Environment & Ecology 35 (3B) : 2146—2151, July—September 2017
Website: environmentandecology.com ISSN 0970-0420

Screening of Chilli (*Capsicum annuum* var *annuum* L.) Accessions for Yield and Quality Suitable for Rainfed Conditions

Vanitha, Jansirani

Received 5 October 2016 ; Accepted 7 November 2016 ; Published online 26 November 2016

Abstract Field evaluation of seventy four collections of chilli germplasm were conducted in farmers field during the year 2013-2014 in randomized block design with two replications with an objective to identify the most appropriate chilli genotype with high yield and quality suitable for rainfed conditions. The location of evaluation is unique in cultivating chilli under rainfed conditions depending on monsoon rains only. Evaluations of chilli genotypes showed wide variations for yield and quality traits. In the present study, the highest number of fruits per plant was registered in CA 74 (233). The genotype CA 7 recorded the highest fruit length (14.30 cm) and CA 74 recorded the highest fruit girth (5.64 cm). Significant variation was found among the genotypes for single pod weight. The highest individual fresh and dry pod weight were registered by the genotype CA 65 (7.47 g) and CA 42 (1.152 g), respectively. The highest fresh (1,072.9 g per plant) and dry pod yield per plant (225.06 g) were registered in CA 74. For quality parameters, the highest capsaicin (0.655%) and oleoresin content (11.89%) were registered in CA 74. Based on the *per se* performance, the accession CA 74 was found to be superior with growth attributes of root length (18.08 cm) and root volume (52.50 cc) and fruit characters such as number of fruits (233.0), fruit girth (5.64 cm), fresh pod yield (1,072.9 g), dry pod yield per plant (225.06 g) and quality characters capsaicin (0.655%) and oleoresin (11.89%). Hence, the chilli genotype CA 74 may be exploited for further improvement of the above fruit characters through breeding programs suitable for Sivagangai district.

Keywords Evaluation, Diversity, Genotypes, Chilli, Yield.

Introduction

Chilli (*Capsicum annuum* L.) is an important vegetable cum spice crop grown in almost all parts of tropical and sub-tropical regions of the world [1]. It belongs to the family Solanaceae. It is a rich source of vitamin A and C with good medicinal properties. India stands first in chilli cultivation in the world due to its suitable growing climate. India contributes one-fourth of the world production of chilli with an average annual production of 1, 492,000 tonnes from an area of 7, 94,000 hectares with productivity of 1,900 kg per hectare (Horticultural Statistics, 2015). In India, chillies are grown in almost all the states and the important ones in terms of production are Andhra Pradesh (49%), Karnataka (15%), Orissa (8%), Maharashtra (6%), West Bengal (5%), Rajasthan (4%) and Tamil Nadu (3%).

In Tamil Nadu, chilli is grown in an area of 50.70

Vanitha*
PhD Scholar, Department of Vegetable Crops, HC and RI, TNAU, Coimbatore 641003, India

Jansirani
Professor and Head, Dept of Spices and Plantation Crops, HC and RI, TNAU, Periyakulam 625601, India
e-mail: ajjanvanitha@gmail.com
*Correspondence

Table 1. List of chilli genotypes along with sources of collection.

