

Original Research Article

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## ***Per se* Performance of Pumpkin Hybrids for Small Size, Thick Flesh with High Yield and Quality Traits**

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### **A B S T R A C T**

An investigation was carried out to study the performance of 18 hybrids of pumpkin (*Cucurbita moschata* Duch. ex Poir) through Line x Tester mating design. Observations were recorded on the traits viz., vine length, days to first female flower appearance, node number for first female flower appearance, sex ratio, days to first harvest, fruit number per vine, fruit weight, flesh thickness and fruit yield per vine, besides quality traits such as ascorbic acid content, beta carotene content and crude fibre content in the fruit. Evaluation of hybrids for *per se* and *sca* revealed that the cross Rajasthan Local x Pusa Viswas (L<sub>5</sub> x T<sub>2</sub>) was adjudged as the best hybrid, since it recorded the highest mean and *sca* effect for traits of study viz., fruit weight and total yield per vine. The next best hybrid, Ambili x Pusa Viswas (L<sub>2</sub> x T<sub>2</sub>) could also be justified as the best combination through less days for first female flower appearance, more fruit number per vine, crude fibre content and fruit yield per vine. The next best hybrid, Saras x Pusa Viswas (L<sub>3</sub> x T<sub>2</sub>) could also be adjusted as the best combination, since it recorded the highest mean and *sca* effect of traits of study like flesh thickness and beta carotene content. Thus, first generation hybrids can be well-utilized for exploiting hybrid vigour to achieve improved quality.

#### **Keywords**

Small size, Pumpkin, beta carotene

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### **Introduction**

Pumpkin (*Cucurbita moschata* Duch. ex Poir.) originated in Central Mexico and is cultivated in the tropical and subtropical regions of the world. It is an important cucurbitaceous vegetable crop of India, constituting a principal ingredient in several Indian dishes.

Pumpkin has received little attention in crop improvement compared to other cucurbitaceous vegetables even it is a rich source of beta carotene next to carrot. Vitamin A deficiency constitute a public health problem and affects mainly children and women. In India, consumers prefer dark yellow color, round shape fruit with thick and

deep yellow internal flesh color. In pumpkin, the major problem is its large-sized fruits (4-5 kg each). This is not preferred by the present nuclear families of three to four members.

Further, with increase in number of such families recently in India, customers prefer to buy only whole fruits of medium-size pumpkins, instead of cut pieces. Further, small fruits are easily packed and transported, without any damage. Therefore, developing pumpkin hybrids with small sized fruits (1-2 kg) with rich in beta carotene content is essential. The present study was undertaken to evaluate F<sub>1</sub> hybrids for yield and quality purpose.

### **Materials and Methods**

The investigation was carried out at Department of Vegetable Crops, Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, during 2016-17, with 18 F<sub>1</sub> hybrids (obtained by crossing 6 lines and 3 testers through line x tester mating design) along with the standard check (Arjuna) from East West Seeds (P) Ltd. Field experiments with the hybrids were laid out in Randomized Block Design, with two replications and five plants per replication at a spacing of 1.5 x 2.0 m<sup>2</sup>. Recommended package of practices of TNAU was followed to grow a successful crop of pumpkin. Observations were recorded in five randomly selected plants in each replication on important quantitative traits, viz., vine length (m), days to first female flower appearance, node number for first female flower appearance, sex ratio, days to first harvest, fruit number per vine, fruit weight (kg), flesh thickness (cm) and fruit yield per vine (kg) besides quality traits such as ascorbic acid content (mg/100g), beta carotene content (µg/g) and crude fibre content of the fruit (%) were analysed as per AOAC method (1975), Chopra and Kanwar method (1972). Statistical

analysis of data was done to estimate *per se* values and degree of significance of various traits (Panse and Sukhatme, 1978).

### **Results and Discussion**

In Pumpkin hybrids exhibited significant differences for all the characters under study for growth, yield and quality, thus offering scope for selecting high-yielding hybrids with good quality traits. Results of *per se* performance of hybrids are presented in Tables 1. The *sca* effect of a hybrid denotes deviation from performance prediction based on *gca* of the parents (Allard, 1960). The *sca* effect seen is due to dominance, epistasis and environmental influence. Under certain favourable conditions, all the non-additive gene functions may be triggered and may result in high *sca* effect and mean value of a responding hybrid. Thus, evaluation of a hybrid for high *per se* and *sca* effect is also an important criterion. Hybrids with high *per se* and *sca* effect were evaluated for selecting the best hybrids.

