



EVALUATION OF PAPRIKA (*CAPSICUM ANNUUM* L.) GENOTYPES FOR YIELD AND YIELD ATTRIBUTING TRAITS

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Abstract

An experiment was conducted during *kharif*, 2016-17 at Horticultural Research Station, Lam, Guntur, Andhra Pradesh (India) to identify potential genotypes for thirteen quantitative traits among forty four genotypes of paprika (*Capsicum annuum* L.). The analysis of variance revealed significant differences among the genotypes for all the thirteen characters indicating the presence of genetic variability among the genotypes. Among forty four genotypes, the genotype LCA-446 recorded maximum plant height and number of primary branches per plant whereas the genotype LCA-424 recorded the maximum plant spread. The genotype LCA-436 recorded earlier flowering and the genotype LCA-513 the earliest to mature. The genotype LCA-439 recorded maximum fruits per plant, whereas the maximum fruit length was observed for the genotype Byadagi kaddi. The genotype Warangal Chappatta double patti recorded highest fruit diameter, number of seeds per fruit, weight of seeds per fruit and 1000 seed weight, whereas the genotypes LCA-442 and LCA-453 recorded the maximum fruit pedicel length and the genotype LCA-470 recorded the highest dry fruit yield per plant.

Key words : *Capsicum annuum* L., paprika, genotypes, yield.

Introduction

Paprika (*Capsicum annuum* L. 2n = 24) is one of the most important commercial vegetable as well as spice crops grown all over the world. The genus *Capsicum* belongs to family Solanaceae comprises of about 20 to 30 species of the new world tropics and subtropics and native to tropical areas of the Western Hemisphere, including Mexico, Central America, South America, and West Indies. Paprika, a form of chilli is mainly valued for its high colour, low or no pungency and oleoresins. In chilli, three major products *viz.*, paprika, oleoresins and dried chilli (both in whole and powder form) are traded in the world market. The pungent principle of paprika is capsaicin, an acid amide of Vanillylamine. They are widely used in curry powder, paste, pickles, sauces and ketchups for its characteristic pungency, color and aroma (Shiva *et al.*, 2006).

Globally, chilli and paprika (dry) are grown on a total

area of 1.94 million hectares with global production of 3.35 million tonnes. The global productivity of chilli and paprika (dry) is 1.73 metric tonnes/ha (Kumari *et al.*, 2014) and the value of the total chilli and paprika is estimated at 3.42 million USD. India is the world's leading producer occupying an area of 0.76 million hectares with a production of 1.6 million tonnes and productivity of 2109 kg/ha (NHB, 2015).

Chilli besides imparting pungency and red colour to dishes, is also rich source of vitamin C, A and E and assists in good digestion. The vitamin C content (150-200 mg/100g) of chilli is the highest among all the vegetables. It has also acquired a great importance because of the presence of 'oleoresin', which permits better distribution of color and flavor in foods. There is considerable demand for paprika powder in the western countries. There is a great demand for the natural colour from paprika fruits and is used in processed foods in place of synthetic colours. The demand for paprika oleoresin as a coloring agent has increased in international market

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especially in Europe and USA due to ban on artificial coloring substances (Joshi *et al.*, 1995).

The assessment of nature and magnitude of variability in the available germplasm is the prerequisite of any breeding programme. The effectiveness of selection and development of improved varieties depends on the nature of variability expressed for yield and its contributing characters in the gene pool. High yield and yield contributing characters with improved quality parameters have been the major objective of chilli breeding programme. The importance of genetically diverse genotypes with desirable combinations has also been realized by several workers (Peter and Rai, 1978; Das *et al.*, 1998). Keeping in view the above facts, the present investigation was undertaken to observe the performance of genotypes of paprika for quantitative traits and to screen the best performing genotypes for utilization in further breeding programme.