Sl. No.	Geno-types	Collection area/ Source	Sl. No.	Geno-types	Collection area/ Source
1	CA–1	ARS, Kovilpatti	41	CA–41	NBPGR–Hydrabad
2	CA–2	Killikulam	42	CA–42	NBPGR–Hydrabad
3	CA–3	IIHR	43	CA–43	AVRDC
4	CA–4	IIHR	44	CA–44	AVRDC
5	CA–5	IIVR	45	CA–45	AVRDC
6	CA–6	IIVR	46	CA–46	AVRDC
7	CA–7	Guntur Local	47	CA–47	AVRDC
8	CA–8	Guntur Local	48	CA–48	AVRDC
9	CA–9	Guntur Local	49	CA–49	AVRDC
10	CA–10	Guntur Local	50	CA–50	AVRDC
11	CA–11	Guntur Local	51	CA–51	AVRDC
12	CA–12	Karnataka Local	52	CA–52	AVRDC
13	CA–13	Madhya Pradesh Local	53	CA–53	AVRDC
14	CA–14	Virusampatti Local	54	CA–54	AVRDC
15	CA–15	Perayur Local	55	CA–55	AVRDC
16	CA–16	Samypatti	56	CA–56	AVRDC
17	CA–17	Mettupatti	57	CA–57	AVRDC
18	CA–18	Serndhakottai	58	CA–58	AVRDC
19	CA–19	Valayapookulam	59	CA–59	AVRDC
20	CA–20	Arianachiapuram	60	CA–60	AVRDC
21	CA–21	Punavasal	61	CA–61	AVRDC
22	CA–22	Vallakulam	62	CA–62	AVRDC
23	CA–23	Thopudapatti	63	CA–63	AVRDC
24	CA–24	Nerinjipatti	64	CA–64	AVRDC
25	CA–25	Kodangipatti	65	CA–65	AVRDC
26	CA–26	Arasakulam	66	CA–66	AVRDC
27	CA–27	Mavilpatti	67	CA–67	AVRDC
28	CA–28	Pothanadhi	68	CA–68	AVRDC
29	CA–29	Villathikulam	69	CA–69	AVRDC
30	CA–30	Sathur	70	CA–70	AVRDC
31	CA–31	Aruppukottai	71	CA–71	AVRDC
32	CA–32	Surandai	72	CA–72	AVRDC
33	CA–33	Amarnadu	73	CA–73	AVRDC
34	CA–34	NBPGR-Hydrabad	74	CA–74	China type
35	CA–35	NBPGR-Hydrabad			
36	CA–36	NBPGR-Hydrabad			
37	CA–37	NBPGR-Hydrabad			
38	CA–38	NBPGR-Hydrabad			
39	CA–39	NBPGR-Hydrabad			
40	CA–40	NBPGR-Hydrabad			

hectares and with production of 23.10 tonnes (Spice board, 2014). The rainfed tracts viz., Viruthunagar, Ramnad and Triunelvelli districts situated at the Southern Tamil Nadu is a typical zone for cultivation of dry chillies. But there is no location specific chilli variety is available in terms of yield and quality which has a good export market. In this situation, varietal improvement in developing location specific variety has to be undertaken with special emphasis on yield and quality. To achieve this, high variability present in this crop has to be fully utilized and parents with high genetic variability have to be selected and used in breeding programs. Keeping the above facts in view, the present experiment was undertaken with the objectives of collection and evaluation of chilli germplasm for high pod yield and quality under rainfed conditions of Tamil Nadu.

Materials and Methods

The study was carried out in the farmers field at Virudhunagar district of Tamil Nadu during 2013-2014

Table 2. Mean performance of chilli genotypes for yield and quality characters.