The *gca* and *sca* values of parents and hybrids are presented in Tables 2 and 3, respectively. Vine length is an important parameter for obtaining high fruit yield in pumpkin. Among the 18 hybrids of pumpkin studied, the cross 'Odisha Local x CO2' followed by 'Ambili x Punjab Samrat' and 'Mysore Local x Punjab Samrat' exhibited high *sca* and mean performance for vine length. Sharma *et al.*, (1993) recorded similar results in bitter melon in the cross 'Pocha Seed x PSPL'.

In these crosses, the parents, Odisha Local, Ambili except Mysore Local (poor combiner) and the tester Punjab Samrat exhibited good general combining ability for vine length. A predominant role of non-additive gene action for vine length in pumpkin was reported by Tamilselvi *et al.*, (2013), Sirohi and Ghorui (1993) and Nisha (1999).

Days taken to first female flower appearance is considered as one of the essential criteria for selecting for earliness in hybrids. The present study of 18 pumpkin crosses, the *sca* variances of days taken to first female flower appearance were greater than those of *gca* suggesting the better role of non-additive genetic factors than that of additive action. It was also noticed that, the cross Ambili x CO2 ( $L_2 \times T_3$ ), Ambili x Pusa Viswas ( $L_2 \times T_2$ ) and Rajasthan Local x Punjab Samrat ( $L_5 \times T_1$ ) exhibited the high negative and significant *sca* and less mean performance for earliness in terms of days for first female flower appearance. In these crosses, the parents Rajasthan Local ( $L_5$ ), Ambili ( $L_2$ ), and the tester Punjab Samrat ( $T_1$ ) exhibited good general combining ability and high *per se* values for days for first female flower appearance. Neeraj Sharma *et al.*, (2002) recorded the similar results in bottle gourd. The lowest mean performance for sex ratio was observed in the hybrids Odisha Local x CO2 ( $L_4 \times T_3$ ) followed by Ambili x Punjab Samrat ( $L_2 \times T_1$ ) among the 18 pumpkin hybrids of the study while, the hybrids Ambili x Punjab Samrat ( $L_2 \times T_1$ ) followed by Odisha Local x Punjab Samrat ( $L_4 \times T_1$ ) recorded lowest mean coupled with negative significant *sca* values for the same trait. Kumaresan *et al.*, (2005) also endorsed the same results of lowest sex ratio by the snake gourd hybrid PKM-1 x Mahyco Short. In the present investigation, the variance due to *sca* was greater than that of *gca* for sex ratio which referred the preponderance of non-additive gene action for sex ratio was clearly indicated.

The fruit number per vine has a considerable influence on yield of fruits. The hybrids Saras x Pusa Viswas ( $L_3 \times T_2$ ) followed by Ambili x Pusa Viswas ( $L_2 \times T_2$ ) recorded the highest *per se* coupled with significant *sca* effect for fruit number per vine. In this cross, as the female parents Ambili ( $L_2$ ) had already proved as a good general combiner for this trait.

Similar results were observed in bitter gourd, by Lawande and Patil (1989) where the hybrid Green Long x CO2 gave higher significant *sca* value for fruit number per vine. In the present investigation, the variance due to *sca* was much greater than the *gca* indicating the influence of non-additive gene action for fruit number per vine. This is in accordance with the reports of Richard Kennedy (1994), Munshi and Sirohi (1994) in bitter gourd that non-additive gene action had influenced this trait. With respect to fruit weight, the pumpkin crosses Rajasthan Local x Pusa Viswas ( $L_5 \times T_2$ ) followed by Odisha Local x Pusa Viswas ( $L_4 \times T_2$ ) recorded the highest mean and *sca* effect. In these crosses, the parents Rajasthan Local ( $L_5$ ), Odisha Local ( $L_4$ ), and the tester Pusa Viswas ( $T_2$ ) exhibited good general combining ability and high *per se* values for same trait.

