

Preliminary evaluation of turmeric (*Curcuma longa* L.) varieties at Konkan region of Maharashtra

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Abstract

The performance of 21 varieties of turmeric (*Curcuma longa*) for rhizome characters, yield and curcumin content was studied at Konkan region (Maharashtra). Salem was found to be the best variety, which recorded significantly higher weight of primary fingers (208.92 g), secondary fingers (243.75 g), yield plot⁻¹ (11.99 kg) and yield hectare⁻¹ (44,395 kg). The curcumin content was significantly higher in CA-71 (4.87%). The phenotypic and genotypic coefficient of variation, heritability and genetic advance on mean basis were appreciably high for yield and curcumin content. The magnitude for environmental coefficient of variation was very low.

Key words: *Curcuma longa*, turmeric, variability, yield.

Introduction

Turmeric (*Curcuma longa* L.) is a non-traditional crop in Konkan region of Maharashtra. However, the climatic and soil conditions seem to be suitable for its cultivation in this region. The successful introduction of a suitable variety of this crop in a large area will not only provide an opportunity to generate income but will also be an option for crop diversification. The present investigation was therefore undertaken to identify promising turmeric varieties for cultivation in the Konkan region.

Materials and methods

The experiment was conducted during 2003–04 at the Department of Horticulture, College of Agriculture, Dapoli (17°45' N, 73°12' E) (Maharashtra). The climate is warm and

humid throughout the year with annual rainfall of 3005 mm. The maximum temperature ranged between 27.9°C and 34.5°C and minimum temperature varied from 11.2°C to 25.5°C. The humidity ranged between 68.9% and 95.6%. The experiment was conducted in a randomized block design with 21 varieties representing treatments replicated three times (Table 1).

The total plot size was 19.8 m x 10.5 m with a net plot size of 1.8 m x 1.5 m. The mother rhizomes were planted in the second fortnight of May at 45 cm x 30 cm spacing. Observations on plant height, leaf area, leaf length and leaf breadth were recorded at 120 days of planting. At the time of harvesting, length and weight of mother rhizomes and number, length and weight of primary and secondary fingers were recorded. Rhizome yield plot⁻¹

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was recorded and rhizome yield hectare⁻¹ was estimated. The curcumin content was estimated by the method suggested by Sadasivam & Manikam (1992). Analysis of variance was done as suggested by Panse & Sukhatme (1995). The biometrical analysis was done according to Singh & Chaudhari (1985).

Results and discussion

Plant height ranged from 28.17 cm to 35.27 cm and the variation was not significant. Maximum leaf area was observed in Krishna (626.38 cm²) which was at par with Salem, CLI-332 and Rajapuri and significantly superior over rest of the varieties. CLI-362 produced the longest leaf (64.15 cm), which was at par with Rajapuri, CLI-332, Krishna and Salem and significantly superior over rest of the varieties (Table 1).

The phenotypic coefficient of variation (PCV) was maximum for leaf area (20.77) followed by leaf length (20.38), leaf breadth (14.17) and

plant height (13.75). A similar trend was observed for genotypic coefficient of variation (GCV). The environmental coefficient of variation (ECV) was lowest for leaf area (3.64) followed by leaf breadth (6.36), leaf length (10.05) and plant height (11.71). The higher magnitudes of heritability (67.96) and moderate genotypic advance on per cent mean basis for leaf area suggest dominance of genetic component over environment in governing these characters (Table 2).

Rajapuri recorded the longest mother rhizome (9.23 cm) that was at par with CA-62-3, CLI-332, Salem, CLI-362, CLI-104-2, CLI-107 and CLI-70-1. Maximum weight of mother rhizome was recorded in Salem (90.35 g), which was at par with Krishna, Rajapuri, Tekurpeta and CLI-362. The number of primary rhizomes was maximum in CLI-243-6 (10), which was significantly superior over other varieties. The variation recorded for length of primary rhizome was not significant. The weight of primary rhizome was maximum in Salem (208.92 g), which was sig-