Materials and Methods

The investigation was carried out during *kharif*, 2016-17 at Horticultural Research Station, Lam, Guntur with 44 paprika genotypes of paprika (*Capsicum annuum* L.) (table 1) in a randomized block design with two replications. The nursery was raised during first week of August and the seedlings were transplanted at a spacing

of 75 cm × 30 cm in a row of 4 m length during first fortnight of September. Each row consisted of 12 plants, of which five competitive plants were selected at random for recording the observations on plant height (cm), plant spread (cm), number of primary branches per plant, days to 50 per cent flowering, days to maturity, number of fruits per plant, fruit length (cm), fruit diameter (cm), fruit pedicel length (cm), number of seeds per fruit, weight of seeds per fruit (g), 1000 seed weight (g) and dry fruit yield per plant (g). The crop was raised as per the recommended package of practices. Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1985).

Results and Discussion

The analysis of variance (table 2) revealed significant differences among the genotypes for all the thirteen characters studied indicating the presence of genetic variability in the genotypes and considerable scope for their improvement. These results are in conformity with earlier reports of Vani *et al.* (2007), Farhad *et al.* (2008), Gupta *et al.* (2009), Kumari *et al.* (2010), Kumar *et al.* (2012), Lakshmi and Padma (2012), Tasso *et al.* (2014), Pandit and Ahikary (2014), Vijaya *et al.* (2014), Janaki *et al.* (2015) and Leeladhar *et al.* (2016) in chilli.

The plant height ranged from 54.80 cm to 119 cm

Table 1 : Source of the paprika genotypes (*Capsicum annuum* L.).

Treatment	Accession Number	Treatment	Accession Number	Source
T ₁	LCA 445	T ₂₃	LCA 465	HRS, Lam farm, Guntur
T ₂	LCA 447	T ₂₄	LCA 475	HRS, Lam farm, Guntur
T ₃	LCA 439	T ₂₅	LCA 488	HRS, Lam farm, Guntur
T ₄	LCA 442	T ₂₆	LCA 499	HRS, Lam farm, Guntur
T ₅	LCA 430	T ₂₇	LCA 506	HRS, Lam farm, Guntur
T ₆	LCA 457	T ₂₈	LCA 503	HRS, Lam farm, Guntur
T ₇	LCA 443	T ₂₉	LCA 490	HRS, Lam farm, Guntur
T ₈	LCA 437	T ₃₀	LCA 501	HRS, Lam farm, Guntur
T ₉	LCA 453	T ₃₁	LCA 504	HRS, Lam farm, Guntur
T ₁₀	LCA 450	T ₃₂	LCA 510	HRS, Lam farm, Guntur
T ₁₁	LCA 441	T ₃₃	LCA 510	HRS, Lam farm, Guntur
T ₁₂	LCA 425	T ₃₄	LCA 511	HRS, Lam farm, Guntur
T ₁₃	LCA 440	T ₃₅	LCA 512	HRS, Lam farm, Guntur
T ₁₄	LCA 446	T ₃₆	LCA 513	HRS, Lam farm, Guntur
T ₁₅	LCA 470	T ₃₇	Warangal chappatta single patti	HRS, Lam farm, Guntur
T ₁₆	LCA 436	T ₃₈	Warangal chappatta double patti	HRS, Lam farm, Guntur
T ₁₇	LCA 466	T ₃₉	Byadagi kaddi	HRS, Lam farm, Guntur
T ₁₈	LCA 472	T ₄₀	Byadagi dabbi	HRS, Lam farm, Guntur
T ₁₉	LCA 476	T ₄₁	Kt-1	HRS, Lam farm, Guntur
T ₂₀	LCA 480	T ₄₂	Jangareddy gudem local	HRS, Lam farm, Guntur
T ₂₁	LCA 482	T ₄₃	LCA 436	HRS, Lam farm, Guntur
T ₂₂	LCA 498	T ₄₄	LCA 424	HRS, Lam farm, Guntur

Table 2 : Analysis of variance for various characters in paprika (*Capsicum annum L.*).