Similar results were recorded by Rao *et al.*, (2000) in ridge gourd. In pumpkin, flesh thickness is an important parameter. In this study, the hybrids Rajasthan Local x CO2 ( $L_5 \times T_3$ ) and Saras x Pusa Viswas ( $L_3 \times T_2$ ) recorded the highest *per se* coupled with significant *sca* effect for fruit flesh thickness.

In these crosses, the parents Rajasthan Local ( $L_5$ ) and the tester Pusa Viswas ( $T_2$ ) exhibited good general combining ability and high *per se* values for same trait. This is in agreement with the findings of Nisha (1999) in pumpkin.

It was observed that seed weight was governed by dominant gene or non-additive gene action. The hybrid Mysore Local x Pusa Viswas ( $L_1 \times T_2$ ) followed by Saras x CO2 ( $L_3 \times T_3$ ) recorded the better significant mean and *sca* values. These results were coincides with the results obtained by Munshi and Sirohi (1994) and Richard Kennedy (1994) in bitter gourd and Nisha (1999) in pumpkin that the hybrid CM31 x CO2 recorded the highest mean and *sca* values for this trait.

**Table.1** *Per se* performance of hybrids for different traits in Pumpkin

Hybrids	Vine length (m)	Days to first female flower appearance	Node number for first female flower appearance	Sex ratio	Days to first harvest	No. of fruit per vine	Fruit weight (kg)	Fruit equ. Diameter (cm)	Fruit polar diameter (cm)	Flesh thickness (cm)	No. of seed/ fruit	Seed wt./ fruit (g)	100 seed wt. (g)	Ascorbic acid content (mg/100g)	Crude fiber (%)	$\beta$ carotene ( $\mu$ g/g)	Fruit yield/vine (kg)
L <sub>1</sub> x T <sub>1</sub>	4.52	51.10	7.90	18.26	90.33	4.20	1.21	16.00	16.50	2.30	210.00	27.30	13.00	5.32	0.98	40.32	7.22
L <sub>1</sub> x T <sub>2</sub>	3.48	53.40	15.70	15.11	98.20	4.80	1.72	17.20	11.50	2.10	280.00	29.60	10.57	6.30	1.04	25.46	11.09
L <sub>1</sub> x T <sub>3</sub>	3.89	53.80	7.40	16.70	120.30	4.30	2.31	17.40	15.00	3.20	140.00	24.80	17.71	4.20	1.06	24.45	7.31
L <sub>2</sub> x T <sub>1</sub>	4.94	51.70	8.25	14.19	98.70	5.30	1.70	16.50	9.00	2.50	310.01	15.60	5.03	6.29	0.86	12.44	5.83
L <sub>2</sub> x T <sub>2</sub>	4.30	42.20	8.03	14.84	88.20	6.80	1.10	15.50	10.00	2.10	163.00	12.30	7.55	6.34	1.30	28.06	14.03
L <sub>2</sub> x T <sub>3</sub>	4.10	43.10	7.70	15.79	95.31	4.40	2.50	22.50	10.40	2.70	280.00	21.20	7.57	5.31	0.94	17.46	10.38
L <sub>3</sub> x T <sub>1</sub>	3.22	51.60	12.90	23.88	94.60	2.10	1.96	14.20	12.00	3.10	312.00	20.20	6.47	7.20	1.20	14.16	5.38
L <sub>3</sub> x T <sub>2</sub>	3.86	51.90	11.80	15.23	88.89	6.50	1.70	17.50	14.00	3.80	188.00	15.30	8.14	8.31	1.45	89.60	10.10
L <sub>3</sub> x T <sub>3</sub>	3.56	50.90	12.80	21.45	93.14	3.10	1.14	16.00	12.50	1.20	230.00	26.80	11.65	6.20	1.05	9.61	3.53
L <sub>4</sub> x T <sub>1</sub>	4.92	52.70	12.20	14.20	83.10	5.23	2.16	19.30	12.00	3.00	328.00	26.30	8.02	6.30	1.23	2.54	11.30
L <sub>4</sub> x T <sub>2</sub>	4.28	47.70	6.10	14.77	86.90	5.10	2.75	20.60	16.00	4.10	258.00	24.30	9.42	8.80	1.86	4.59	12.29
L <sub>4</sub> x T <sub>3</sub>	4.98	52.80	14.90	13.35	94.60	5.30	2.07	18.10	10.00	3.90	356.00	29.30	8.23	6.20	1.45	5.44	10.97
L <sub>5</sub> x T <sub>1</sub>	3.89	45.80	9.90	19.23	82.62	3.28	1.90	19.50	12.50	2.70	326.00	22.60	6.93	5.89	0.84	17.45	6.23
L <sub>5</sub> x T <sub>2</sub>	4.20	50.30	12.60	14.63	83.81	5.90	3.24	19.50	18.30	3.10	278.00	20.30	7.30	9.20	0.93	16.26	16.65
L <sub>5</sub> x T <sub>3</sub>	4.09	50.40	12.50	14.64	95.81	5.13	2.07	20.30	11.50	3.90	280.00	25.60	9.14	8.71	1.08	20.30	10.62
L <sub>6</sub> x T <sub>1</sub>	3.26	52.60	6.20	22.56	98.32	2.36	1.27	15.50	8.20	2.60	288.00	15.60	5.42	3.20	1.01	21.14	3.00
L <sub>6</sub> x T <sub>2</sub>	3.89	63.00	14.30	23.12	102.08	2.16	1.55	16.90	12.20	2.10	138.00	13.20	9.57	4.82	0.95	9.95	3.35
L <sub>6</sub> x T <sub>3</sub>	3.64	63.30	3.50	23.64	115.30	2.12	1.26	15.80	9.30	2.00	182.00	20.68	11.36	2.09	0.39	10.97	2.67
Check Hybrid	4.89	69.00	22.10	19.27	115.80	4.16	3.20	20.80	12.00	3.40	395.22	24.20	6.22	9.93	2.93	18.53	8.74
Mean	4.06	51.57	10.26	17.53	95.01	4.34	1.87	17.68	12.27	2.80	252.61	21.72	9.06	6.15	1.09	20.57	8.44
SEd	0.050	0.718	0.149	0.238	1.213	0.056	0.027	0.183	0.189	0.034	3.064	0.335	0.086	0.079	0.017	0.486	0.105
C.D. (0.05)	0.105	1.546	0.315	0.501	2.556	0.119	0.572	0.386	0.389	0.072	6.465	0.707	0.182	0.168	0.036	1.024	0.222