Table 1. Morphological characters of turmeric varieties

Variety	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	Leaf area (cm ²)
Krishna	35.23	54.95	16.90	626.38
Salem	35.27	52.95	16.40	586.75
Rajapuri	30.40	56.45	15.75	582.85
Tekurpeta	34.64	41.70	15.25	485.72
CA-70-1	30.49	42.05	13.75	395.23
CA-64	29.74	40.63	12.20	361.15
CA-62-3	30.90	41.21	14.35	407.85
CLI-324	29.68	43.20	15.85	352.10
CLI-326	30.68	46.58	15.15	451.95
CLI-332	31.58	56.00	16.75	583.85
CLI-333	28.95	40.08	14.40	439.75
CLI-329	28.60	50.08	14.75	459.25
CLI-362	28.50	64.12	16.25	469.25
CLI-107	30.72	42.12	15.60	444.25
CLI-127	27.87	46.65	14.15	463.55
CLI-317	31.75	46.58	15.10	527.70
CLI-104-2	28.17	42.72	13.35	339.00
CLI-243-6	28.78	38.32	13.15	380.95
PCT-8	30.93	43.32	13.05	393.00
ACCN-1	30.10	43.38	11.65	414.50
ACCN-2	28.98	46.42	12.70	388.95
Range	28.17–35.27	38.32–64.12	11.65–16.90	339.00–626.38
Mean	30.57	46.59	14.59	454.95
SE±m	2.08	4.73	1.00	30.89
CD (P=0.05)	NS	13.50	2.85	88.25

nificantly superior over all other varieties. The production of secondary rhizomes was maximum in CLI-104-2 (13.13), which was superior over other varieties. The weight of secondary rhizome was maximum and signifi-

cantly superior in Salem (243.75 g) (Table 3). Philip & Nair (1983) and Balashanmugam (1986) noticed wide variation for rhizome characters in turmeric under Kerala and Tamil Nadu conditions, respectively.

Table 2. Genetic parameters for morphological characters in turmeric

Particulars	Plant height	Leaf length	Leaf breadth	Leaf area
Mean	30.57	46.59	14.59	454.95
Mean sum of square for treatment	14.14	135.54*	6.89*	21080.10**
Mean sum of square for error	12.97	66.99	2.98	2863.22
Phenotypic variance	13.36	90.17	4.28	8935.91
Genotypic variance	0.39	23.18	1.30	6072.29
Phenotype coefficient of variation	13.75	20.38	14.17	20.77
Genotypic coefficient of variation	2.04	10.33	7.81	17.13
Environmental coefficient of variation	11.71	10.05	6.36	3.64
Heritability	2.92	25.17	30.37	67.96
Genetic advance	0.22	5.02	1.29	133.33
Genetic advance on % mean basis	0.72	10.77	8.84	29.30