Genotypes	Number of fruits per plant	Fresh fruit weight (g)	Dry fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Fresh fruit yield per plant (g/plant)	Dry fruit weight per plant (g/plant)	Number of seed per pod	Thousand seed weight (g)	Capsaicin (per cent)	Oleoresin (per cent)
CA1	206.8	3.65	0.774	10.42	3.99	754.2	150.34	47.7	7.80	0.122	9.13
CA2	195.8	2.60	0.630	9.19	2.68	509.2	120.07	50.2	7.00	0.466	8.86
CA3	149.4	3.87	0.870	9.39	2.34	577.5	123.68	70.3	7.95	0.321	10.25
CA4	202.2	2.91	0.618	8.15	3.32	297.3	63.19	45.0	7.20	0.125	8.57
CA5	71.8	3.22	0.643	8.28	2.82	230.9	46.17	80.4	6.10	0.178	8.22
CA6	81.0	3.78	0.795	12.22	3.74	306.0	64.38	64.9	7.05	0.238	6.06
CA7	143.4	4.87	0.851	**14.30**	3.41	698.6	118.87	38.6	6.45	0.315	7.15
CA8	175.3	3.19	0.687	9.04	2.86	558.7	117.13	69.8	7.65	0.544	10.32
CA9	138.2	5.05	0.999	7.46	3.98	697.2	134.82	85.1	7.60	0.287	9.98
CA10	92.6	4.21	0.831	13.15	3.62	389.8	73.69	46.4	7.90	0.080	7.33
CA11	92.6	5.04	1.058	11.55	3.86	465.6	94.72	74.8	7.15	0.165	9.19
CA12	52.4	3.59	0.720	9.96	2.94	188.2	34.45	91.8	7.45	0.184	7.34
CA13	118.0	3.13	0.685	11.50	3.46	369.5	77.53	73.9	7.50	0.174	6.40
CA14	87.8	3.64	0.879	11.98	4.52	319.7	73.88	73.7	7.90	0.138	8.68
CA15	92.2	3.56	0.790	10.96	3.74	328.4	69.54	110.4	7.20	0.110	9.08
CA16	106.8	3.19	0.638	11.34	3.92	340.8	64.86	63.9	7.75	0.156	8.02
CA17	99.2	4.43	0.849	9.39	5.24	438.8	80.89	59.4	7.30	0.147	7.26
CA18	187.6	2.23	0.510	11.00	3.40	418.1	116.31	44.8	7.05	0.207	8.88
CA19	72.4	3.00	0.623	12.20	5.10	217.3	41.82	82.7	8.20	0.135	8.06
CA20	70.6	3.64	0.871	10.76	2.52	256.9	58.19	83.4	7.95	0.176	9.07
CA21	74.4	2.38	0.670	10.09	2.94	177.0	46.54	70.2	8.35	0.270	8.37
CA22	135.0	2.62	0.631	11.07	3.24	353.8	81.94	61.6	7.30	0.101	6.98
CA23	159.8	6.39	1.129	13.00	3.76	1022.0	177.17	69.6	8.40	0.140	7.82
CA24	106.2	1.83	0.580	8.35	2.96	194.4	58.29	64.0	7.00	0.160	7.73
CA25	129.2	3.07	0.750	9.65	4.74	396.6	107.01	80.2	7.55	0.151	9.06
CA26	78.2	4.69	0.882	10.50	4.44	366.6	65.71	90.7	8.10	0.103	8.28
CA27	79.9	5.28	1.022	12.01	4.68	422.2	78.31	**118.4**	7.00	0.109	9.26
CA28	120.8	3.97	0.880	11.27	4.26	479.6	114.88	92.4	7.80	0.195	7.19
CA29	171.6	2.85	0.685	11.04	3.11	489.2	114.30	90.2	6.80	0.266	9.18
CA30	141.2	3.28	0.856	8.01	3.66	463.3	117.51	62.9	7.50	0.162	9.29
CA31	187.4	4.20	0.928	11.35	4.54	787.4	170.72	76.8	7.35	0.214	10.10
CA32	72.6	2.86	0.750	11.20	3.53	207.7	51.23	62.6	7.20	0.160	8.09
CA33	82.8	3.69	0.819	10.11	4.34	305.7	64.57	66.0	6.65	0.190	6.48
CA34	79.6	3.03	0.966	7.01	4.54	241.1	73.59	48.2	6.42	0.092	8.47
CA35	144.2	1.43	0.470	6.69	2.62	206.3	100.33	59.8	**8.60**	0.049	9.49
CA36	37.6	5.58	1.131	10.38	5.44	209.7	39.26	71.8	8.50	0.033	8.18
CA37	129.0	2.97	0.598	8.02	4.30	382.9	73.89	62.0	6.60	0.237	8.09
CA38	104.8	1.41	0.514	6.05	2.34	147.7	50.58	60.2	7.05	0.154	8.38
CA39	67.0	**1.20**	0.530	6.37	2.72	80.4	32.26	54.0	7.30	0.176	8.28
CA40	77.0	2.09	0.586	8.07	3.34	161.0	41.84	70.2	7.85	0.153	8.09
CA41	70.0	5.17	0.613	10.46	3.02	362.0	39.62	43.2	6.90	0.186	7.18
CA42	79.6	4.90	**1.152**	12.15	3.54	390.2	88.43	75.6	7.35	0.225	9.07
CA43	44.7	2.28	0.374	9.56	2.58	101.9	13.44	52.6	5.95	0.067	6.91
CA44	33.4	3.72	0.550	7.20	2.48	124.3	18.37	33.2	4.05	0.061	6.11
CA45	48.0	1.82	0.434	9.83	5.06	87.4	17.55	**29.2**	4.45	0.089	7.27
CA46	30.4	2.24	0.522	7.46	3.36	68.1	12.61	76.8	6.40	0.120	7.03
CA47	40.6	1.48	0.379	5.80	2.81	65.8	14.40	32.0	4.70	0.009	7.23
CA48	45.4	3.07	0.463	6.65	2.44	139.4	17.78	36.0	4.05	0.099	6.20
CA49	**20.0**	4.07	0.411	3.62	4.18	61.0	12.14	32.8	3.90	0.087	6.14

