & 3^{* *} \end{aligned}$ | $\begin{aligned} & 6.3 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 6.8 \\ 5 * * \end{gathered}$ | $\begin{gathered} 33 . \\ 12^{*} \\ * \end{gathered}$ | $\begin{gathered} 0.8 \\ 5 \end{gathered}$ | $\underset{* *}{7.41}$ | $\begin{aligned} & 5.3 \\ & 3^{* *} \end{aligned}$ | $\begin{aligned} & 8.8 \\ & 2^{* *} \end{aligned}$ | - 0.0 9 | $\begin{gathered} 2.1 \\ 3 \end{gathered}$ | 11. $42 *$ $*$ | 6.67* $*$ | $\underset{* *}{13.24}$ | 2.60** |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{gathered} 18.9 \\ 6^{* *} \end{gathered}$ | $\begin{aligned} & 6.8 \\ & 4^{* *} \end{aligned}$ | $\begin{gathered} 15 . \\ 33^{*} \end{gathered}$ | $\begin{aligned} & - \\ & 8.2 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 2.2 \\ 1 \end{gathered}$ | $\begin{aligned} & 2.3 \\ & 2^{*} \end{aligned}$ | $\underset{*}{7.43}$ | $\begin{gathered} 19 . \\ 18^{*} \\ * \end{gathered}$ | $\begin{gathered} 8.4 \\ 7 * * \end{gathered}$ | $\begin{aligned} & 16 . \\ & 16^{*} \end{aligned}$ | $\begin{gathered} 5.8 \\ 5 * * \end{gathered}$ | $\begin{aligned} & 9.7 \\ & 0^{* *} \end{aligned}$ | $\stackrel{-}{2.27 *}$ | 3.29* $*$ | 2.28** |
| $\begin{gathered} \hline \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{1} \\ \hline \end{gathered}$ | $\stackrel{8.20}{* *}$ | $\begin{aligned} & 6.0 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 2.4 \\ 9 \end{gathered}$ | $\begin{gathered} 0.8 \\ 1 \end{gathered}$ | 18. <br> 56 | $\begin{gathered} 8.7 \\ 7 * * \end{gathered}$ | $\begin{gathered} 6.83 \\ * * \end{gathered}$ | $\begin{aligned} & 4.2 \\ & 9^{* *} \end{aligned}$ | $\begin{aligned} & 8.1 \\ & 4^{* *} \end{aligned}$ | $\begin{gathered} 1.8 \\ 4 \end{gathered}$ | $\begin{gathered} 0.1 \\ 2 \end{gathered}$ | - 5.1 $3 * *$ | 0.55 | $\underset{\text { 7.02* }}{*}$ | 1.65 |
| $\begin{gathered} \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{aligned} & 14.1 \\ & 1 * * \end{aligned}$ | $\begin{aligned} & 3.6 \\ & 4 * \end{aligned}$ | $\begin{aligned} & 15 . \\ & 91^{*} \end{aligned}$ | $\begin{aligned} & 2.4 \\ & 4 * \end{aligned}$ | $\begin{gathered} 2.4 \\ 1 \end{gathered}$ | $\begin{gathered} 2.2 \\ 8 \end{gathered}$ | $\underset{* *}{7.44}$ | $\begin{gathered} 1.5 \\ 1^{* *} \end{gathered}$ | $\begin{gathered} 7.2 \\ 7 * * \end{gathered}$ | $\begin{gathered} 0.0 \\ 8 \end{gathered}$ | $\begin{aligned} & 3.4 \\ & 2^{*} \end{aligned}$ | - <br> 8 <br> $1 *$ | $\stackrel{-}{5.07 *}$ | 7.89* | 2.49** |
| $\begin{gathered} \hline \mathrm{L} 5 \\ \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | -1.37 | - 3.2 $4 *$ | $\begin{aligned} & 11 . \\ & 65^{*} \end{aligned}$ | $\begin{gathered} 2.8 \\ 5 * \end{gathered}$ | 27. $84 *$ $*$ | $\begin{gathered} - \\ 2.5 \\ 6 \end{gathered}$ | 1.14 | $\begin{aligned} & 5.1 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 5.5 \\ & 8^{*} \end{aligned}$ | $\begin{gathered} 5.6 \\ 7 * * \end{gathered}$ | - 0.6 0 | $\begin{gathered} 0.6 \\ 5 \end{gathered}$ | 1.25 | 11.27 $* *$ | -1.79* |
| $\begin{gathered} \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ |  | $\begin{gathered} 12 . \\ 84^{*} \end{gathered}$ | $\begin{gathered} 10 . \\ 54 * \\ * \end{gathered}$ | $\begin{gathered} 2.0 \\ 3 \end{gathered}$ | $\begin{gathered} 27 . \\ 15^{*} \\ * \end{gathered}$ | $\begin{gathered} 3.4 \\ 7 \end{gathered}$ | $0.74$ | $\begin{aligned} & 4.7 \\ & 0^{* *} \end{aligned}$ | $\begin{gathered} 8.8 \\ 7 * * \end{gathered}$ | - 0.8 8 | $\begin{aligned} & 7.2 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 1.3 \\ & 3^{* *} \end{aligned}$ | ${ }_{\text {5.81* }}^{*}$ | $\underset{*}{4.23 *}$ | 2.94** |
| $\begin{gathered} \mathrm{L}_{6} \\ \mathrm{x} \\ \mathrm{~T} 1 \end{gathered}$ | $\begin{aligned} & 18.5 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} 7.0 \\ 3^{* *} \end{gathered}$ | $\begin{aligned} & 3.7 \\ & 9 * * \end{aligned}$ | $\begin{gathered} 2.7 \\ 8 \end{gathered}$ | $\begin{aligned} & 16 . \\ & 07 \end{aligned}$ | $\begin{gathered} 1.7 \\ 7 \end{gathered}$ | $1.58$ | $\begin{aligned} & 3.0 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} 10 . \\ 14^{*} \\ * \end{gathered}$ | $\begin{gathered} 10 . \\ 20^{*} \end{gathered}$ | $\begin{aligned} & 10 . \\ & 24 * \end{aligned}$ | $\begin{gathered} 5.3 \\ 7 * * \end{gathered}$ | $\underset{\substack{\text { 8.20* } \\ *}}{\text { - }}$ |  | 8.54** |
| L6 | - | 3.7 | 5.3 | 6.9 | 2.9 | 12. | 1.66 | - | - | - | - | 8.3 | - | - | 12.11** |