*, ** Significant at 5% and 1% levels, respectively

Table 3. Rhizome characters of turmeric varieties

Variety	Mother rhizome		Primary rhizome			Secondary rhizome		
	Length (cm)	Weight (g)	Av. no. of fingers mother rhizome ⁻¹	Length (cm)	Weight (g)	Av. no. of fingers plant ⁻¹	Length (cm)	Weight (g)
Krishna	7.89	85.02	7.20	8.51	121.91	7.27	7.13	112.25
Salem	8.65	90.35	7.00	10.33	208.92	11.40	7.99	243.75
Rajapuri	9.23	83.91	7.80	7.41	91.20	7.20	7.52	61.26
Tekurpeta	7.93	78.95	6.33	8.60	104.31	10.00	6.83	83.10
CA-70-1	8.13	34.73	6.00	9.27	90.12	12.67	8.39	71.21
CA-64	6.81	47.11	6.13	8.98	59.75	7.53	5.69	35.78
CA-62-3	8.83	64.67	6.3	8.50	77.45	7.67	6.05	48.53
CLI-324	6.80	35.16	6.47	8.94	88.16	11.53	7.67	74.89
CLI-326	7.87	56.42	6.13	9.95	95.13	8.13	7.34	52.78
CLI-332	8.82	58.62	5.87	10.12	107.60	10.67	7.17	78.48
CLI-333	7.67	52.01	7.07	10.73	110.80	7.67	7.19	79.86
CLI-329	8.01	47.97	5.50	7.97	63.78	6.20	6.93	35.92
CLI-362	8.49	65.90	4.93	7.15	48.88	4.60	5.31	56.48
CLI-107	8.14	61.46	6.83	7.83	83.90	6.60	6.28	49.56
CLI-127	7.29	51.94	6.13	8.89	83.56	6.00	5.93	39.86
CLI-317	7.41	44.67	6.27	7.92	89.57	10.40	7.19	84.36
CLI-104-2	8.21	45.27	6.93	9.59	94.23	13.13	7.39	102.56
CLI-243-6	7.43	41.02	10.00	9.53	83.48	8.45	7.92	79.86
PCT-8	6.87	34.86	8.00	8.60	85.66	8.80	6.99	70.80
ACCN-1	7.81	35.05	4.87	8.75	65.77	10.13	7.92	69.56
ACCN-2	6.89	26.22	5.27	9.57	68.95	9.67	7.44	41.75
Range	6.80 - 9.23	26.22 - 90.35	4.87 - 10.00	7.15 - 10.73	48.88 - 208.92	4.60 - 13.13	5.31 - 8.39	35.78 - 243.75
Mean	7.86	55.35	6.52	8.91	91.58	8.84	7.06	74.89
S E±m	0.41	8.90	0.39	0.72	15.11	0.14	0.55	14.21
C D (P=0.05)	1.18	25.40	0.91	NS	43.18	0.40	1.57	40.59

The magnitudes of PCV were relatively low for length of mother, primary and secondary rhizomes and moderately high for weight of mother, primary and secondary rhizomes and number of primary and secondary rhizomes. The ECV was relatively low for these parameters, which suggested that the environment played little role in governing these parameters. Jalgaonkar *et al.* (1990) also found moderate values of PCV and GCV for length and girth of mother and secondary rhizomes. The moderately high values of heritability for these parameters along with moderately high genetic advance on per cent mean basis confirmed the same (Table 2). Philip & Nair (1985) recorded high heritability for number of primary and secondary rhizomes in turmeric.

The highest yield of fresh turmeric plot⁻¹ was recorded in Salem (11.99 kg), which was significantly superior over other varieties. The variety also produced the highest yield hectare⁻¹ (44,395.07 kg), which was significantly superior to other varieties (Table 5). The variety CA-70-1 had the highest curcumin content of 4.87%, which was significantly higher over other varieties. The curcumin content of fingers was less as compared to that of mother rhizomes of the respective variety. The variety CA-70-1 was significantly superior to all the varieties with respect to curcumin content of fingers (4.77%) (Table 5). Curcumin content of 1.8% to 4.8 % have been reported earlier under Maharashtra conditions (Pujari *et al.* 1987). Rakhunde *et al.* (1998) have recorded higher curcumin content in mother rhizomes than fingers.

Table 4. Genetic parameters for rhizome characters of turmeric

Particulars	Length (cm)	Weight (g)	Av. no. of primary fingers plant ⁻¹	Av. length of primary finger (cm)	Av. wt. of primary finger plant ⁻¹ (g)	Av. no. of secondary fingers plant ⁻¹	Av. length of secondary finger (cm)	Av. wt. of secondary finger (g)
Mean	7.86	54.35	6.52	8.91	91.58	8.84	7.06	74.89
Mean sum of squares for treatment	1.49**	1017.93**	3.97**	2.73	3108.74**	15.70**	1.95*	5801.56**
Mean sum of squares for error	0.51	237.80	0.31	1.55	685.35	0.06	0.91	605.59
Phenotypic variance	0.84	497.71	1.53	1.94	1493.15	5.27	1.26	2337.58
Genotypic variance	0.33	259.90	1.22	0.39	807.80	5.21	0.35	1731.99
Phenotype coefficient of variation	11.66	41.04	18.97	15.63	42.19	25.90	15.90	64.56
Genotypic coefficient of variation	7.31	29.66	16.94	7.00	31.03	25.82	8.38	55.57
Environmental coefficient of variation	4.35	11.38	2.03	8.63	11.16	0.08	7.52	8.99
Heritability	39.28	52.21	79.83	20.10	54.10	98.86	27.77	74.09
Genetic advance	0.74	23.99	2.04	0.57	43.06	4.66	0.64	73.80
Genetic advance on % mean basis	9.41	44.15	31.39	6.39	47.01	92.75	9.08	98.54