Table 2. Continued.

Genotypes	Number of fruits per plant	Fresh fruit weight (g)	Dry fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Fresh fruit yield per plant (g/plant)	Dry fruit weight per plant (g/plant)	Number of seed per pod	Thousand seed weight (g)	Capsaicin (per cent)	Oleoresin (per cent)
CA50	44.7	2.47	0.479	11.40	2.64	110.8	18.14	42.4	4.00	0.072	8.03
CA51	40.1	2.75	0.506	10.17	**1.86**	110.2	17.04	59.4	5.60	0.169	8.17
CA52	38.8	3.71	0.503	8.10	4.08	144.0	16.26	38.6	4.50	0.117	8.07
CA53	31.0	4.09	0.857	9.54	4.18	126.8	23.31	31.0	4.60	0.009	8.66
CA54	30.4	7.29	0.902	8.66	4.06	221.5	24.16	51.5	5.30	0.171	6.21
CA55	48.0	2.22	0.532	4.50	3.16	106.6	22.26	86.8	5.70	0.099	8.13
CA56	32.0	3.55	0.618	9.66	5.46	113.6	16.52	65.5	5.10	0.011	9.11
CA57	23.6	4.62	0.871	12.30	3.36	108.8	17.28	67.8	6.15	0.155	8.87
CA58	36.7	2.19	0.479	7.03	2.96	80.2	14.30	39.0	5.30	0.121	7.01
CA59	36.6	3.02	0.290	8.16	2.11	110.6	10.61	38.8	3.90	0.032	7.19
CA60	39.6	1.93	**0.286**	7.52	3.72	76.5	11.33	58.6	4.45	0.122	7.46
CA61	47.0	1.94	0.376	4.36	2.56	91.2	14.40	37.0	5.35	0.123	8.41
CA62	72.0	1.60	0.423	4.20	2.51	115.2	27.17	38.6	5.80	0.143	6.77
CA63	51.2	2.20	0.496	5.81	3.26	112.7	22.13	66.4	6.35	0.157	10.06
CA64	43.2	2.65	0.472	6.35	3.09	114.4	17.14	50.1	**3.24**	**0.003**	5.14
CA65	28.6	**7.47**	1.099	12.40	4.60	213.6	28.17	104.9	6.65	0.176	9.27
CA66	38.7	3.53	0.372	2.90	4.48	**60.1**	**8.22**	33.2	7.60	0.082	8.32
CA67	39.6	1.93	0.314	4.82	2.84	76.4	12.43	30.4	4.25	0.010	8.09
CA68	41.0	1.79	0.371	**1.82**	2.46	73.6	11.95	53.5	5.70	0.041	**4.67**
CA69	34.2	2.28	0.512	2.08	4.08	78.1	14.25	79.0	5.75	0.113	8.08
CA70	43.6	2.35	0.515	8.25	4.24	102.5	19.20	58.9	6.50	0.154	9.67
CA71	21.7	4.07	0.820	9.30	4.34	88.0	14.49	74.4	6.60	0.150	8.37
CA72	26.8	5.81	0.972	2.20	3.34	155.6	22.79	52.3	7.05	0.095	7.01
CA73	69.2	1.98	0.300	3.70	2.97	136.7	17.52	50.7	4.85	0.162	8.87
CA74	**233.0**	4.61	1.003	8.40	**5.64**	**1072.9**	**225.06**	33.2	5.15	**0.655**	**11.89**
Mean	**82.67**	**3.35**	**0.669**	**8.77**	**3.57**	**279.2**	**57.63**	**61.38**	**6.49**	**0.15**	**8.09**
SEd	4.11	0.119	0.016	0.146	0.229	17.95	4.32	1.27	0.183	0.005	0.126
CD (5%)	8.18	0.236	0.031	0.292	0.458	35.77	8.61	2.52	0.365	0.011	0.250