| $\begin{gathered} \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{aligned} & 15.2 \\ & 7 * * \\ & \hline \end{aligned}$ | 0* | 7** | $\begin{gathered} 4 \\ * * \end{gathered}$ | 8 | $\begin{gathered} 67^{*} \\ * \end{gathered}$ |  | $\begin{aligned} & \hline 9.3 \\ & 1 * * \end{aligned}$ | $\begin{gathered} 0.0 \\ 9 \end{gathered}$ | $\begin{gathered} 1.2 \\ 3 \end{gathered}$ | $\begin{aligned} & \hline 4.0 \\ & 3^{*} \end{aligned}$ | 6** | 1.70 * $*$ | 11.84 $* *$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \hline \mathrm{L}_{6} \\ \mathrm{X} \\ \mathrm{~T}_{3} \end{gathered}$ | $9.09$ | $\begin{gathered} 7.7 \\ 4^{* *} \end{gathered}$ | $\begin{gathered} 7.9 \\ 9 * * \end{gathered}$ | $\begin{gathered} 8.0 \\ 3 \\ \text { ** } \end{gathered}$ | $\begin{gathered} 6.5 \\ 5 \end{gathered}$ | $\begin{aligned} & 6.0 \\ & 2^{*} \end{aligned}$ | 2.84 | $\begin{gathered} 3.1 \\ 0 * * \end{gathered}$ | $\begin{gathered} 4.2 \\ 6 \end{gathered}$ | $\begin{aligned} & 5.2 \\ & 5^{* *} \end{aligned}$ | $\begin{gathered} 2.0 \\ 1 \end{gathered}$ | $\begin{aligned} & 3.1 \\ & 6 * * \end{aligned}$ | 2.58* | $4.41^{*}$ | 4.54** |
| $\begin{gathered} \mathrm{L}_{6} \\ \mathrm{X} \\ \mathrm{~T}_{4} \end{gathered}$ | $8.91$ | $\begin{gathered} 12 . \\ 78^{*} \\ * \end{gathered}$ | $\begin{gathered} 5.4 \\ 8^{* *} \end{gathered}$ | $\begin{gathered} 10 . \\ 67 * \\ * \end{gathered}$ | $\begin{aligned} & 16 . \\ & 0 . \end{aligned}$ | $\begin{gathered} 3.4 \\ 5 \end{gathered}$ | $\begin{aligned} & 11.8 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 16 . \\ 33^{*} \end{gathered}$ | $\begin{gathered} 0.3 \\ 9 \end{gathered}$ | $\begin{gathered} - \\ 3.8 \\ 7 * * \end{gathered}$ | 14. <br> 69* <br> * | $\begin{gathered} 9.0 \\ 7 * * \end{gathered}$ | 0.26 | 4.69* | -1.43 |
| $\begin{gathered} \mathrm{L}_{7} \\ \mathrm{X} \\ \mathrm{~T}_{1} \end{gathered}$ | $\begin{gathered} 4.12 \\ * * \end{gathered}$ | $\begin{gathered} 10 . \\ 99^{*} \\ * \end{gathered}$ | $\begin{gathered} 0.6 \\ 0 \end{gathered}$ | $\begin{gathered} 0.6 \\ 3 \end{gathered}$ | $\begin{gathered} - \\ 0.9 \\ 4 \end{gathered}$ | $\begin{gathered} 4.5 \\ 3 \end{gathered}$ | $\begin{gathered} 4.94 \\ * \end{gathered}$ | $\begin{gathered} 7.4 \\ 2 * * \end{gathered}$ | $\begin{gathered} 2.8 \\ 0 \end{gathered}$ | $\begin{gathered} 10 . \\ 04^{*} \\ * \end{gathered}$ | $\begin{gathered} 17 . \\ 19 * \\ * \end{gathered}$ | 18. 39* * | 0.45 | 0.01 | -1.05 |
| $\begin{gathered} \hline \mathrm{L}_{7} \\ \mathrm{x} \\ \mathrm{~T}_{2} \\ \hline \end{gathered}$ | $\begin{aligned} & 10.3 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 7.3 \\ 7 * * \end{gathered}$ | $\begin{gathered} - \\ 8.9 \\ 6 * * \end{gathered}$ | $\begin{gathered} \hline 12 . \\ 61 * \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 19 . \\ 75^{*} \end{gathered}$ | $\begin{gathered} 18 . \\ 61^{*} \\ * \\ \hline \end{gathered}$ | $0.43$ | $\begin{gathered} 0.7 \\ 7 \end{gathered}$ | $\begin{gathered} 6.1 \\ 0 * * \end{gathered}$ | $\begin{aligned} & 6.0 \\ & 3^{*} * \end{aligned}$ | $\begin{gathered} 9.8 \\ 5 * * \end{gathered}$ | $\begin{gathered} 2.3 \\ 0 * * \end{gathered}$ | $10.95$ | $3.95 *$ $*$ | 14.43** |
| $\begin{gathered} \hline \mathrm{L}_{7} \\ \mathrm{X} \\ \mathrm{~T}_{3} \end{gathered}$ | $7.59$ | $\begin{gathered} 15 . \\ 13^{*} \\ * \end{gathered}$ | $\begin{gathered} 8.5 \\ 6^{* *} \end{gathered}$ | $\begin{gathered} 18 . \\ 47 * \end{gathered}$ | $\begin{aligned} & 15 . \\ & 36 \end{aligned}$ | $\begin{gathered} 10 . \\ 51^{*} \\ * \end{gathered}$ | 3.44 | $\begin{aligned} & 2.6 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} - \\ 1.8 \\ 6 \\ \hline \end{gathered}$ | $\begin{gathered} 0.1 \\ 8 \end{gathered}$ | $\begin{gathered} 3.3 \\ 0^{*} \end{gathered}$ | $\begin{gathered} - \\ 1.4 \\ 2 * * \end{gathered}$ | $6.43 *$ | 4.21* | 10.30** |
| $\mathrm{L}_{7}$ X $\mathrm{T}_{4}$ | - 5.62 $* *$ | $\begin{gathered} - \\ 5.0 \\ 8 * * \end{gathered}$ | $\begin{gathered} 9.1 \\ 0^{* *} \end{gathered}$ | $\begin{gathered} 12 . \\ 89^{*} \\ * \end{gathered}$ | $\begin{gathered} \hline 27 . \\ 90^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} \hline 10 . \\ 18^{*} \\ * \\ \hline \end{gathered}$ | 3.16 | $\begin{gathered} 1.3 \\ 8^{* *} \end{gathered}$ | - 3.9 0 | - 2.7 $2 *$ | 11. $10 *$ $*$ | $\begin{gathered} 3.4 \\ 8^{* *} \end{gathered}$ | - 9.59* $*$ | 10.75 $* *$ | 12.54** |

