

## Evaluation of Turmeric Genotypes for Quality

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Received 27 February 2023, Accepted 23 June 2023, Published on 21 August 2023

### ABSTRACT

Fifty four genotypes of turmeric were evaluated for quality characteristics. Highest leaf protein content was recorded in Duggirala Red (236.2 mg/g), highest total phenols in leaf recorded in IC-211641 (29.66 mg GAE /g), highest protein content in rhizomes is observed in the genotype CL-5 (80.21 mg/g), maximum total phenol content recorded in rhizome NDH-96 (30.61 mg/g), highest Oleoresin content recorded in TP-161 (10%), highest curcumin content in leaves and rhizomes in Megha (38.67 mg/g and 48.1 mg/g).

**Keywords** Turmeric, Phenol, *Oleoresin*, Curcumin.

### INTRODUCTION

Turmeric (*Curcuma longa* L.) belongs to the family Zingiberaceae and it is industrially important crop widely cultivated in India. By analyzing the qualitative traits of the turmeric, revealed the presence of curcumin, essential oil from the leaves and rhizomes (Wuthi-udolmlert *et al.* 2000). The presence of various metabolites such as curcuminoid, oil content, flavonoids, phenolics and some important amino acids, protein and high alkaloid content reveals that co-relation with its medicinal uses (Sarangthem and Haokip 2010).

### MATERIALS AND METHODS

Fifty four genotypes are utilized in the study.

#### Curcumin content (%)

Curcumin content in the rhizomes of the turmeric cultivars was estimated by the method given by Manjunath *et al.* (1991). The plant samples were powdered in a plant sample analyzer and finely ground turmeric sample, weighing 0.1 g was extracted by refluxing over water cooled condenser with 40 ml of alcohol for 2 1/2 hr. The extract was cooled and filtered quantitatively into 100 ml volumetric flask. The residue was then transferred to the filter, washed thoroughly and volume was made upto 100 ml with alcohol. Then 5 ml of this aliquot was pipette out into 100 ml volumetric flask and the volume was made up with the alcohol. The diluted extract was mixed well and its absorbance was read at 425 nm against

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alcohol in Spectrophotometer (Citizen).

The curcumin content was calculated as follows :

$$\text{Curcumin content (\%)} = \frac{0.00025 \times A_{425} \times 100 \times 100}{\text{Absorbance of standard (0.42)} \times \text{weight of samples} \times 5 \text{ (0.42 absorbance at 425 nm corresponds to 0.00025 g curcumin)}}$$

### Oleoresin (%)

The oleoresin content was estimated as per the procedure given by Ranganna (1986). The finely mashed 25 g turmeric powder was transferred to a glass column, which was plugged by cotton plug on its narrow end. A thin layer of cotton was placed over turmeric powder in the glass column and 25 ml of acetone was added. After the decantation, the resulting red colored liquid in beaker contains all the principle constituents of turmeric. The collected filtrate was transferred to a 250 ml volumetric flask and the volume was made up with acetone.

The turmeric extract was transferred to a 250 ml beaker of known weight ( $W_1$ ) and was kept in water bath at 50-60°C for 15-30 minutes so that acetone gets evaporated. Then, weight of the beaker along with contents was recorded as  $W_2$ g. The weight of the oleoresin content in the ( $W_1$ ) turmeric powder was calculated and expressed in percentage by using the following formula.

$$\text{Oleoresin content (\%)} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

### Protein content (mg/g)

Protein content in fresh and dried powder was estimated by using Lowry's method. 500 mg of sample was weighed and grind well with pestle and motor in 5 ml of buffer. Centrifuged the sample and the supernatant was used for protein estimation. 0.2, 0.4, 0.6, 0.8 and 1.0 ml of working standards were pipetted out into a series of test tubes and 0.1 and 0.2 ml of sample extract in two other test tubes. Make up the volume to 1 ml in all the test tubes. 5 ml of reagent C (alkaline copper solution) was added to each test tube and 0.3 ml of Folin reagent added and kept in dark condition

for 30 min. The OD readings were taken at 660 nm, a standard graph was drawn and the amount of protein in the sample was calculated.