*, ** Significant at 5% and 1% levels, respectively

Table 5. Yield and curcumin content of turmeric varieties

Variety	Av. yield of fresh turmeric (kg plot ⁻¹)	Av. yield of fresh turmeric (kg ha ⁻¹)	Curcumin content (%)	
			Mother rhizome	Finger rhizome
Krishna	7.21	26,691.36	3.19	2.61
Salem	11.99	44,395.07	4.44	4.36
Rajapuri	5.32	19,711.11	2.54	2.82
Tekurpeta	5.84	21,618.27	3.46	3.22
CA-70-1	4.41	16,326.91	4.87	4.77
CA-64	3.14	11,610.87	2.69	2.49
CA-62-3	4.34	16,060.74	3.93	3.64
CLI-324	4.47	16,544.20	3.96	3.68
CLI-326	4.41	16,344.69	4.03	3.46
CLI-332	5.33	19,749.63	2.85	2.39
CLI-333	5.26	19,462.72	3.02	2.79
CLI-329	3.15	11,636.54	4.33	4.28
CLI-362	3.64	13,486.42	2.75	2.47
CLI-107	4.13	15,310.62	1.94	1.80
CLI-127	3.65	13,485.43	1.75	1.63
CLI-317	4.79	17,737.78	3.85	3.55
CLI-104-2	5.69	21,104.20	3.15	2.62
CLI-243-6	4.59	17,000.49	2.12	1.74
PCT-8	4.30	15,950.12	2.45	2.28
ACCN-1	3.77	13,975.31	2.20	1.79
ACCN-2	3.26	12,067.16	1.65	1.27
Range	3.14-11.99	11,610.87-44,395.07	1.65-4.87	1.27-4.77
Mean	4.88	18,108.88	3.10	2.84
S E±m	0.69	2569.79	0.12	0.01
C D (P=0.05)	1.98	7340.78	0.34	0.02

Table 6. Genetic parameters for yield and curcumin content in turmeric

Particulars	Av. wt. of fresh turmeric (kg plot ⁻¹)	Av. wt. of fresh turmeric (kg ha ⁻¹)	Curcumin content (%)	
			Mother rhizome	Finger rhizome
Mean	4.89	18108.88	3.10	2.84
Mean sum of square for treatment	10.83**	15003540.00**	2.63**	2.80**
Mean sum of square for error	1.44	19811430.00	0.04	0.01
Phenotypic variance	4.60	63219420.00	0.90	0.93
Genotypic variance	3.16	43407990.00	0.86	0.93
Phenotype coefficient of variation	43.86	43.91	30.60	33.95
Genotypic coefficient of variation	36.35	36.38	29.91	33.95
Environmental coefficient of variation	7.51	7.53	0.69	0.00
Heritability	68.69	68.66	95.55	100.00
Genetic advance	3.02	11246.34	1.85	1.98
Genetic advance on % mean basis	61.75	62.10	59.67	69.72

** Significant at 1% level

The PCV and GCV were moderately high for yield and curcumin content. The magnitudes of PCV were very low. The heritability was moderately high for yield and curcumin content along with high estimates of genetic advance on per cent mean basis (GAM), which suggest a scope for selection of better varieties based on these parameters. Philip & Nair (1985) reported high magnitudes of heritability and GAM for curcumin content under Kerala conditions. Thus, based on the experimentation, it can be concluded that variety Salem was the most promising, which can be further tested before recommendation under Konkan conditions.

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