Estimation of standard heterosis for fifteen characters

| hyb | $\begin{gathered} \text { Days } \\ \text { to } \\ \text { 50pe } \\ \mathbf{r} \\ \text { cent } \\ \text { flow } \\ \text { erin } \\ \mathbf{g} \end{gathered}$ | Pla <br> nt <br> hei <br> ght | Pla nt spr ead | Fru <br> it <br> len <br> gth | Fru <br> it <br> wid <br> th | Fru it ped icel len gth | Plac <br> enta <br> leng <br> th | No. of frui ts per pla nt | Fru <br> it <br> wei <br> ght | No. of see ds per frui t | $\begin{gathered} 100 \\ 0 \\ \text { see } \\ \text { d } \\ \text { wei } \\ \text { ght } \end{gathered}$ | Fru <br> it yiel d per pla nt | Ascor bic acide onten t | Caps aicin cont ent | capsanthi ncontent |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | 11.8 $8 * *$ | $\begin{gathered} 6.4 \\ 7 * * \end{gathered}$ | $\begin{gathered} 1.1 \\ 7 \end{gathered}$ | $\begin{aligned} & 20 . \\ & 96^{*} \end{aligned}$ | $\begin{aligned} & 20 . \\ & 96 \end{aligned}$ | $\begin{gathered} 14 . \\ 20^{*} \\ * \end{gathered}$ | $\begin{aligned} & 13.5 \\ & 7 * * \end{aligned}$ | $\begin{aligned} & 3.6 \\ & 8^{* *} \end{aligned}$ | $\begin{gathered} - \\ 24 . \\ 98^{*} \\ * \end{gathered}$ | $\begin{gathered} 13 . \\ 07 * \end{gathered}$ | $\begin{aligned} & 8.4 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} 16 . \\ 71^{*} \end{gathered}$ | -0.10 | -1.75 | 2.97* |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | 0.99 | $\begin{gathered} - \\ 1.9 \\ 5 \end{gathered}$ | $\begin{gathered} - \\ 1.6 \\ 9 \end{gathered}$ | $\begin{gathered} 9.2 \\ 8 \end{gathered}$ | $\begin{gathered} - \\ 9.2 \\ 8 \end{gathered}$ | $\begin{gathered} 0.1 \\ 0 \end{gathered}$ | $\begin{aligned} & 14.4 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 10 . \\ 65 * \\ * \end{gathered}$ | $\begin{gathered} 22 . \\ 80^{*} \\ * \end{gathered}$ | $\begin{aligned} & 17 . \\ & 60^{*} \end{aligned}$ | $\begin{gathered} 2.3 \\ 2 \end{gathered}$ | $\begin{gathered} 11 . \\ 99^{*} \\ * \end{gathered}$ | 0.27 | 6.14* | 1.76* |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $\stackrel{4.12}{*}$ | $\begin{gathered} 12 . \\ 34 * \\ * \end{gathered}$ | $\begin{gathered} 7.3 \\ 0^{* *} \end{gathered}$ | $\begin{gathered} 9.6 \\ 2 \end{gathered}$ | $\begin{gathered} - \\ 9.6 \\ 2 \end{gathered}$ | $\begin{gathered} 0.7 \\ 2 \end{gathered}$ | $3.92$ | $\begin{gathered} 0.1 \\ 8 \end{gathered}$ | $\begin{gathered} 13 . \\ 71^{*} \end{gathered}$ | $\begin{aligned} & 13 . \\ & 84 * \end{aligned}$ | $\begin{aligned} & 9.2 \\ & 1^{* *} \end{aligned}$ | $\begin{gathered} 7.4 \\ 4^{*} \end{gathered}$ | $\stackrel{-}{4.28 *}$ | $2.19^{*}$ | 3.25** |
| $\begin{gathered} \mathrm{L}_{1} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\stackrel{8.56}{* *}$ | $\begin{gathered} 20 . \\ 48 * \\ * \end{gathered}$ | $\begin{gathered} 20 . \\ 11^{*} \\ * \end{gathered}$ | 15. <br> 12 | $\begin{aligned} & 15 . \\ & 12 \end{aligned}$ | $\begin{aligned} & 15 . \\ & 12^{*} \end{aligned}$ | $7.14$ | $\begin{gathered} 3.7 \\ 5 * * \end{gathered}$ | $\begin{aligned} & 23 . \\ & 43^{*} \end{aligned}$ | $\begin{gathered} \hline- \\ 11 . \\ 63^{*} \end{gathered}$ | - 2.9 3 | $\begin{gathered} - \\ 15 . \\ 05^{*} \\ * \end{gathered}$ | $\underset{*}{2.95 *}$ | 0.00 | 5.16** |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | $\begin{gathered} 21.6 \\ 1^{* *} \end{gathered}$ | $\begin{gathered} 15 . \\ 45^{*} \\ * \end{gathered}$ | $\begin{aligned} & 2.9 \\ & 9 * \end{aligned}$ | 17. 87 | $\begin{aligned} & 17 . \\ & 87 \end{aligned}$ | $\begin{gathered} 2.5 \\ 7 \end{gathered}$ | $3.52$ | $\begin{aligned} & 1.8 \\ & 3 * * \end{aligned}$ | 11. <br> 44* | $\begin{gathered} 11 . \\ 37 * \end{gathered}$ | - 0.6 8 | $\begin{aligned} & 4.8 \\ & 4^{*} * \end{aligned}$ | -1.59* | $\underset{\substack{\text { 5.26* } \\ *}}{ }$ | 5.28** |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{aligned} & 15.7 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 22 . \\ 49 * \\ * \end{gathered}$ | $\begin{gathered} 11 . \\ 97 * \\ * \end{gathered}$ | $\begin{gathered} 28 . \\ 52^{*} \\ * \end{gathered}$ | $\begin{gathered} 28 . \\ 52 * \\ * \end{gathered}$ | $\begin{aligned} & 7.0 \\ & 0^{*} \end{aligned}$ | 3.87 | $\begin{gathered} - \\ 5.3 \\ 3^{* *} \end{gathered}$ | $\begin{aligned} & -9.9 \\ & 9 * * \\ & 9 * \end{aligned}$ | - 11. $25^{*}$ $*$ | - 1.6 4 | $\begin{aligned} & 3.7 \\ & 4^{* *} \end{aligned}$ | 3.91* | $2.19^{*}$ | 3.22** |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $\stackrel{4.11}{*}$ | $\begin{gathered} 18 . \\ 97 * \\ * \end{gathered}$ | $\begin{gathered} 2.2 \\ 5 \end{gathered}$ | $\begin{aligned} & 17 . \\ & 87 \end{aligned}$ | $\begin{aligned} & 17 . \\ & 87 \end{aligned}$ | $\begin{gathered} 18 . \\ 93^{*} \\ * \end{gathered}$ | 1.81 | $\begin{gathered} 3.8 \\ 2^{* *} \end{gathered}$ | $\begin{aligned} & 10 . \\ & 99^{*} \end{aligned}$ | $\begin{aligned} & 9.8 \\ & 8^{* *} \end{aligned}$ | - 5.1 $8 * *$ | $\begin{aligned} & 8.3 \\ & 3^{* *} \end{aligned}$ | $\stackrel{-}{4.25 *}$ |  | 0.31 |
| $\begin{gathered} \mathrm{L}_{2} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{aligned} & 15.8 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 24 . \\ 17^{*} \\ * \end{gathered}$ | $\begin{gathered} 11 . \\ 76 * \\ * \end{gathered}$ | $\begin{aligned} & 29 . \\ & 55^{*} \end{aligned}$ | $\begin{aligned} & 29 . \\ & 55^{*} \end{aligned}$ | $\begin{gathered} 0.5 \\ 1 \end{gathered}$ | $5.18$ | $\begin{aligned} & 2.5 \\ & 6^{* *} \end{aligned}$ | $\begin{gathered} 10 \\ 08^{*} \end{gathered}$ | $\begin{aligned} & 4.2 \\ & 1 * * \end{aligned}$ | $\begin{gathered} 6.7 \\ 5 * * \end{gathered}$ | $\begin{gathered} 6.0 \\ 7 * * \end{gathered}$ | $\stackrel{-}{4.69 *}$ | 7.46* | 2.09* |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | 6.42 $*$ | $\begin{gathered} 33 . \\ 23 * \\ * \end{gathered}$ | $\begin{gathered} 11 . \\ 24 * \\ * \end{gathered}$ | $\begin{aligned} & 12 . \\ & 37 \end{aligned}$ | $\begin{aligned} & 12 . \\ & 37 \end{aligned}$ | $\begin{gathered} 3.6 \\ 0 \end{gathered}$ | $\begin{aligned} & 12.3 \\ & 1^{* *} \end{aligned}$ | - 16. $61 *$ $*$ | $\begin{aligned} & 22 . \\ & 07 * \end{aligned}$ | $\begin{gathered} 0.8 \\ 9 \end{gathered}$ | 13 $10 *$ $*$ | $\begin{aligned} & 2.4 \\ & 3^{* *} \end{aligned}$ | 0.80 | $\stackrel{-}{*}_{3.95^{*}}^{*}$ | -1.30 |
| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | $\begin{aligned} & 14.1 \\ & 9 * * \end{aligned}$ | $\begin{aligned} & 32 . \\ & 48^{*} \end{aligned}$ | $\begin{gathered} 10 . \\ 37 * \\ * \end{gathered}$ | $\begin{gathered} 9.6 \\ 2 \end{gathered}$ | $\begin{gathered} 9.6 \\ 2 \end{gathered}$ | $\begin{gathered} 3.7 \\ 0 \end{gathered}$ | $\begin{gathered} 9.30 \\ * * \end{gathered}$ | $\begin{aligned} & 9.5 \\ & 4^{* *} \end{aligned}$ | $\begin{aligned} & 13 . \\ & 90^{*} \end{aligned}$ | $\begin{gathered} 2.5 \\ 7 \end{gathered}$ | $\begin{gathered} 17 . \\ 39^{*} \\ * \end{gathered}$ | $\begin{aligned} & 1.4 \\ & 9^{* *} \end{aligned}$ | $\underset{*}{2.74 *}$ | -1.32 | 2.02* |