### Total phenols (mg/g)

The amount of total phenols was determined by using Folin-Ciocalteus reagent, as described by Malick and Singh (1980). About g of dry sample was extracted with 80% aqueous methanol (10 ml) on a mechanical shaker for 2 h. The mixture was centrifuged at 1000 rpm for 15 min and the supernatant were decanted into polypropylene tubes. Evaporate the supernatant to dryness. Dissolve the residue in a known volume of distilled water (5 ml, pipette out different aliquots (0.2 to 2 ml) into test tubes. Make up the volume in each tube to 3 ml with water, 2 ml of 20%  $\text{NaCO}_3$  solution added to each test tube. Mixed thoroughly, place the tubes in boiling water for exactly one min, cooled and measure the absorbance at 650 nm against a reagent blank. Prepare a standard curve using different concentrations of catechol. The determination of phenolic content expressed as milligram gallic acid equivalents (mg CE/1000 g dry weight).

## RESULTS AND DISCUSSION

The qualitative parameters with respect to dry recovery, leaf protein, total phenols in leaf, curcumin content in leaves 150 days after sowing, protein content in rhizomes, total phenol content in rhizomes, oleoresin content, curcumin content in rhizomes are presented in the Table 1.

### Dry recovery

The data of qualitative parameters was represented in the Table 1. Dry recovery among the genotypes varied from 9.21% (TC-14) to 20.35% (Megha) with a mean value of 18.17%. The genotypes Megha (20.35%), CLI- 367 (19.52%), CLI-325 (19.52%) recorded highest dry recovery compared to the best check Tekuripet (19.25%).

### Leaf protein

Leaf protein content (mg/g) recorded at 120 DAP varied significantly among the genotypes. The values ranged from 117 mg/g to 236.2 mg/g with a mean