Mysore Local (L<sub>1</sub>), Ambili (L<sub>2</sub>), Saras (L<sub>3</sub>), Odisha Local (L<sub>4</sub>), Rajasthan Local (L<sub>5</sub>), CO1 (L<sub>6</sub>), Punjab Samrat (T<sub>1</sub>), Pusa Viswas (T<sub>2</sub>), CO2 (T<sub>3</sub>)

**Table.2** General combining ability effects of pumpkin parents

Parents	Vine length (m)	Days to first female flower appearance	Node number for first female flower appearance	Sex ratio	Days to first harvest	No. of fruit per vine	Fruit weight (kg)	Fruit equ. Diameter (cm)	Fruit polar diameter (cm)	Flesh thickness (cm)	No. of seed/ fruit	Seed wt./ fruit (g)	100 seed wt. (g)	Ascorbic acid content (mg/100g)	Crude fiber (%)	$\beta$ carotene ( $\mu$ g/g)	Fruit yield/vine (kg)
<b>L<sub>1</sub></b>	-0.09 **	1.19 **	0.07 ns	-0.84 **	7.93 **	0.10 **	-0.12 **	-0.82 **	2.06 **	-0.27 **	-42.61 **	5.51 **	4.70 **	-0.88 **	-0.06 **	9.51 **	0.10 *
<b>L<sub>2</sub></b>	0.39 **	-5.91 **	-2.27 **	-2.59 **	-0.94 ns	1.16 **	-0.10 **	0.48 **	-2.47 **	-0.37 **	-1.61 ns	-5.35 **	-2.35 **	-0.17 **	-0.06 **	-1.25 **	1.64 **
<b>L<sub>3</sub></b>	-0.51 **	-0.11 ns	2.24 **	2.65 **	-2.80 **	-0.44 **	-0.27 **	-1.78 **	0.56 **	-0.10 **	-9.28 **	-0.95 **	-0.31 **	1.09 **	0.14 **	17.22 **	-2.10 **
<b>L<sub>4</sub></b>	0.67 **	-0.51 ns	0.81 **	-3.43 **	-6.81 **	0.87 **	0.46 **	1.65 **	0.39 **	0.87 **	61.39 **	4.91 **	-0.50 **	0.95 **	0.42 **	-16.38 **	3.08 **
<b>L<sub>5</sub></b>	0.00 ns	-2.74 **	1.41 **	-1.37 **	-7.60 **	0.43 **	0.54 **	2.08 **	1.83 **	0.43 **	42.05 **	1.11 **	-1.27 **	1.78 **	-0.14 **	-2.56 **	2.73 **
<b>L<sub>6</sub></b>	-0.46 **	8.06 **	-2.26 **	5.57 **	10.22 **	-2.12 **	-0.51 **	-1.62 **	-2.37 **	-0.57 **	-49.95 **	-5.23 **	-0.28 **	-2.78 **	-0.31 **	-6.55 **	-5.44 **
<b>SEd</b>	0.020	0.293	0.061	0.970	0.495	0.023	0.011	0.075	0.077	0.014	1.251	0.137	0.035	0.032	0.007	0.198	0.043
<b>T<sub>1</sub></b>	0.07 **	-0.66 **	-0.70 **	1.19 **	-3.73 **	-0.59 **	-0.17 **	-0.85 **	-0.57 **	-0.10 **	43.06 **	-0.45 **	-1.58 **	-0.45 **	-0.07 **	-2.56 **	-1.95 **
<b>T<sub>2</sub></b>	-0.06 **	-0.16 ns	1.16 **	-1.25 **	-3.66 **	0.87 **	0.14 **	0.18 **	1.39 **	0.08 **	-35.11 **	-2.55 **	-0.30 **	1.15 **	0.16 **	8.42 **	2.81 **
<b>T<sub>3</sub></b>	-0.01 ns	0.81 **	-0.46 **	0.06 ns	7.40 **	-0.28 **	0.02 **	0.67 **	-0.82 **	0.02 ns	-7.95 **	3.01 **	1.88 **	-0.70 **	-0.10 **	-5.86 **	-0.86 **
<b>SEd</b>	0.014	0.207	0.043	0.069	0.350	0.016	0.008	0.053	0.055	0.010	0.884	0.097	0.025	0.023	0.005	0.140	0.030

\*Significant at 5 per cent level

\*\* Significant at 1 per cent level

Mysore Local (L<sub>1</sub>),Ambili (L<sub>2</sub>), Saras (L<sub>3</sub>),Odisha Local (L<sub>4</sub>), Rajasthan Local (L<sub>5</sub>), CO1 (L<sub>6</sub>), Punjab Samrat (T<sub>1</sub>), Pusa Viswas (T<sub>2</sub>), CO2 (T<sub>3</sub>)