S. no.	Character	Mean sum of squares		
		Replications	Genotypes	Error
1	Plant height (cm)	0.1641	257.1176**	122.3585
2	Plant spread (cm)	12.4501	698.0582**	187.3496
3	Number of primary branches per plant	0.0223	0.1720**	0.0495
4	Days to 50 per cent flowering	0.4091	52.4641**	12.5951
5	Days to maturity	405.9204	840.9797**	121.3391
6	Number of fruits per plant	78.0956	2217.2776**	97.2712
7	Fruit length (cm)	2.1018	10.3219**	0.7897
8	Fruit diameter (cm)	0.1392	2.9213**	0.1155
9	Fruit pedicel length (cm)	0.2005	0.6842**	0.1300
10	Number of seeds per fruit	192.6368	1204.1255**	85.2880
11	Weight of seeds per fruit (g)	0.0018	0.0978**	0.0040
12	1000 seed weight (g)	1.7388	16.8606**	0.7356
13	Dry fruit yield per plant (g)	0.1023	2316.4702**	178.9162

*: Significant at 5 per cent level, **: Significant at 1 per cent level

with a mean of 88.95 cm. The genotype LCA-446 recorded maximum plant height (119.00 cm) followed by LCA-457 (110.10cm) while the genotype LCA-513 recorded the minimum plant height (54.80 cm). The plant spread ranged from 57.40 cm to 176.00 cm with a mean of 128.89 cm. The genotype LCA-424 recorded maximum plant spread (176.00 cm) followed by LCA-430 (154.00 cm) while the genotype LCA-513 recorded the minimum plant spread (57.40 cm). The number of primary branches per plant was in the range of 2.30 to 4.20 with a mean of 3.57. The genotypes LCA- 446 recorded the highest number of primary branches (4.20) followed by LCA- 425 (4.00), LCA - 480 and Byadagi kaddi (4.00) while the lowest was observed for LCA-513 (2.30) (table 3). These results are in line with findings of Munshi *et al.* (2010), Nehru *et al.* (2012), Amit *et al.* (2014), Vijaya *et al.* (2014), who also reported highest variability for above traits.

Days to 50 per cent flowering ranged from 41.50 to 65.50 with a mean of 59.97 days. The genotype Warangal chappatta single patti recorded maximum no. of days to 50 per cent flowering (65.50) followed by LCA-453 (64.50), while LCA-436 (41.50) and LCA- 424 (43.50) were the earliest to flower. Bharadwaj *et al.* (2007), Temburne *et al.* (2008), Arup *et al.* (2011), Amit *et al.* (2014) and Vijaya *et al.* (2014) reported same trends of flowering in chilli. Days to maturity ranged from 87.00 to 163.50 with a mean of 132.87 days. The genotype LCA-465 recorded maximum no. of days to maturity (163.50) followed by LCA-437 (159.00), while LCA-513 (87.00) were the earliest to mature. These results are in conformity with earlier reports of Priyanka and Naidu

(2016).

The number of fruits per plant ranged from 90.50 to 214.20 with a mean of 155.75. The genotype LCA-439 (214.20) recorded the maximum number of fruits per plant followed by LCA-465 (206.90), while the lowest was recorded for Jangareddy gudem local (90.50) preceded by Kt-1 (96.50). The fruit length had the range of 5.70cm to 16.80cm with a mean of 11.67cm. The maximum fruit length was observed for the genotype Byadagi kaddi (16.80cm) followed by LCA- 470 (15.15cm) and LCA-439 (14.95cm) while the minimum was recorded by Jangareddy gudem local (5.70cm) preceded by LCA-443 (6.45cm). Padhar and Zaveri (2010), Arup *et al.* (2011), Lakshmi and Padma (2012), Sharma *et al.* (2014), Amit *et al.* (2014), Vijaya *et al.* (2014) and Rosmaina *et al.* (2016) also reported same trend of range for number of fruits and fruit length.