| $\begin{gathered} \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{3} \end{gathered}$ | $\begin{aligned} & 12.3 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 35 . \\ 25^{*} \\ * \end{gathered}$ | $\begin{gathered} 1.1 \\ 0 \end{gathered}$ | $\begin{aligned} & 20 . \\ & 62^{*} \end{aligned}$ | $\begin{aligned} & 20 . \\ & 62^{*} \end{aligned}$ | $\begin{gathered} 22 . \\ 12 * \\ * \end{gathered}$ | 0.15 | $16 .$ $56^{*}$ | $\begin{gathered} 2.9 \\ 1 \end{gathered}$ | $\begin{gathered} 1.2 \\ 5 \end{gathered}$ | $\begin{aligned} & 9.2 \\ & 1 * * \end{aligned}$ | $\begin{gathered} - \\ 1.2 \\ 3 \end{gathered}$ | $6.62 *$ | -1.75 | -0.62 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \hline \mathrm{L}_{3} \\ \mathrm{x} \\ \mathrm{~T}_{4} \\ \hline \end{gathered}$ | $7.45$ | $\begin{gathered} \hline 37 . \\ 01^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 5.6 \\ 3^{* *} \\ \hline \end{gathered}$ | $\begin{gathered} 25 . \\ 09 * \end{gathered}$ | $\begin{gathered} 25 . \\ 09^{*} \end{gathered}$ | $\begin{gathered} 18 . \\ 62^{*} \\ * \end{gathered}$ | $5.88$ | $\begin{aligned} & 8.2 \\ & 1 * * \end{aligned}$ | $\begin{aligned} & 8.7 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 7.9 \\ 1^{* *} \end{gathered}$ | $\begin{gathered} 15 . \\ 42^{*} \\ * \end{gathered}$ | $\begin{gathered} - \\ 1.8 \\ 8 * * \end{gathered}$ | -1.98* | $5.26^{*}$ | -1.05 |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{1} \end{gathered}$ | 2.53 | $\begin{gathered} 54 . \\ 29^{*} \\ * \end{gathered}$ | $\begin{gathered} 6.1 \\ 7 * * \end{gathered}$ | $\begin{gathered} 36 . \\ 43^{*} \\ * \end{gathered}$ | $\begin{gathered} 36 . \\ 43^{*} \\ * \end{gathered}$ | $\begin{gathered} 30 . \\ 56^{*} \\ * \end{gathered}$ | $\begin{aligned} & 10.4 \\ & 5 * * \end{aligned}$ | $16 .$ $57 *$ <br> * | $\begin{gathered} 7.2 \\ 7 * * \end{gathered}$ | $\begin{aligned} & 3.6 \\ & 3^{*} \end{aligned}$ | $\begin{gathered} 19 . \\ 58^{*} \\ * \end{gathered}$ | $\begin{gathered} 4.7 \\ 9 * * \end{gathered}$ | -1.74* | 3.07* | 4.64** |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{2} \end{gathered}$ | -1.30 | $\begin{gathered} 34 . \\ 07 * \\ * \end{gathered}$ | $\begin{gathered} 17 . \\ 38 * \end{gathered}$ | $\begin{gathered} 39 . \\ 18^{*} \\ * \end{gathered}$ | $\begin{gathered} 39 . \\ 18 * \\ * \end{gathered}$ | $\begin{aligned} & 40 . \\ & 74^{*} \end{aligned}$ | $\begin{aligned} & 12.6 \\ & 6 * * \end{aligned}$ | $\begin{gathered} 27 . \\ 73^{*} \end{gathered}$ | $\begin{gathered} 1.8 \\ 2 \end{gathered}$ | $\begin{gathered} - \\ 0.3 \\ 0 \end{gathered}$ | $\begin{gathered} 23 . \\ 87 * \\ * \end{gathered}$ | $\begin{gathered} 12 . \\ 81^{*} \\ * \end{gathered}$ | 4.40* | $14.47$ | 5.12** |
| $\begin{gathered} \hline \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\begin{aligned} & 13.6 \\ & 7 * * \end{aligned}$ | $\begin{gathered} \hline 31 . \\ 55^{*} \\ * \end{gathered}$ | $\begin{gathered} 17 . \\ 23^{*} \end{gathered}$ | $\begin{gathered} 45 . \\ 02^{*} \\ * \end{gathered}$ | $\begin{gathered} 45 . \\ 02^{*} \\ * \end{gathered}$ | $\begin{gathered} 34 . \\ 36^{*} \\ * \end{gathered}$ | $\begin{aligned} & 17.9 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 1.5 \\ 1 * * \end{gathered}$ | $\begin{gathered} 10 . \\ 90^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 7.1 \\ 1^{* *} \end{gathered}$ | $\begin{gathered} 27 . \\ 42^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} \hline 21 . \\ 36^{*} \\ * \end{gathered}$ | 8.77* | 1.32 | 5.84** |
| $\begin{gathered} \mathrm{L}_{4} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{aligned} & 15.9 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 33 . \\ 99^{*} \\ * \end{gathered}$ | $\begin{aligned} & 6.6 \\ & 4 * * \end{aligned}$ | $\begin{aligned} & 11 . \\ & 34 \end{aligned}$ | $\begin{aligned} & 11 . \\ & 34 \end{aligned}$ | $\begin{gathered} 30 . \\ 14^{*} \\ * \end{gathered}$ | $\begin{aligned} & 18.4 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 16 . \\ 56^{*} \end{gathered}$ | $\begin{gathered} 6.7 \\ 2 * * \end{gathered}$ | $\begin{gathered} 8.7 \\ 1 * * \end{gathered}$ | $\begin{gathered} 17 . \\ 46^{*} \\ * \end{gathered}$ | $\begin{gathered} 2.8 \\ 9 * * \end{gathered}$ | -2.17* | $9.65^{*}$ | 4.76** |
| $\begin{gathered} \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{1} \\ \hline \end{gathered}$ | $\begin{aligned} & 18.8 \\ & 0^{* *} \end{aligned}$ | $\begin{gathered} 35 . \\ 75^{*} \\ * \end{gathered}$ | $\begin{gathered} 15 . \\ 72^{*} \\ * \\ \hline \end{gathered}$ | 18. $56$ | $\begin{aligned} & 18 . \\ & 56 \\ & \hline \end{aligned}$ | $\begin{gathered} 22 . \\ 53^{*} \\ * \end{gathered}$ | $\begin{aligned} & 22.6 \\ & 6 * * \end{aligned}$ | $\begin{gathered} 0.3 \\ 8 \end{gathered}$ | $\begin{gathered} 8.8 \\ 1^{* *} \end{gathered}$ | $\begin{gathered} 4.0 \\ 9 * * \\ \hline \end{gathered}$ | $\begin{gathered} 15 \\ 42 * \end{gathered}$ | $\begin{gathered} 8.1 \\ 0 * * \end{gathered}$ | -1.67* | 7.02* | 5.07** |
| $\begin{gathered} \hline \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{2} \\ \hline \end{gathered}$ | $\begin{aligned} & 14.1 \\ & 1 * * \end{aligned}$ | $\begin{aligned} & 32 . \\ & 65^{*} \end{aligned}$ | $\begin{gathered} 15 . \\ 91^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 2.4 \\ 1 \end{gathered}$ | $\begin{gathered} 2.4 \\ 1 \end{gathered}$ | $\begin{gathered} 15 . \\ 23^{*} \\ * \end{gathered}$ | $\begin{aligned} & 23.3 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 1.6 \\ 4 * * \end{gathered}$ | $\begin{gathered} 7.2 \\ 7 * * \end{gathered}$ | $\begin{gathered} 0.0 \\ 8 \end{gathered}$ | $\begin{aligned} & 17 . \\ & 67 * \end{aligned}$ | $\begin{gathered} 4.0 \\ 2 * \end{gathered}$ | 5.07* | 7.89* $*$ | 5.17** |
| $\begin{gathered} \hline \mathrm{L} 5 \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | - <br> .53 <br> $*$ | $\begin{gathered} 23 . \\ 84^{*} \\ * \end{gathered}$ | $\begin{aligned} & 11 . \\ & 98^{*} \end{aligned}$ | $\begin{gathered} 27 . \\ 84^{*} \\ * \end{gathered}$ | $\begin{gathered} 27 . \\ 84^{*} \\ * \end{gathered}$ | $\begin{gathered} 9.7 \\ 7 * * \end{gathered}$ | $\begin{aligned} & 16.1 \\ & 3 * * \end{aligned}$ | $\begin{gathered} 0.6 \\ 1 \end{gathered}$ | $\begin{gathered} 4.8 \\ 1^{*} \end{gathered}$ | $\begin{aligned} & 3.2 \\ & 6^{*} \end{aligned}$ | $\begin{gathered} 13 . \\ 10^{*} \\ * \end{gathered}$ | $\begin{gathered} 14 . \\ 69^{*} \\ * \end{gathered}$ | -1.59 | -0.44 | 1.31 |
