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Performance of Parents and Hybrids for Yield and Other Economic Traits in Tomato (*Solanum lycopersicum* L.)

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ABSTRACT

The experiment was carried out at the Department of Vegetable Science, College of Horticulture, UHS Campus, Bengaluru during 2012-13. Among the parents used for investigation maximum average fruit weight (67.96 g) as well as highest yield per plant (1.94 kg) was observed in Arka Sourabh followed by PKM-1recording 67.05 g average fruit weight and yielding 1.85 kg per plant. Among the three F_1 hybrids evaluated Utkal Raja x Arka Sourabh recorded maximum number of branches at peak harvest stage (9.86) and maximum number of clusters per plant (16.60) which contributes to the total yield of the plant. The maximum average fruit weight (98.14 g) as well as highest yield per plant (2.72 kg) was observed in cross Utkal Raja x Arka Sourabh so, this is best among the three F_1 hybrids. Arka Sourabh and Utkal Raja x Arka Sourabh were found best among other parents and F_1 hybrids respectively.

Key words: *Tomato, Parents, Hybrids, F_1 hybrids, Yield.*

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most popular vegetable and widely grown crop in the world. It is a versatile vegetable for culinary purpose. Because of its wider adaptability and nutrition, tomato is grown throughout the world either in outdoors or indoors. In India, it ranks second among the vegetables next to potato with an area of 8.82 lakh hectare and 187.35 lakh tonnes of annual production[1]. Tomato belongs to the family Solanaceae and is native to Peru Equador region[3]. The genus *Solanum* consists of annual or short lived perennial herbaceous plants. Tomato is a typical day neutral plant and warm season crop; it is resistant to heat as well as drought.

The information about mean performance of genotypes is of basic importance for crop improvement. The range of mean values could present a rough estimate about the variation in magnitude of variability present among the genotypes. The characters showing wide range of variation have more scope for improvement. Evaluation of hybrids and its parents helps to identify best combination of parents which are resulting in best hybrid with desirable yield attributing traits. And it also helps us to understand the combining ability of parents.

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MATERIALS AND METHODS

The experiment was carried out at the Department of Vegetable Science, College of Horticulture, UHS Campus, GKVK (PO), Bengaluru, during the year 2012-13. The plant material used in the investigation is three F_1's (PKM-1 x Utkal Raja, Utkal Raja x Arka Sourabh and Anaga x Arka Meghali), respective parents and two commercial checks namely, Arka Rakshak and Arka Samrat. The seeds were first sown in protrays then transplanted to the main field after twenty-eight days from sowing. The seedlings were planted in Randomized block design in three replications on ridges which were 90 cm apart and 45 cm spacing was given between the plants in rows. The recommended package of practices for the crop was followed during the crop season. The data was subjected to the analysis of variance for randomized block design as suggested by Panse and Sukhatme[4]. Observations on five randomly selected plants were recorded for various yield attributing traits to study the performance of parents, hybrids and checks.

RESULTS AND DISCUSSION

All the nine characters under study exhibited high variability as evident from the ranges of mean values. The results are presented in **Table 1.** The maximum plant height was recorded in Arka Sourabh (69.33 cm) among the parents followed by Anaga (68.20 cm). The mean values of F_1's surpassed both the parental means in crosses PKM-1 x Utkal Raja (9.36 cm) and Utkal Raja x Arka Sourabh (9.86 cm), which indicated that it may be due to positive heterosis for the trait. Whereas in cross Anaga x Arka Meghali (6.60 cm), the mean value of F_1 was less than that of both the parents, which indicated that it may be due to negative heterosis for plant height. Among the three F_1's evaluated PKM-1 x Utkal Raja recorded highest mean value for plant height followed by cross Utkal Raja x Arka Sourabh. Commercial checks Arka Samrat and Arka Rakshak recorded plant height of 98.93 cm and 92.53 cm respectively.