The range of fruit diameter varied from 2.55 cm to 9.70 cm with a mean of 4.63 cm. The maximum diameter was recorded by the genotype Warangal chappatta double patti (9.70cm) followed by LCA-446 (6.95cm), whereas the minimum diameter was recorded by Byadagi kaddi (2.55cm) preceded by Byadagi dabbi (2.90cm). These findings were in accordance with earlier reports of Singh *et al.* (2009) and Gupta *et al.* (2009).

The range of fruit pedicel length varied from 2.15 cm to 4.55 cm with a mean of 3.55 cm. The maximum fruit pedicel length was recorded by the genotype LCA-442 (4.55 cm) and LCA-453 (4.55) followed by LCA-447 (4.50 cm), whereas the minimum fruit pedicel length was recorded by LCA-510 (2.15 cm) preceded by

Table 3 : Mean performance of various quantitative characters in paprika (*Capsicum annum* L.) genotypes.

Genotype	PH	PS	NPBP	DFP	DM	NFP	FL	FD	FPL	NSP	WSP	1000 SW	DFYP
LCA 445	87.80	138.90	3.50	63.50	157.00	140.05	13.00	5.20	4.30	102.30	0.73	2.50	160.00
LCA 447	89.90	100.60	3.50	62.50	156.00	199.90	14.80	4.30	4.50	63.90	0.49	4.49	148.00
LCA 439	98.30	136.30	3.70	61.00	157.50	214.20	14.95	3.55	3.90	47.20	0.36	2.69	172.50
LCA 442	100.90	133.20	3.60	63.50	156.00	159.80	13.60	4.55	4.55	74.20	0.56	2.41	144.00
LCA 430	90.00	154.00	3.90	61.50	113.00	168.90	13.50	4.15	4.25	74.70	0.48	2.21	112.00
LCA 457	110.10	130.50	3.60	63.00	109.00	158.60	12.50	4.15	3.95	58.30	0.50	7.19	100.00
LCA 443	105.30	118.00	3.70	56.50	152.50	117.20	6.450	6.05	3.40	97.90	0.585	5.38	99.00
LCA 437	89.10	130.90	3.40	61.50	159.00	199.00	11.90	3.85	3.05	70.30	0.53	6.08	102.00
LCA 453	81.80	128.30	3.30	64.50	154.00	108.30	10.40	5.95	4.55	87.50	0.47	6.14	94.50
LCA 450	89.80	134.40	3.40	60.00	138.00	134.00	10.15	4.75	3.35	68.90	0.42	2.29	87.00
LCA 441	96.70	140.80	3.50	65.00	158.50	153.20	12.10	4.25	3.80	64.10	0.39	3.53	112.00
LCA 425	90.50	136.80	4.00	63.00	149.00	168.60	14.75	4.70	4.05	51.80	0.45	2.64	133.50
LCA 440	95.90	149.60	3.80	60.50	143.00	177.10	9.30	4.30	3.35	64.70	0.59	6.78	119.00
LCA 446	119.00	148.00	4.20	58.50	137.00	152.50	12.95	6.95	3.75	69.60	0.51	3.69	139.50
LCA 470	83.40	125.70	3.60	58.50	140.50	190.20	15.15	4.85	4.25	77.10	0.51	2.60	220.00
LCA 436-1	80.20	125.60	3.30	41.50	96.00	168.20	10.55	4.30	3.50	59.40	0.46	5.87	155.00
LCA 466	82.00	122.50	3.40	62.50	126.00	143.50	8.55	4.55	2.75	47.00	0.21	4.82	112.00
LCA 472	75.20	125.90	3.60	59.50	148.00	169.40	10.95	5.60	3.50	85.10	0.56	3.49	195.00
LCA 476	81.60	127.50	3.50	64.00	137.00	179.85	13.15	4.90	4.05	54.90	0.34	5.61	162.50
LCA 480	83.10	132.40	4.00	61.00	138.00	197.10	11.55	4.85	3.90	53.90	0.32	2.59	144.00
LCA 482	87.40	126.10	3.50	61.00	137.50	138.60	10.95	4.35	3.65	70.90	0.48	7.48	108.00
LCA 498	86.30	133.90	3.60	62.00	140.00	167.00	10.75	5.40	2.90	64.60	0.45	7.47	136.00
LCA 465	82.50	127.80	3.30	61.00	163.50	206.90	11.55	5.25	3.70	45.20	0.33	6.41	135.50
LCA 475	79.50	136.10	3.50	64.00	137.50	163.60	13.65	3.95	3.65	39.50	0.32	7.58	152.00
LCA 488	95.00	139.40	3.80	63.50	127.50	183.00	12.80	4.55	3.45	45.80	0.25	5.05	137.00
LCA 499	77.30	114.00	3.50	56.50	141.00	159.80	12.15	4.70	3.95	56.70	0.37	5.34	129.50
LCA 506	79.40	130.80	3.70	62.00	131.00	161.30	11.80	5.10	3.50	63.30	0.42	7.69	185.00
LCA 503	86.70	136.00	3.50	63.00	108.50	171.60	13.00	4.10	3.65	64.40	0.29	5.87	164.00
LCA 490	86.70	138.60	3.90	61.50	134.50	154.30	12.55	4.50	3.80	73.90	0.47	2.81	174.50
LCA 501	85.20	124.65	3.40	60.00	138.50	206.10	12.60	4.45	3.95	68.10	0.43	6.07	179.00
LCA 504	96.70	133.30	3.70	61.50	149.00	192.80	14.00	3.50	4.00	51.20	0.28	4.53	140.50
LCA 510	78.60	84.60	3.40	59.50	154.50	164.30	8.85	3.30	2.15	37.80	0.35	5.30	92.50
LCA 510-1	75.00	89.20	3.60	62.00	150.00	133.90	8.95	3.35	2.50	41.80	0.43	8.20	84.00
LCA 511	108.80	132.20	3.70	58.50	125.00	108.50	12.05	6.35	3.75	98.80	0.70	9.75	97.00
LCA 512	108	126.10	3.50	63.00	133.50	107.20	10.80	5.35	3.30	137.10	1.05	9.43	103.00
LCA 513	54.80	57.40	2.30	58.50	87.00	113.90	11.90	3.80	3.05	37.30	0.26	8.75	102.50
Warangal	86.20	121.30	3.20	65.50	117.00	108.00	11.55	5.70	3.05	102.90	1.02	8.87	105.00