| $\begin{gathered} \hline \mathrm{L}_{5} \\ \mathrm{x} \\ \mathrm{~T}_{4} \\ \hline \end{gathered}$ | $9.78$ | $\begin{gathered} \hline 19 . \\ 56^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 16 . \\ 86^{*} \end{gathered}$ | $\begin{gathered} \hline 27 . \\ 15^{*} \end{gathered}$ | $\begin{gathered} \hline 27 . \\ 15^{*} \end{gathered}$ | $\begin{gathered} \hline 16 . \\ 56^{*} \\ * \end{gathered}$ | $\begin{aligned} & 13.9 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 1.6 \\ 0^{* *} \end{gathered}$ | $\begin{gathered} 8.0 \\ 8 * * \end{gathered}$ | $\begin{gathered} 7.9 \\ 2 * * \end{gathered}$ | $\begin{gathered} \hline 22 . \\ 03 * \\ * \end{gathered}$ | $\begin{aligned} & 15 . \\ & 46^{*} \end{aligned}$ | 5.71* | $2.63^{*}$ | 5.64** |
| $\begin{gathered} \hline \mathrm{L}_{6} \\ \mathrm{x} \\ \mathrm{~T} 1 \\ \hline \end{gathered}$ | $\begin{aligned} & 10.5 \\ & 8^{* *} \\ & \hline \end{aligned}$ | $\begin{gathered} 21 . \\ 40^{*} \end{gathered}$ | $\begin{aligned} & 6.5 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 34 . \\ 02 * \end{gathered}$ | $\begin{gathered} 34 . \\ 02^{*} \end{gathered}$ | $\begin{gathered} 14 . \\ 09^{*} \end{gathered}$ | $\begin{gathered} 21.8 \\ 6 * * \end{gathered}$ | $\begin{gathered} 6.7 \\ 2 * * \end{gathered}$ | $\begin{gathered} 6.2 \\ 7 * * \\ \hline \end{gathered}$ | $\begin{aligned} & 5.6 \\ & 2 * * \end{aligned}$ | $\begin{aligned} & 3.4 \\ & 8^{*} \end{aligned}$ | $\begin{gathered} 5.7 \\ 1 * * \end{gathered}$ | $10.23$ | $3.51^{*}$ | 12.18** |
| $\begin{gathered} \hline \mathrm{L}_{6} \\ \mathrm{x} \\ \mathrm{~T}_{2} \\ \hline \end{gathered}$ | $\begin{aligned} & 10.3 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 17 . \\ 63^{*} \\ * \end{gathered}$ | $\begin{gathered} \hline 16 . \\ 69^{*} \\ * \\ \hline \end{gathered}$ | $\begin{aligned} & 18 . \\ & 90 \end{aligned}$ | $\begin{aligned} & 18 . \\ & 90 \end{aligned}$ | $\begin{aligned} & 30 . \\ & 86^{*} \end{aligned}$ | $\begin{aligned} & 25.8 \\ & 8^{* *} \end{aligned}$ | $\begin{aligned} & 9.3 \\ & 1 * * \end{aligned}$ | $\begin{gathered} 0.0 \\ 9 \\ \hline \end{gathered}$ | $\begin{gathered} 3.8 \\ 2 * \end{gathered}$ | $\begin{gathered} 2.5 \\ 2 \\ \hline \end{gathered}$ | $\begin{aligned} & 8.7 \\ & 1^{* *} \end{aligned}$ | -1.70* | $11.84$ ** | 14.93** |
| $\begin{gathered} \mathrm{L}_{6} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\begin{aligned} & 14.8 \\ & 5 * * \\ & \hline \end{aligned}$ | $\begin{aligned} & 13 . \\ & 43^{*} \end{aligned}$ | $\begin{gathered} 19 . \\ 59^{*} \\ * \end{gathered}$ | $\begin{gathered} 7.9 \\ 0 \end{gathered}$ | $\begin{gathered} 7.9 \\ 0 \end{gathered}$ | $\begin{aligned} & 23 . \\ & 15 * \\ & \text { * } \end{aligned}$ | $\begin{gathered} 27.3 \\ 4^{* *} \end{gathered}$ | $\begin{gathered} 3.7 \\ 2 * * \end{gathered}$ | $\begin{aligned} & 6.5 \\ & 4^{* *} \\ & \hline \end{aligned}$ | $\begin{gathered} 0.4 \\ 1 \\ \hline \end{gathered}$ | $\begin{aligned} & 3.6 \\ & 2^{*} \end{aligned}$ | $\begin{gathered} - \\ 2.8 \\ 5 * * \\ \hline \end{gathered}$ | 4.96* | $14.47$ | 7.85** |
| $\begin{gathered} \mathrm{L}_{6} \\ \mathrm{x} \\ \mathrm{~T}_{4} \end{gathered}$ | $\begin{aligned} & 14.7 \\ & 0 * * \end{aligned}$ | $\begin{gathered} 19 . \\ 64^{*} \\ * \end{gathered}$ | $\begin{gathered} 16 . \\ 80^{*} \\ * \end{gathered}$ | $\begin{gathered} 35 . \\ 05^{*} \\ * \end{gathered}$ | $\begin{gathered} 35 . \\ 05 * \\ * \end{gathered}$ | $\begin{gathered} 20 . \\ 16^{*} \\ * \end{gathered}$ | $\begin{gathered} 38.4 \\ 9 * * \end{gathered}$ | $13 .$ $62^{*}$ * | $\begin{gathered} 7.3 \\ 6^{* *} \end{gathered}$ | $\begin{aligned} & 4.6 \\ & 6 * * \end{aligned}$ | - 2.9 3 | $\begin{gathered} 3.6 \\ 1 * * \end{gathered}$ | 0.36 | $10.96$ | 1.06 |
| $L_{7}$ x $\mathrm{T}_{1}$ | $\begin{aligned} & 14.3 \\ & 2^{* *} \end{aligned}$ | $\begin{gathered} 41 . \\ 71^{*} \end{gathered}$ | $\begin{aligned} & 9.1 \\ & 5 * * \end{aligned}$ | $\begin{gathered} 8.5 \\ 9 \end{gathered}$ | $\begin{gathered} 8.5 \\ 9 \end{gathered}$ | $\begin{gathered} 1.8 \\ 5 \end{gathered}$ | $\begin{aligned} & 33.4 \\ & 7 * * \end{aligned}$ | 10. 89* * | $\begin{gathered} 10 . \\ 17 * \\ * \end{gathered}$ | $\begin{aligned} & 3.3 \\ & 2^{*} \end{aligned}$ | - 0.7 5 | $\begin{gathered} 4.7 \\ 3^{* *} \end{gathered}$ | -1.77* | 0.01 | 2.28* |
| $\begin{gathered} \mathrm{L}_{7} \\ \mathrm{x} \\ \mathrm{~T}_{2} \\ \hline \end{gathered}$ | $\begin{aligned} & 15.2 \\ & 7 * * \end{aligned}$ | $\begin{gathered} 37 . \\ 09^{*} \\ * \end{gathered}$ | $\begin{gathered} - \\ 1.2 \\ 2 \end{gathered}$ | $\begin{gathered} 31 . \\ 27 * \\ * \end{gathered}$ | $\begin{gathered} 31 . \\ 27^{*} \end{gathered}$ | $\begin{gathered} \hline 26 . \\ 54^{*} \\ * \\ \hline \end{gathered}$ | $\begin{aligned} & 26.6 \\ & 3^{* *} \end{aligned}$ | $\begin{gathered} 0.7 \\ 7 \end{gathered}$ | $\begin{gathered} 0.6 \\ 4 \end{gathered}$ | $\begin{gathered} 6.0 \\ 3^{* *} \end{gathered}$ | $\begin{aligned} & 31 . \\ & 65^{*} \end{aligned}$ | $\begin{gathered} 19 . \\ 42^{*} \\ * \end{gathered}$ | $10.95$ | $3.95^{*}$ | 14.43** |
| $\begin{gathered} \mathrm{L}_{7} \\ \mathrm{x} \\ \mathrm{~T}_{3} \\ \hline \end{gathered}$ | $\begin{aligned} & 13.4 \\ & 5 * * \end{aligned}$ | $\begin{aligned} & 46 . \\ & 99^{*} \end{aligned}$ | $\begin{gathered} 17 . \\ 79^{*} \end{gathered}$ | $\begin{gathered} 26 . \\ 46^{*} \\ * \end{gathered}$ | $\begin{gathered} 26 . \\ 46^{*} \\ * \end{gathered}$ | $\begin{gathered} 17 . \\ 90^{*} \\ * \end{gathered}$ | $\begin{aligned} & 31.5 \\ & 6 * * \end{aligned}$ | $\begin{aligned} & 4.1 \\ & 4 * * \end{aligned}$ | $\begin{aligned} & 5.1 \\ & 8^{*} \end{aligned}$ | $\begin{aligned} & 5.9 \\ & 4 * * \end{aligned}$ | $\begin{gathered} 15 . \\ 89^{*} \\ * \end{gathered}$ | $\begin{gathered} 15 . \\ 08^{*} \\ * \end{gathered}$ | 8.89* | $2.19^{*}$ | 13.79** |
| $\mathrm{L}_{7}$ X $\mathrm{T}_{4}$ | $\begin{aligned} & 11.6 \\ & 1 * * \end{aligned}$ | $\begin{gathered} 30 . \\ 21^{*} \\ * \end{gathered}$ | $\begin{gathered} 18 . \\ 37^{*} \end{gathered}$ | $\begin{gathered} \hline 40 . \\ 21 * \\ * \\ \hline \end{gathered}$ | $\begin{gathered} \hline 40 . \\ 21 * \\ * \\ \hline \end{gathered}$ | $\begin{gathered} \hline 18 . \\ 00^{*} \\ * \\ \hline \end{gathered}$ | $\begin{gathered} 31.2 \\ 1 * * \end{gathered}$ | $\begin{gathered} 4.6 \\ 7 * * \end{gathered}$ | $\begin{gathered} 3.0 \\ 0 \end{gathered}$ | $\begin{gathered} 5.9 \\ 2^{* *} \end{gathered}$ | 33. $15 *$ $*$ | 20. $80 *$ $*$ | - 9.50 $*$ | $3.95 *$ $*$ | 14.93** |