**Table.3** Specific combining ability effects of hybrids for different traits in pumpkin

Hybrids	Vine length (m)	Days to first female flower appearance	Node number for first female flower appearance	Sex ratio	Days to first harvest	No. of fruit per vine	Fruit weight (kg)	Fruit equ. Diameter (cm)	Fruit polar diameter (cm)	Flesh thickness (cm)	No. of seed/ fruit	Seed wt./ fruit (g)	100 seed wt. (g)	Ascorbic acid content (mg/100g)	Crude fiber (%)	β carotene (µg/g)	Fruit yield/vine (kg)
L <sub>1</sub> x T <sub>1</sub>	0.49 **	-1.01 NS	-1.73 **	0.38 *	-8.88 **	0.36 **	-0.37 **	-0.02 NS	2.74 **	-0.13 **	-43.05 **	0.52 *	0.82 **	0.50 **	0.02 ns	12.80 **	0.63 **
L <sub>1</sub> x T <sub>2</sub>	-0.43 **	0.79 NS	4.20 **	-0.33 NS	-1.08 NS	-0.51 **	-0.17 **	0.15 NS	-4.23 **	-0.52 **	105.11 **	4.92 **	-2.89 **	-0.12 *	-0.15 **	-13.04 **	-0.26 **
L <sub>1</sub> x T <sub>3</sub>	-0.06 NS	0.22 NS	-2.47 **	-0.05 NS	9.96 **	0.15 **	0.54 **	-0.13 NS	1.49 **	0.65 **	-62.06 **	-5.44 **	2.07 **	-0.38 **	0.13 **	0.24 NS	-0.37 **
L <sub>2</sub> x T <sub>1</sub>	0.42 **	6.69 **	0.96 **	-1.94 **	8.36 **	0.39 **	0.10 **	-0.82 **	-0.23 NS	0.17 **	15.95 **	-0.31 NS	-0.10 NS	0.76 **	-0.10 **	-4.32 **	-2.30 **
L <sub>2</sub> x T <sub>2</sub>	-0.09 *	-3.31 **	-1.13 **	1.15 **	-2.21 *	0.43 **	-0.81 **	-2.85 **	-1.19 **	-0.42 **	-52.89 **	-1.51 **	1.13 **	-0.79 **	0.10 **	0.32 NS	1.14 **
L <sub>2</sub> x T <sub>3</sub>	-0.33 **	-3.38 **	0.17 NS	0.79 **	-6.16 **	-0.82 **	0.71 **	3.67 **	1.42 **	0.25 **	36.94 **	1.82 **	-1.03 **	0.03 ns	0.00 ns	4.00 **	1.16 **
L <sub>3</sub> x T <sub>1</sub>	-0.39 **	0.79 NS	1.10 **	2.51 **	6.12 **	-1.21 **	0.53 **	-0.85 **	-0.26 NS	0.50 **	25.61 **	-0.11 NS	-0.70 **	0.41 **	0.04 **	-21.07 **	0.99 **
L <sub>3</sub> x T <sub>2</sub>	0.37 **	0.59 NS	-1.86 **	-3.71 **	0.35 NS	1.73 **	-0.04 *	1.42 **	-0.23 NS	1.02 **	-20.22 **	-2.91 **	-0.31 **	-0.07 NS	0.05 **	43.39 **	0.95 **