Table 1 continued...

Table 1 continued...

chappatta single Patti													
Warangal chappatta double Patti	91.80	117.80	3.40	59.00	112.00	120.50	8.30	9.70	2.40	154.00	1.35	18.10	95.00
Byadagi kaddi	83.0	141.10	4.00	52.50	97.50	118.70	16.80	2.55	3.70	45.40	0.25	8.40	82.00
Byadagi dabbi	80.80	127.60	3.50	62.00	97.00	116.50	9.25	2.90	2.95	84.50	0.56	7.40	85.00
Kt-1	83.80	141.00	3.70	62.00	111.50	96.50	9.15	2.75	3.00	51.00	0.31	8.30	92.00
Jangareddy gudem Local	99.20	135.20	3.70	59.50	119.00	90.50	5.70	4.45	2.35	92.20	0.65	8.62	87.00
LCA-424	99.90	176.00	3.90	43.50	97.00	197.50	12.20	3.75	3.75	88.60	0.66	4.20	137.00
LCA 436	90.60	141.40	3.60	46.00	112.00	172.65	11.95	4.40	3.75	77.50	0.34	5.60	142.00
Mean	88.95	128.89	3.57	59.97	132.87	155.75	11.67	4.63	3.55	69.66	0.49	5.91	128.55
C.V	12.43	10.61	6.21	5.91	8.29	6.33	7.61	7.33	10.13	13.25	12.95	14.49	10.40
F ratio	2.10	3.72	3.47	4.16	6.93	22.79	13.07	25.29	5.26	14.11	24.19	22.92	12.94
S.E.	7.82	9.67	0.15	2.50	7.78	6.97	0.62	0.24	0.25	6.53	0.04	0.60	9.45
C.D.5%	22.30	27.60	0.44	7.15	22.21	19.89	1.79	0.68	0.72	18.62	0.12	1.72	26.97