Utkal Raja (9.13) recorded maximum number of branches at peak harvest stage among parents evaluated followed by Arka Sourabh (8.00). Number of branches exhibited by crosses may be due to positive heterosis in both the crosses Utkal Raja x Arka Sourabh (9.86) and PKM-1 x Utkal Raja (9.36), indicated by the fact that the F_1 means surpassed both the parental means in both crosses. In the cross Anaga x Arka Meghali (6.60) the mean value of F_1 is similar to its male parent which indicated a complete dominance nature of inheritance. Among the three F_1's evaluated Utkal Raja x Arka Sourabh recorded highest mean value for plant height followed by cross PKM-1 x Utkal Raja. Commercial checks Arka Samrat and Arka Rakshak recorded 10.13 and 9.53 branches at peak harvest stage respectively.

The maximum number of clusters per plant were recorded in Arka Sourabh (14.06) among the parents evaluated followed by Arka Meghali (12.33). The mean values of F_1's surpassed both the parental means in all the three crosses PKM-1 x Utkal Raja (16.33), Utkal Raja x Arka Sourabh (16.60) and Anaga x Arka Meghali (15.93) which indicated the positive heterosis for the trait number of clusters per plant. Among the three F_1's evaluated PKM-1 x Utkal Raja recorded highest mean value for number of clusters per plant followed by cross Utkal Raja x Arka Sourabh. 13.93 and 14.13 clusters per plant were recorded in Arka Samrat and Arka Rakshak respectively.

Early flowering is generally an indication of early yield[6]. Among the parents Anaga recoded early flowering (19.16 days) Lesser mean days to first flowering than both the parents were recorded in cross Utkal Raja x Arka Sourabh (19.63) which indicated that it may be due to negative heterosis and is desirable for early yield. Such earliness could be due to its higher capacity to make available the assimilates to the apex during the sensitive phase before initiation[2]. The mean values for days to first flowering in F_1's of two crosses were higher than both of its parents, indicating that it may be due to positive heterosis and it is

undesirable for this trait. Arka Samrat took 19.93 days for first flowering whereas Arka Rakshak recorded first flowering in 20.27 days.

The trait number of fruits per plant is very important as it plays an important role in deciding the final yield. But in some cases when the average fruit weight is more and less number of fruits per plant are recorded it will not affect the final yield, as the average fruit weight improves the tonnage of final yield. The maximum number of fruits per plant were recorded in Utkal Raja (35.86) followed by Anaga (33.33). The mean value of F_1 surpassed both the parental means in cross Anaga x Arka Meghali (40.06) which indicated that it may be due to positive heterosis for the trait. Whereas in cross PKM-1 x Utkal Raja (28.20) the mean value of F_1 is less than those of its parents and in cross Utkal Raja x Arka Sourabh (31.00) the mean value of F_1 is similar to their male parent which indicated that it may be complete dominance nature of inheritance. 30.33 and 31.00 fruits per plant was recorded in commercial checks Arka Samrat and Arka Rakshak respectively.

Average fruit weight contributes to total fruit yield per plant as well as consumer preference for specific fruit size is considered as one of the major objectives of breeding programs in tomato. The maximum average fruit weight was recorded in parent Arka Sourabh (67.96 g) followed by PKM-1 (67.05 g). The mean values of F_1's in two crosses Utkal Raja x Arka Sourabh (98.14 g) and PKM-1 x Utkal Raja (90.07 g) surpassed both parental means indicating that it may be positive heterosis. And these two F_1's have comparatively less number of fruits per plant. Thus resulting in higher accumulation of assimilates, which may be the reason for higher fruit weight, due to inverse relationship existing between fruit weight and number of fruits per plant as reported by Supe *et al*[5]. Whereas in cross Anaga x Arka Meghali (27.13 g) the mean value of F_1 for the trait average fruit weight is less than both of its parents which indicates bad combination of the cross. Average fruit weight was recorded higher than the cross Utkal Raja x Arka Sourabh in commercial checks Arka Samrat (98.57 g) and Arka Rakshak (99.50 g).