**Table 1.** Biochemical characters of turmeric accessions.

Sl. No.	Accessions	Dry recovery (%)	Oleoresin (g/100 g)	Leaf curcumin (mg/g)	Rhizome curcumin (mg/g)	Leaf protein (mg/g)	Leaf phenol (mg/g)	Rhizome protein (mg/g)	Rhizome phenol (mg/g)
1	CLI-367	19.52	6.61	34.93	33.55	117	21	43.71	22.53
2	TC-14	9.521	7.97	23.63	36.55	178	18.98	65.11	21.82
3	TP-161	18.52	5.09	16.73	14.85	117	11.92	43.31	13.86
4	RH-5	16.52	5.92	9.059	16.95	169.7	10.47	62.41	12.85
5	LTS-16	18.52	8.57	16.63	26.25	158.6	13.29	58.01	14.87
6	CA-304	18.52	7.79	24.33	35.55	167	21.27	61.81	23.04
7	RH-410	17.52	7.90	23.03	28.05	128	13.48	47.91	16.68
8	TC-211	18.52	5.87	17.33	19.96	124.5	21.02	45.91	23.96
9	Banda salem-1	16.52	8.38	27.33	30.85	197.6	25.5	72.31	26.67
10	NDH-96	18.52	8.17	27.29	45.75	155.6	29.58	57.41	30.61
11	CLI-325	19.52	7.44	25.63	30.95	144.6	12.77	53.41	13.86
12	LTS-5	18.52	7.82	27.63	30.03	177	25.54	65.31	27.21
13	Kadapa red	19.94	7.14	29.4	34.05	134.6	21.95	50.12	23.79
14	ST-365	16.94	5.55	17.7	19.95	117.3	18.49	43.53	20.46
15	JTS-608	16.94	8.48	19.84	37.15	164.1	19.15	60.22	20.46
16	CLI-328	17.94	7.08	16.2	29.45	176.3	16.24	64.53	17.06
17	LTS-7	17.94	7.79	34.7	41.55	195.6	17.48	70.62	18.18
18	LTS-13	17.94	9.50	30.7	42.65	145	24.88	53.92	26.94
19	BDR-8	17.94	7.02	15.8	25.75	156.9	18.58	58.22	19.09
20	CLI-339	16.94	7.14	31.4	34.05	198.6	19.14	71.32	20.46
21	LTS-6	18.94	8.15	34.93	39.95	175.6	14.13	64.32	15.83
22	CLI-339-1	17.94	7.29	23.63	35.15	185.7	27.16	68.22	29.37
23	CLI-34	17.94	7.37	16.73	36.65	178.2	17.15	64.22	18.74
24	PCT-1	19.94	8.44	9.059	36.64	180	17.88	53.83	19.09
25	TCP-10	19.19	8.10	16.63	43.30	188.4	25.52	57.91	26.14
26	LTS-9	18.19	6.44	24.33	15.7	190.2	16.35	52.81	17.16
27	CLI-39	19.19	6.87	23.03	18.69	192	16.6	55.11	18.07
28	CLI-385	18.19	7.68	17.33	31.10	193.8	27.67	54.21	28.17
29	KTS-5	20.19	8.19	27.33	29.88	195.6	13.35	55.91	13.8
30	CL-2	19.19	5.70	27.29	11.65	197.6	18.67	75.11	19.18
31	Wynad local-2	17.19	8.17	25.63	43.34	200.8	20.55	44.71	19.86
32	CL-5	19.19	8.92	27.63	25.21	200.9	26.66	80.21	26.81
33	Kasturi	18.19	7.88	29.4	25.10	202.7	16.67	50.61	17.16
34	CLI-96	18.19	7.71	17.7	23.29	204.5	16.76	62.31	17.42
35	IC-211641	19.19	6.75	19.84	9.20	206.3	29.66	74.11	28.53
36	SLM-1	19.19	5.53	16.2	12.65	208.1	24.61	61.01	24.49
37	KTS-18	17.35	7.23	34.7	20.46	205.7	19.86	57.76	23.02
38	CL-328	18.35	6.38	30.7	17.45	207.5	17.61	66.56	19.63
39	JTS-312	19.35	8.44	15.80	43.04	209.3	20.28	40.96	22.01
40	Megha	20.35	9.86	31.40	48.10	211.1	12.27	56.66	13.93
41	CL-18	17.35	6.43	34.93	22.05	212.8	14.31	70.06	16.45
42	CLI-196	18.35	8.22	34.42	40.39	220.9	16.72	60.86	19.9
43	IC-416941	16.35	4.88	15.38	14.08	214.6	23.97	55.56	27.36
44	LTS-14	19.35	8.73	34.31	38.53	216.4	16.56	66.56	19.63
45	Rajendra Sonia	18.35	5.71	11.76	15.28	218.2	26.41	70.16	28.82
46	CO-1	18.35	6.05	12.81	16.99	220	21.88	62.96	24.33
47	Nizamabad-1	17.35	6.79	12.56	18.57	221.8	23.41	66.76	25.46
48	Rajendra sonali	19.35	7.36	21.71	34.24	223.6	27.39	58.56	29.73
49	Mydukur (C)	18.25	8.45	20.12	36.73	227.2	18.93	65.15	19.94
50	Prathibha (C)	16.88	8.16	25.95	42.8	229.4	23.81	66.2	26.12
51	BSR-2 (C)	18	7.17	28.2	25.48	232.3	21.49	59.9	23.15
52	Salem (C)	17.75	9.54	30.10	29.05	234.6	17.3	57.82	14.39
53	Tekuripet (C)	19.25	9.49	31.62	35.3	235	23.27	60.2	25.2

Table 1. Continued.

Sl. No.	Accessions	Dry recovery (%)	Oleoresin (g/100 g)	Leaf curcumin (mg/g)	Rhizome curcumin (mg/g)	Leaf protein (mg/g)	Leaf phenol (mg/g)	Rhizome protein (mg/g)	Rhizome phenol (mg/g)
54	Duggirala								
	Red (C)	18	9.67	34.08	35.58	236.2	20.53	59.47	22.43
	Mean	18.17	7.50	24.04	29.36	188.9	19.93	59.74	21.4
	LSD (p=0.05)	0.89	1.01	4.75	5.74	13.2	4.13	2.05	0.63
	CV (%)	3.99	9.42	13.62	13.83	4.61	16.08	2.72	2.33

value of 188.9 mg/g. None of the genotypes recorded higher leaf protein content than the best check Duggirala Red (236.2 mg/g). Interestingly all the checks, which are widely cultivated recorded higher leaf protein content.