## Plant spread

Significant positive relative heterosis was registered for this trait in twenty-one out of twenty-eight cross combinations. It was maximum with the cross $\mathrm{L}_{5} \times \mathrm{T}_{4}$ (LCA $620 \times$ LCA 678) followed by $\mathrm{L}_{5} \mathrm{x}$ $\mathrm{T}_{3}(\mathrm{LCA} 620 \times \mathrm{G}-4)$ and $\mathrm{L}_{1} \times \mathrm{T}_{4}(\mathrm{LCA} 705-2 \times$ LCA 678$)$. Better parent heterosis was maximum and significant with seventeen cross combinations namely, $\mathrm{L}_{1} \times \mathrm{T}_{4}$ (LCA 705-2 $\times$ LCA 678) followed by $\mathrm{L}_{5} \times \mathrm{T}_{3}(\mathrm{LCA} 620 \times \mathrm{G}-4)$ and $\mathrm{L}_{2} \times \mathrm{T}_{2}(\mathrm{CO}-1 \times \mathrm{K} 1)$. Seventeen cross combinations recorded positively significant heterobeltiosis for this character. Commercial heterosis was significant and positive in nineteen cross combinations. It was maximum with the cross $\mathrm{L}_{1} \times \mathrm{T}_{4}$ (LCA 705-2 $\times$ LCA 678)
followed by $L_{6} \times T_{3}$ (Pusa Jwala $\times$ G- 4) and $L_{7} \times T_{4}$ (Pant C-1 $\times$ LCA 678). Similar findings were putforth by Ganesh Reddy et al. (2008), Surya Kumari et al. (2014).