as a rainfed crop. The details of the genotypes used for the study is given in Table 1. The experiment was laid out in the randomized block design with two replications. The seedlings of 45 days old were transplanted in main field with spacing of 60 × 45 cm. The crop was managed by recommended package of practices. The observations were taken on ten selected plants per replication for yield and quality characters viz., fresh pod weight, fruit length, fruit girth, dry pod weight, number of pods per plant, fresh pod yield per plant, and dry pod yield per plant and quality characters viz., capsaicin and oleoresin. The collected data were subjected to statistical analysis to obtain information on the mean performance of yield and quality characters existing among the chilli accession.

Results and Discussion

The mean performance of chilli genotypes taken for the study for pod yield and quality characters is presented in Table 2. These results have clearly showed that there were significant variations in mean performance among genotypes for all the characters studied. Yield is a determining factor for crop improvement and yield is quantitative trait which is influenced by a number of yield contributing parameters. In the present study, the highest number of pods per plant registered in CA 74 (233) and lowest number of pods per plant was recorded in CA 61 (20). The number of pods per plant is directly influenced by fruit set percentage, genetic nature of genotypes and their re-

sponse to varying environmental conditions and these results were in consonance with the earlier findings [2, 3]. In the present study, chilli accessions of samba type i.e. long fruits were selected. Hence it could be believed that more fruit length of chilli accession would indirectly increase the pod weight and there by the pod yield per plant. The genotype CA7 recorded highest pod length (14.30 cm), while CA 69 registered the lowest pod length (1.82 cm) and the general mean value for pod length was registered as 8.77 cm. In chilli, pod length is having market value because normally medium to long pods are preferred by customers [4]. Pod girth is equally important in deciding the individual pod weight. The pod girth ranged from 1.86 cm (CA 51) to 5.64 cm (CA 74), while the general mean was 3.57 cm. The variation in pod length and pod girth might be due to genetic nature, influence of environmental factors and vigor of the crop. These results were in agreement with the earlier findings [5, 6]. Apart from this significant variation was found among the genotypes for single pod weight. The individual fresh pod weight the range was found to be between 1.20 g to 7.47 g, whereas the accession CA 77 recorded the highest and CA 39 recorded the lowest single pod weight. The highest individual dry pod weight was registered in CA 42 (1.152 g) whereas lowest pod weight was recorded in CA 60 (0.286 g) and CA 59 (0.290 g) with general mean value of 0.669 g. The results are consonance with the earlier findings [7]. In chilli, seeds play a vital role on pod weight, pod yield and quality traits like capsaicin and oleoresin. More seed weight is a preferable trait in chilli. In this study, thousand seed weight was observed to be highest in CA 35 (8.60 g) and the lowest was recorded in CA 76 (3.24 g). Similarly, the highest (118.4) and lowest (29.2) seed number per pod was found in the accession CA 27 and CA 57, respectively. For yield characters, the general mean values of 279.20 g and 57.63 g were recorded for fresh and dry pod yield, respectively. The highest fresh (1,072.9 g per plant) and dry pod yield per plant (225.06 g) were registered in CA 74 whereas the lowest fresh (60.1 g) and dry pod yield (8.22 g) were recorded in CA 66. The difference in pod yield of chilli genotypes has been attributed to the genetic makeup and large genotypic variations in pod yields. These results were also confirmed with the earlier workers in chilli [3, 8].