#### Total phenols in leaf (mg GAE /g)

Total phenols content recorded at 150 DAS varied from 29.66 mg GAE /g to (IC-211641) 10.47 mg GAE/g with a mean value of 19.93 mg/g. Among the genotypes evaluated, significantly higher total phenol content was recorded in IC-211641 (29.66 mg GAE /g) and NDH-96 (29.58 mg GAE/g) compared to the best check prathibha (23.81 mg GAE /g). Niranjana *et al.* (2003) reported variation of phenols in leaves ranges from (0.12-0.22%) of *Curcuma longa*, *C. amada* and *C. zedoaria*.

#### Curcumin content (mg/g) in leaves at 150 DAS

Among the genotypes, curcumin content (mg/g) in the leaves recorded at 150 DAS, on dry weight basis, varied from 9.059 mg/g (RH-5) to 38.67 mg/g (Megha) to with a mean value of 24.04 mg/g. Among the genotypes, significantly higher total curcumin content was recorded in Megha 38.67 mg/g compared to the best check Duggirala Red (34.08 mg/g).

#### Protein content in rhizomes at harvest (mg/g)

Among the genotypes, protein content in rhizomes (mg/g) varied from 40.96 mg/g (JTS-312) to 80.21 mg/g (CL-5) with a mean value of 59.74 mg/g. Among the genotypes evaluated, significantly higher total rhizome protein content was recorded in CL-5

(80.21 mg/g), CL-2 (75.11 mg/g), IC-211641 (74.11 mg/g), Banda Salem-1 (72.31 mg/g), CLI-339 (71.32 mg/g), LTS-7 (70.62 mg/g), Rajendra Sonia (70.16 mg/g) and CL-18 (70.06 mg/g) compared to the best check Prathibha (66.2 mg/g). Similar trends were reported by Niranjana *et al.* (2003) and Fattepurkar *et al.* (2009). Total protein content in *C. aromatica* ranged from 8.25 to 9.98% (Sajitha *et al.* 2014).

#### Total phenol content in rhizome (mg/g)

Among the genotypes, total phenol content in rhizomes (mg/g) varied from 12.85 mg GAE /g (RH-5) to 30.61 mg GAE /g (NDH-96) with a mean value of 21.4 mg GAE/g. Phenol content in rhizomes was recorded in NDH-96 (30.61 mg/g), Rajendra Sonali (29.73 mg GAE/g), CLI-339-1 (29.37 mg GAE/g), Rajendra Sonia (28.82 mg GAE/g), IC-211641 (28.53 mg GAE/g), CLI- 385 (28.17 mg GAE/g), IC-416941 (27.36 mg GAE/g), LTS-5 (27.21 mg GAE/g), LTS-13 (26.94 mg GAE/g) and CL-5 (26.81 mg GAE/g) compared to the best check Prathibha (26.12 mg GAE /g). Niranjana *et al.* (2003) reported variation of phenols in leaves ranges from (0.12-0.22%) of *Curcuma longa*, *C. amada* and *C. zedoaria*.

#### Oleoresin content (%)

The data on oleoresin content of different cultivars of turmeric were indicated significant variation for oleoresin content that varied from 10 % (TP- 161) to 9.87 % (Megha) with a mean of 7.5%. Among the genotypes evaluated, none of the genotypes have recorded better oleoresin content the best check Salem (9.54 %). However, Megha (9.87 %) was on par with the best check Salem. On comparing the results with

previous study varying percentage of the oleoresin values are ranged from 6% to 15% has been reported by Singh S *et al.* (2013).