Highest yield per plant was recorded in Arka Sourabh (1.94 kg) followed by PKM-1 (1.85 kg). Yield per plant may be due to positive heterosis in two crosses PKM-1 x Utkal Raja (2.44 kg) and Utkal Raja x Arka Sourabh (2.72 kg), indicated by the fact that the F_1 mean surpassed both the parental means. Whereas in cross combination Anaga x Arka Meghali (1.29 kg) yield per plant is less because the average fruit weight is less even though the number fruits per plant were more. The yield per plant was recorded higher than the cross Utkal Raja x Arka Sourabh in commercial checks Arka Samrat (2.94 kg) and Arka Rakshak (2.96 kg).

Highest TSS was recorded in Arka Meghali (3.83^0 Brix) followed by Arka Sourabh (3.70^0 Brix). The mean value of F_1's of the three crosses PKM-1 x Utkal Raja (3.06^0 Brix), Utkal Raja x Arka Sourabh (3.06^0 Brix) and Anaga x Arka Meghali (3.20^0 Brix) were less than both of their parents which indicated that it may be due to negative heterosis for this trait. Lesser values of total acidity are preferred in tomato fruits in processing industries. 3.83^0 Brix and 3.90^0 Brix TSS were recorded in commercial checks Arka Samrat and Arka Rakshak respectively.

The total acidity was recorded lowest in Arka Meghali (0.50 %) followed by PKM-1 (0.53 %). The F_1 of cross Utkal Raja x Arka Sourabh (0.46 %) exhibited lesser mean value than both of its parents which may be due to negative heterosis which is preferable. Commercial checks Arka Samrat and Arka Rakshak recorded 0.52 % and 0.43 % of total acidity respectively.

Table 1*: Per se* performance of F_1's, respective parents and commercial checks

Sl. No.	Genotype/Hybrid	Plant height (cm) at peak harvest stage	Number of branches at peak harvest stage	Number of clusters per plant	Days to first flowering	Number of fruits per plant	Average fruit weight (g)	Yield per plant (kg)	Total Soluble Solids (^{0} Brix)	Total acidity (% citric acid)
Parents										
1	PKM-1	68.13	7.46	12.00	20.31	29.73	67.05	1.85	3.66	0.53
2	Arka Meghali	61.53	6.56	12.33	21.02	26.60	60.05	1.55	3.83	0.50
3	Anaga	68.20	7.40	12.06	19.16	33.33	39.86	1.36	3.13	0.55
4	Utkal Raja	67.20	9.13	12.06	20.08	35.86	39.12	1.37	3.43	0.56
5	Arka Sourabh	69.33	8.00	14.06	19.93	30.13	67.96	1.94	3.70	0.58
Crosses										
6	PKM-1 x Utkal Raja	94.13	9.36	16.33	21.37	28.20	90.07	2.44	3.06	0.57
7	Utkal Raja x Arka Sourabh	84.40	9.86	16.60	19.63	31.00	98.14	2.72	3.06	0.46
8	Anaga x Arka Meghali	47.40	6.60	15.93	21.18	40.06	27.13	1.29	3.20	0.51
Commercial checks										
9	Arka Samrat	98.93	10.13	13.93	19.93	30.33	98.57	2.94	3.83	0.52
10	Arka Rakshak	92.53	9.53	14.13	20.27	31.00	99.50	2.96	3.90	0.43
	SEm ±	4.77	0.56	0.73	0.15	0.59	5.37	0.08	0.15	0.017
	CD (@ 5%)	14.17	1.66	2.16	0.44	1.74	15.98	0.24	0.45	0.05
	CV (%)	10.99	11.54	9.07	1.272	3.213	13.55	7.03	7.63	5.64

CONCLUSION

From the study it was concluded Arka Sourabh proved best and the cross Utkal Raja x Arka Sourabh is best combination as it was observed best among the other three hybrids. So this cross combination can be utilized in further crop improvement program.

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