In a breeding program of chilli, to improve the capsaicin content, it is not sufficient to develop genotypes with high fruit yield alone. It is necessary to develop genotypes with high capsaicin recovery. The quality performance of different chilli genotypes taken for the study shown in Table 2. The highest capsaicin content was found in CA 74 (0.655%) and the lowest value was recorded in CA 64 (0.003%). The highest oleoresin content was registered in CA 74 (11.89%) and the lowest content was observed in CA 68 (4.67%) with mean value of 8.09% was recorded for oleoresin content. This variation might be due to the differences in the genetic sources of the genotypes studied. The current investigation is in agreement with the earlier results [9, 10].

In conclusion, the evaluation of different chilli genotypes showed wide variation in all the characters studied. Among the genotypes evaluated for rainfed conditions, the accessions CA 74 was found to be superior with fruit characters such as number of pod per plant (233.0), pod girth (5.64), fresh pod yield (1,072.9) and dry pod yield per plant (225.06) along with quality traits of capsaicin (0.655%) and oleoresin (11.89%). Hence, the chilli genotypes CA 74 may be exploited for further improvement of the above fruit characters through breeding programs.

References

1. Hazra P, Chattopadhyay A, Karmakar K, Dutta S (2011) Modern Technology in Vegetable Production, New India Publ Agency, New Delhi, India, pp 478.
2. Surya Kumari S, Uma Jyothi K, Srihari D, Siva Sankar A, Ravi Sankar C (2010) Variability and genetic divergence in paprika (*Capsicum annuum* L.). J Spices Aromatic Crops 19 : 71—75.
3. Ramgiri M, Shrivastava RK, Naidu AK (2015) Combining ability studies in chilli (*Capsicum annuum* L.) by line × tester method. Green Farming 6 : 267—269.
4. Chowdhury MSN, Hoque F, Mehraj H, Jamal Uddin AFM (2015) Vegetative growth and yield performance of four chilli (*Capsicum frutescens*). Am–Euras J Agric Environ Sci 15 : 514—517.
5. Sreelathakumary I, Rajamony L (2004) Variability and heritability and genetic advance in chilli (*Capsicum annuum* L.). J Tropical Agric 42 : 35—37.
6. Saravaiya SN, Koladiya PB, Desai DT, Bhanderi DR, Patel HB (2010) Performance of various genotypes of chilli under south Gujarat conditions. Asian J Horti 5 : 442—443.
7. Chattopadhyay A, Sharangi AB, Dai N, Dutta S

(2011) Diversity of genetic resources and genetic association analysis of green and dry chillies of eastern India. Chilean J Agric and Res 71 : 350—356.

8. Usman MG, Rafii MY, Ismail MR, Malek MA, Abdiul Lalif M (2014) Heritability and genetic advance among chilli pepper genotypes for heat tolerant and morphological characteristics. Scient World J 1—14.

9. Ghosh Asish, Pugalendhi L (2012) Studies on the improvement of chilli (*Capsicum annuum* L.) cv CO 4 for quality characters through hybridization. Elect J Pl Breed 3 : 811—817.

10. Amit K, Ahad I, Kumar V, Thakur S (2014) Genetic variability and correlation studies for growth and yield characters in chilli (*Capsicum annuum* L.). J Spices Arom Crops 23 : 170—177.