L <sub>3</sub> x T <sub>3</sub>	0.03 NS	-1.38 *	0.76 **	1.20 **	-6.47 **	-0.52 **	-0.48 **	-0.57 **	0.49 **	-1.52 **	-5.39 *	3.02 **	1.01 **	-0.34 **	-0.09 **	-22.32 **	-1.94 **
L <sub>4</sub> x T <sub>1</sub>	0.12 **	2.29 **	1.83 **	-1.09 **	-1.37 NS	0.61 **	0.00 NS	0.82 **	-0.09 NS	-0.57 **	-29.06 **	0.12 NS	1.04 **	-0.35 **	-0.21 **	0.91 *	1.73 **
L <sub>4</sub> x T <sub>2</sub>	-0.39 **	-3.21 **	-6.13 **	1.91 **	2.37 *	-0.98 **	0.28 **	1.08 **	1.94 **	0.35 **	-20.89 **	0.22 NS	1.17 **	0.56 **	0.18 **	-8.02 **	-2.04 **
L <sub>4</sub> x T <sub>3</sub>	0.27 **	0.92 NS	4.29 **	-0.82 **	-1.00 NS	0.37 **	-0.28 **	-1.90 **	-1.84 **	0.22 **	49.94 **	-0.34 NS	-2.21 **	-0.20 **	0.03 *	7.11 **	0.31 **
L <sub>5</sub> x T <sub>1</sub>	-0.24 **	-2.38 **	-1.06 **	1.88 **	-1.06 NS	-0.90 **	-0.34 **	0.58 **	-1.03 **	-0.43 **	-11.72 **	0.22 NS	0.72 **	-1.59 **	-0.04 **	2.00 **	-2.99 **
L <sub>5</sub> x T <sub>2</sub>	0.19 **	1.62 **	-0.23 *	-0.29 NS	0.06 NS	0.26 **	0.69 **	-0.45 **	2.81 **	-0.22 **	18.44 **	0.02 NS	-0.19 **	0.12 *	-0.19 **	-10.16 **	2.67 **
L <sub>5</sub> x T <sub>3</sub>	0.04 NS	0.76 NS	1.29 **	-1.59 **	1.00 NS	0.64 **	-0.36 **	-0.13 NS	-1.78 **	0.65 **	-6.72 **	-0.24 NS	-0.53 **	1.47 **	0.23 **	8.16 **	0.31 **
L <sub>6</sub> x T <sub>1</sub>	-0.41 **	-6.38 **	-1.10 **	-1.73 **	-3.18 **	0.74 **	0.08 **	0.28 *	-1.13 **	0.47 **	42.28 **	-0.44 NS	-1.78 **	0.28 **	0.30 **	9.68 **	1.94 **
L <sub>6</sub> x T <sub>2</sub>	0.35 **	3.52 **	5.14 **	1.26 **	0.51 NS	-0.93 **	0.05 *	0.65 **	0.91 **	-0.22 **	-29.56 **	-0.74 **	1.08 **	0.30 **	0.00 NS	-12.49 **	-2.46 **
L <sub>6</sub> x T <sub>3</sub>	0.06 NS	2.86 **	-4.04 **	0.47 *	2.67 **	0.19 **	-0.12 **	-0.93 **	0.22 NS	-0.25 **	-12.72 **	1.18 **	0.70 **	-0.58 **	-0.30 **	2.81 **	0.53 **
SEd	0.0351	0.5076	0.1057	0.168	0.8574	0.0398	0.0192	0.1294	0.1335	0.024	2.1664	0.2368	0.0609	0.0561	0.0119	0.3433	0.0743