## Fruit length

Relative heterosis for fruit length was found to be positive and significant in twenty-three cross combinations. The cross $\mathrm{L}_{7} \times \mathrm{T}_{2}($ Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ followed by $\mathrm{L}_{7} \times \mathrm{T}_{3}($ Pant $\mathrm{C}-1 \times \mathrm{G}-4)$ and $\mathrm{L}_{4} \times \mathrm{T}_{1}$ (LCA $625 \times$ LCA 334) attains maximum relative heterosis when compared to other cross combinations. Thirteen cross combinations recorded positively significant heterobeltiosis for this character. The crosses $\mathrm{L}_{7} \times \mathrm{T}_{3}$ (Pant C-1 $\times \mathrm{G}-4$ ) followed by $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant $\mathrm{C}-1 \times \mathrm{LCA} 678$ ) and $\mathrm{L}_{7} \times \mathrm{T}_{2}$ (Pant C-1 $\times \mathrm{K} 1$ ) recorded maximum better parent value for this trait. When it comes to standard heterosis twenty-seven cross combinations shows positively significant and it registered maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{3}\left(\right.$ Pant C-1 $\times \mathrm{G}-4$ ) followed by $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$ and $\mathrm{L}_{4} \times \mathrm{T}_{1}(\mathrm{LCA} 625 \times$ LCA 334). There exists scope for inclusion of this character in heterosis breeding programme of chillies Payakhapaab et al. (2012), Suryakumari et al. (2014).

## Fruit width

Significant and positive relative heterosis was observed in fifteen cross combinations, with the highest value observed in the cross L4 x T1 (LCA $625 \times$ LCA 334) followed by the cross L6 x T1 (Pusa Jwala $\times$ LCA 334) and L4 x T3 (LCA $625 \times$ G-4). For this trait, heterobeltiosis was positive and significant in nine cross combinations. The cross L4 x T3 (LCA 625 G-4) was showed maximum heterobeltiosis followed by L7 x T4 (Pant C-1 LCA 678) and L5 x T3 (LCA 620 G-4). Twelve cross combinations exhibited significant and positive standard heterosis. The highest standard heterosis was observed in the cross L4 x T3 (LCA $625 \times$ G-4) followed by L7 x T4 (Pant C-1 $\times$ LCA678) and L4 x T2 (LCA $625 \times$ K1). This information was reported by Payakhapaab et al. (2012) and Khalil and Hatem (2014). Fruit pedicel length

Nineteen out of twenty-eight cross combinations registered positively significant relative heterosis for this character. It was maximum with the cross $L_{7} \times T_{2}$ (Pant C-1 $\times$ K1) followed by $L_{6} \times T_{2}$ (Pusa Jwala $\times \mathrm{K} 1$ ) and $\mathrm{L}_{4} \times \mathrm{T}_{2}(\mathrm{LCA} 625 \times \mathrm{K} 1)$. Twelve cross combinations exhibited better parent heterosis for this character. It was maximum with the cross $L_{7} \times T_{2}($ Pant $C-1 \times K 1)$ followed by $L_{2} x$ $\mathrm{T}_{3}(\mathrm{CO}-1 \times \mathrm{G}-4)$ and $\mathrm{L}_{6} \times \mathrm{T}_{2}($ Pusa Jwala $\times \mathrm{K} 1)$. Standard heterosis was positive and significant in twenty cross combinations. It was maximum with the cross $L_{4} \times T_{2}(L C A ~ 625 \times K 1)$ followed by $L_{4} x$ $\mathrm{T}_{3}\left(\right.$ LCA $625 \times$ G-4) and $\mathrm{L}_{6} \times \mathrm{T}_{2}($ Pusa Jwala $\times \mathrm{K} 1)$. There exists a good scope for inclusion of this character in heterosis breeding programme of chillies.

## Placenta length

For this particular trait, there were twenty-two cross combinations that showed significant and positive relative heterosis. The highest relative heterosis was observed in the cross between L1 x T1 (LCA 705-2 $\times$ LCA 334). This was followed by L7 x T1 (Pant C-1 x LCA 334), and L3 x T1 (Arka Lohit $x$ LCA 334). In better parent heterosis nine crosses were significant for this trait. It was maximum with the cross $\mathrm{L}_{1} \times \mathrm{T}_{1}\left(\mathrm{LCA} 705-2 \times\right.$ LCA 334) followed by $\mathrm{L}_{3} \times \mathrm{T}_{1}$ (Arka Lohit $\times \mathrm{LCA}$ 334) and $\mathrm{L}_{6} \times \mathrm{T}_{4}$ (Pusa Jwala $\times$ LCA 678). Nineteen out of twenty-eight cross combinations registered positively significant standard heterosis for this character. It was maximum with the cross $L_{6} \times T_{4}$ (Pusa Jwala $\times$ LCA 678) followed by $\mathrm{L}_{7} \times \mathrm{T}_{1}\left(\right.$ Pant C-1 $\times \mathrm{LCA} 334$ ) and $\mathrm{L}_{7} \times \mathrm{T}_{3}$ (Pant C-1 $\times \mathrm{G}-4$ ) respectively. Incorporating this character in heterosis breeding programme may be beneficial, as it exhibited a higher number of crosses with significant positive standard heterosis. The direction and magnitude of standard heterosis in these crosses further supports its inclusion.

## Number of fruits per plant

Positive and significant relative heterosis for this trait was observed in eleven cross combinations. The highest positive heterosis was detected in L7 x T4 (Pant C-1 $\times$ LCA 678), followed by L4 x T3 (LCA $625 \times$ G-4) and L1 x T3 (LCA 705-2 $\times$ G- 4). Better parent heterosis was significant for nine cross combinations. The highest heterosis was observed in the cross L1 x T3 (LCA 705-2 $\times$ G-4), followed by L4 x T3 (LCA $625 \times$ G-4) and L5 x T3 (LCA $620 \times$ G-4). Three crosses out of twenty-eight cross combinations registered positive and significant standard heterosis for this character. It was maximum with the cross $L_{7} \times T_{4}$ (Pant C-1 $\times$ LCA 678) followed by $L_{2} \times T_{1}(C O-1 \times L C A 334)$ and $L_{4} \times T_{3}$ (LCA $625 \times$ G-4) respectively. Supporting evidences for results of the current study were available from the earlier studies of Ganesh Reddy et al. (2008), Kumar et al. (2013), Savitha et al. (2015).

## Fruit weight

Eleven different crosses showed significant relative heterosis for this particular trait. The highest level of heterosis was observed in the L4 x T1 cross (LCA $625 \times$ LCA 334). This was followed by the L7 x T1 cross (Pant C-1 $\times$ LCA 334) and the L4 x T3 cross (LCA $625 \times \mathrm{G}-4$ ). Only six crosses out of twenty-eight cross combinations exhibited heterobeltiosis for this character. It was maximum with the cross $L_{6} \times T_{1}\left(\right.$ Pusa Jwala $\times$ LCA 334), $L_{5} \times T_{4}\left(L C A 620 \times\right.$ LCA 678) and $L_{4} \times T_{3}$ (LCA $625 \times$ G- 4). Seven cross combinations evinced standard heterosis for this character. It was maximum with the cross $L_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$ followed by $\mathrm{L}_{7} \times \mathrm{T}_{1}($ Pant $\mathrm{C}-1 \times \mathrm{LCA} 334)$ and $\mathrm{L}_{5} \times \mathrm{T}_{4}(\mathrm{LCA} 620 \times$ LCA 678).