*Bold values indicate maximum and minimum mean performance

Note : PH – Plant height (cm), PS-Plant spread (cm), NPBP – Number of primary branches per plant, DFF – Days to 50 per cent flowering, DM- Days to maturity, NFP – Number of fruits per plant, FL– Fruit length (cm), FD – Fruit diameter (cm), FPL- Fruit pedicel length (cm), NSF – Number of seeds per fruit, WSF- Weight of seeds per fruit (g), 1000 SW- 1000 seed weight (g), DFYP – Dry fruit yield per plant (g).

Jangareddy gudem local (2.35 cm) and Warangal chapata double patti (2.40). These results are in conformity with earlier reports of Pandit and Adhikary (2014) and Priyanka and Naidu (2016).

The number of seeds per fruit ranged from 37.30 to 154.00 with a mean of 69.66. The highest mean performance for this trait was recorded for genotype the Warangal chappatta double patti (154.00) followed by LCA-512 (137.10) whereas the lowest for LCA-513 (37.30) preceded by LCA-510 (37.80). Similar range was reported by Shirshat *et al.* (2007), Arup *et al.* (2011) and Pandit and Adhikary (2014).

The weight of seeds per fruit ranged from 0.21g to 1.35 g with a mean of 0.49 g. The highest mean performance for this trait was recorded for genotype the Warangal chappatta double patti (1.35 g) followed by LCA-512 (1.05 g) whereas the lowest for LCA-466 (0.21 g) preceded by LCA-488 (0.25 g). These results are in conformity with earlier reports of Ashish *et al.* (2015).

The 1000 seed weight ranged from 2.21g to 18.10g with a mean of 5.91g. The highest mean performance for this trait was recorded for genotype the Warangal Chappatta double patti (18.10g) followed by LCA-511 (9.75g), whereas the lowest for LCA-430 (2.21g)

preceded by LCA-450 (2.29g). These results are in conformity with earlier reports of Pandit and Adhikary (2014).

Dry fruit yield varied from 82.00 g to 220.00 g with a mean of 128.55 g. The maximum mean performance was observed for genotype LCA-436 (220.00 g) followed by LCA-472 (195.00 g) and LCA-506 (185.00 g) while the minimum value was observed for Byadagi kaddi (82.00g) preceded by Byadagi dabbi (85.00 g) and Jangareddy gudem local (87.00 g). Kumari *et al.* (2010), Kumar *et al.* (2012), Sharma *et al.* (2014) and Priyanka and Naidu (2016) were also observed wider range of variation between the genotypes studied.

Conclusion

In the present study, a high range of variability was observed for all the characters. It was maximum for dry fruit yield per plant (82-220 g) followed by number of fruits per plant (90.50-214.20), number of seeds per fruit (37.30- 154) and minimum for weight of seeds per fruit (0.21 to 1.35) and number of branches per plant (2.30-4.20). These results are in accordance with those reported by earlier workers like Cherian *et al.* (2003), Vani *et al.* (2007), Farhad *et al.* (2008), Jyothi *et al.* (2008), Gupta

et al. (2009), Thul et al. (2009), Kumari et al. (2010), Kumar et al. (2012), Lakshmi and Padma (2012), Amit et al. (2014), Janaki et al. (2015), Shiva et al. (2015) and Priyanka and Naidu (2015). The characters showing wide range of variation provide an ample scope for selecting superior types and the selected genotypes can be used in further crossing programme for introgression of their desired genes and to obtain heterotic hybrids.

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