#### Curcumin content (mg/g) in rhizomes

Among the genotypes, curcumin content (mg/g) in the rhizomes varied from 9.201 mg/g (IC-211641) to 48.1 mg/g (Megha) with a mean value of 29.36 mg/g. Among the genotypes significantly higher total curcumin content was recorded in Megha (48.1 mg/g) compared to the best check Prathibha (42.8 mg/g). Anusuya (2004) recorded the highest curcumin content in Suroma under Arabhavi condition. Hrideek *et al.* (2006) recorded maximum curcumin content in turmeric variety Prabha (5.56%) under Western Ghats conditions. Kumar *et al.* (2015) recorded very high level of curcumin content (6.30%) in Roma. Maurya (1990) had recommended a promising variety RH-10 with 8.4% curcumin content through selection made at Rajendra Agricultural University, Delhi. Mathai (1976) and Mehta *et al.* (1980) estimated curcumin content of 39 cultivars of turmeric and found that curcumin content varied from 2.5% to 8%.

#### ACKNOWLEDGMENT

Authors are thankful to the Dr. YSR Horticultural University, Venkataramannagudem, West Godavari for providing the institutional support to carry out this work.

#### REFERENCES

- Anusuya (2004) Evaluation of different genotypes of turmeric for yield and quality under irrigated condition for command area of Northern Karnataka. MSc (Agric) Thesis Uni Agric Sci Dharwad, Karnataka, India.
- Fattepurkar SC, Damame SV, Ghadge SN (2009) Chemical composition of finger rhizome of *Curcuma aromatic* L. and *Curcuma longa* L. *Asian J Experim Chem* 4 (1) : 84—86.
- Hrideek TK, Kuruvilla KM, Indianumol GP, Menon PP, Madhusoodanan KJ, Thomas J (2006) Performance evaluation of turmeric (*Curcuma longa* L.) varieties at higher elevation of Western Ghats. *J Plantation Crops* 34 (3) :178—188 *J Spice Ind* 12 : 7—9.
- Kumar RK, Rao NS, Kumar RN (2015) Evaluation of turmeric (*Curcuma longa* L.) cultivars at agency areas of north coastal Andhra Pradesh. *Progressive Res Internat J* 10 : 2417—2420.
- Mathai CK (1976) Variability in turmeric (*Curcuma* species) germplasm for essential oil and curcumin. *Qualitas Plantarum* 25 (3-4) : 227—230.
- Malick S, Singh (1980) Evaluation of *in vitro* antioxidant activity of leaf extract of *Andrographis paniculata*. *Pl Physiol* 102 : 7—9.
- Manjunath MN, Sattigeri VD, Nagaraja KV (1991) Curcumin in turmeric. *Spice India* 4 (3) : 7—9.
- Maurya KR (1990) RH 10, a promising variety of turmeric to boost farmer's economy. *Indian Cocoa, Arecanut and Spices J* 13 : 100—101.
- Mehta KG, Raghava Rao DV, Patel SH (1980) Relative curcumin content during various growth stages in the leaves and rhizomes of three cultivars of *Curcuma longa* and *C. amada*.
- Niranjan A, Prakash D, Tewari SK, Pande A, Pushpangadan P (2003) Chemistry of species of *Curcuma* cultivated on sodic soil. *J Med Aromatic Pl Sci* 25 : 69—75.
- Ranganna S (1986) Handbook of analysis and quality control for fruits and vegetable products. 2<sup>nd</sup> edition : 259.
- Sajitha PK, Prasath D, Sasikumar B (2014) Phenological variation in two species of *Curcuma*. *J Plantation Crop* 42 (2) : 252—255.
- Sarangthem K, Haokip MJ (2010) Bioactive component in *Curcuma caesia* Roxb. Grown in Manipur. *The Bioscan* 5 : 113—115.
- Singh S, Joshi RK, Nayak S (2013) Identification of elite genotypes of turmeric through agroclimatic zone based evaluation of important drug yielding traits. *Industrial Crops Products* 43 : 165—171.
- Wuthi-udolmlert MW, Grisanapam O, Luanratana, Caichompoo W (2000) Antifungal activity of *Curcuma longa* grown in Thailand, Southeast Asian. *J Trop Medicine and Public Health* 3 (1) : 178—182.