\*Significant at 5 per cent level

\*\* Significant at 1 per cent level

Mysore Local (L<sub>1</sub>), Ambili (L<sub>2</sub>), Saras (L<sub>3</sub>), Odisha Local (L<sub>4</sub>), Rajasthan Local (L<sub>5</sub>), CO1 (L<sub>6</sub>), Punjab Samrat (T<sub>1</sub>), Pusa Viswas (T<sub>2</sub>), CO2 (T<sub>3</sub>)

With respect to quality parameters, the highest *per se* and *sca* values of beta carotene content was observed in Saras x Pusa Viswas ( $L_3 \times T_2$ ) followed by Mysore Local x Punjab Samrat ( $L_1 \times T_1$ ) proved its good performance in developing hybrids with high carotene content as proved through the significant mean, *gca* and *sca* performance. Hazara *et al.*, (2007) endorsed the same results in pumpkin. In case of crude fibre content though the crosses Odisha Local x Pusa Viswas ( $L_4 \times T_2$ ) and Ambili x Pusa Viswas ( $L_2 \times T_2$ ) were found to be the best crosses to develop hybrids with high total crude fibre content as adjudged by their mean *per se* values and *sca* values. Similar results were observed in ridge gourd, by Shivanand Hegde (2009) where the hybrid IC 393014 x IC 413592 gave highest significant mean value for crude fibre content. Expression of yield to its fullest potential is the prime important trait to be considered in hybridization programme. Based on the *per se* performance and *sca* of hybrids, the crosses Rajasthan Local x Pusa Viswas ( $L_5 \times T_2$ ) followed by Ambili x Pusa Viswas ( $L_2 \times T_2$ ) proved to be the best specific combiners for yield which proved their superiority through *gca* and *sca* values. Choudhary *et al.*, (2006) also justified similar results that the crosses MS1 x Punjab Sunheri and MS1 x Hara Madhu exhibited the highest *sca* effect and recorded the highest fruit yield per vine in muskmelon.

In conclusion, evaluation of hybrids for *per se* and *sca* revealed that the cross Rajasthan Local x Pusa Viswas ( $L_5 \times T_2$ ) was adjudged as the best hybrid, since it recorded the highest mean and *sca* effect for traits of study *viz.*, fruit weight and total yield per vine. The next best hybrid, Ambili x Pusa Viswas ( $L_2 \times T_2$ ) could also be justified as the best combination through less days for first female flower appearance, more fruit number per vine, crude fibre content and fruit yield per vine. The another best hybrid, Saras x Pusa

Viswas ( $L_3 \times T_2$ ) could also be adjusted as the best combination, since it recorded the highest mean and *sca* effect of traits of study like flesh thickness and beta carotene content.

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