## Number of seed fruit ${ }^{\mathbf{- 1}}$

Relative heterosis for this trait was observed in eleven different cross combinations. The highest level of heterosis was observed in L4 x T1 cross (LCA $625 \times$ LCA 334), followed by Pant C-1 x T1 (LCA $334 \times$ L7) and G-4 x L5 (G-4 $\times$ LCA 620). Three cross combinations showed heterobeltiosis for number of seeds per fruit. The highest value was achieved with the cross L4 x T1 (LCA $625 \times$ LCA 334). After that, the next best cross combinations were L7 x T1 (Pant C-1 $\times$ LCA 334) and L5 x T3 (LCA $620 \times$ G-4). Commercial heterosis was positive and significant with eight cross combinations. It was maximum with the cross $\mathrm{L}_{5} \times \mathrm{T}_{4}\left(\mathrm{LCA} 620 \times\right.$ LCA 678) followed by $\mathrm{L}_{3} \mathrm{x} \mathrm{T}_{4}$ (Arka Lohit $\times \mathrm{LCA}$ 678 ) and $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1 $\times$ LCA 678). The outcome agrees with the findings of Tembhurne and Rao (2012), Kumar et al. (2013), Surya Kumari et al. (2014).

## 1000 seed weight

Twelve cross combinations demonstrated relative heterosis for this character. It was maximum with the cross combination $L_{7} \times T_{2}($ Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ followed by $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$ and $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1 $\times$ LCA 678). Six cross combinations showed heterobeltiosis for grain yield per plant. It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{4}($ Pant $\mathrm{C}-1 \times \mathrm{LCA} 678)$ followed by $\mathrm{L}_{7} \times \mathrm{T}_{2}($ Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ and $\mathrm{L}_{1} \mathrm{x}$ $\mathrm{T}_{3}$ (LCA 705-2 $\times$ G-4). Commercial heterosis was positive and significant with twenty cross combinations. It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1×LCA 678) followed by $\mathrm{L}_{7} \times \mathrm{T}_{2}$ (Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ and $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$. The result is in agreement with the findings of Tembhurne and Rao (2012), Kumar et al. (2013), Surya Kumari et al. (2014).

## Fruit yield plant ${ }^{-1}$

Thirteen cross combinations demonstrated relative heterosis for fruit yield per plant. It was maximum with the cross combination $L_{4} \times T_{3}(L C A 25 \times G-4)$ followed by $L_{7} \times T_{2}($ Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ and $L_{6} \times \mathrm{T}_{2}$ (Pusa Jwala $\times \mathrm{K} 1$ ). Eight cross combinations showed heterobeltiosis for fruit yield per plant. It was maximum with the cross $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 25 \times \mathrm{G}-4)$ followed by $\mathrm{L}_{6} \times \mathrm{T}_{2}$ (Pusa Jwala $\times \mathrm{K} 1$ ) and $\mathrm{L}_{6} \times \mathrm{T}_{1}$ (Pusa Jwala $\times$ LCA 334). Commercial heterosis was positive and significant with sixteen cross combinations. It was maximum with the cross $\mathrm{L}_{4} \times \mathrm{T}_{3}$ (LCA $625 \times \mathrm{G}-4$ ) followed by $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1 $\times$ LCA 678) and $\mathrm{L}_{7} \times \mathrm{T}_{2}$ (Pant $\left.\mathrm{C}-1 \times \mathrm{K} 1\right)$. The result is in agreement with the findings of Prajapati and Agalodia (2011), Payakhapaab et al. (2012).

## Ascorbic acid content

Fourteen cross combinations demonstrated negative relative heterosis for this character. It was maximum with the cross combination $\mathrm{L}_{7} \times \mathrm{T}_{2}\left(\right.$ Pant $\mathrm{C}-1 \times \mathrm{K} 1$ ) followed by $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant $\mathrm{C}-1 \times \mathrm{LCA}$ 678) and $\mathrm{L}_{6} \times \mathrm{T}_{1}$ (Pusa Jwala $\times$ LCA 334). Eigtheen cross combinations showed heterobeltiosis for Ascorbic acid content( $\mathrm{mg} / 100 \mathrm{gm}$ ). It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{2}$ (Pant $\mathrm{C}-1 \times \mathrm{K} 1$ ) followed by $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1 $\times$ LCA 678) and $\mathrm{L}_{6} \times \mathrm{T}_{1}$ (Pusa Jwala $\times \mathrm{LCA} 334$ ). Commercial heterosis was negative and significant with twenty-three cross combinations. It was maximum with the cross $\mathrm{L}_{7} \mathrm{x} \mathrm{T}_{2}$ (Pant C-1 $\times$ K1) followed by $L_{6} \times T_{1}$ (Pusa Jwala $\times$ LCA 334) and $L_{7} \times T_{4}$ (Pant C-1 $\times$ LCA 678). The result is in agreement with the findings of Patel et al. (2010), Asish and Pugalendi (2012).

## Capsaicin content

Relative heterosis for this trait was shown by twenty-four cross combinations. The highest relative heterosis was observed in the cross combination of L4 x T3 (LCA $625 \times G-4$ ), followed by L3 x T3 (Arka Lohit $\times$ G-4) and L2 x T3 (CO -1 x G-4). Nine cross combinations showed heterobeltiosis for capsaicin content. It was maximum with the cross $\mathrm{L}_{4} \times \mathrm{T}_{3}(\mathrm{LCA} 625 \times \mathrm{G}-4)$ followed by $\mathrm{L}_{5} \times \mathrm{T}_{3}$ (LCA $620 \times$ G-4) and $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C1 x LCA 678) Commercial heterosis was positive and significant with two cross combinations. It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{2}($ Pant $\mathrm{C}-1 \times \mathrm{K} 1)$ and $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C$1 \times$ LCA 678). The result is in agreement with the findings of Patel et al. (2010), Prasath and Ponnuswami (2008), Suryakumari et al. (2014).

## Capsanthin content

For this character, eighteen cross combinations showed relative heterosis. The cross combination L 7 x T2 (Pant C-1 K1), L7 x T4 (Pant C-1 LCA 678) and L6 x T2 (Pusa Jwala K1) were the highest. Fifteen cross combinations showed heterobeltiosis for grain yield per plant. It was maximum with the cross $\mathrm{L}_{7} \times \mathrm{T}_{2}\left(\right.$ Pant $\mathrm{C} 1 \times \mathrm{K} 1$ ) followed by $\mathrm{L}_{7} \times \mathrm{T}_{4}$ (Pant C-1×LCA 678) and $\mathrm{L}_{6} \times \mathrm{T}_{2}$ (Pusa Jwala $\times$ K1). Twenty-two cross combinations showed positive and significant standard heterosis. L7 x T4 (Pant C-1 $\times$ LCA 678) and L6 x T2 (Pusa Jwala $\times \mathrm{K} 1$ ) reached its maximum, followed by L7 x T2 (Pant C-1 $\times \mathrm{K}-1$ ) and L7 x T3 (Pant C-1 $\times \mathrm{G}-4$ ). The result is in agreement with the findings of Rekha (2015).

## 4. Conclusion

In the present study, the hybrids L4 x T3 (LCA $625 \times \mathrm{G}-4$ ) is the best hybrids followed by L7 x T4 (Pant C-1 $\times$ LCA 678) and L7 x T2 (Pant C-1 $\times$ K1) recorded significant standard heterosis for fruit yield per plant. It would be more effective to choose hybrids for heterosis breeding based on per se performance, specific combining ability effects, and standard heterosis. Overall, the three best hybrids identified from among the twenty-eight evaluated are L4 x T3 (LCA $625 \times \mathrm{G}-4$ ), L7 x T4 (Pant C-1 $\times$ LCA 678), and L7 x T2 (Pant C-1 $\times$ K1), based on all three criteria.

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