Journal of Spices and Aromatic Crops 10 (1) : 33-36 (2001)

Evaluation and selection of turmeric (*Curcuma longa* L.) genotypes

K A Shanmugasundaram, T Thangaraj, R S Azhakiamanavalan & M Ganga

Horticultural College and Research Institute
Tamil Nadu Agricultural University
Coimbatore-641 003, Tamil Nadu, India.

Received 05 August 2000; Revised 04 November 2000; Accepted 12 November 2001.

Abstract

Fifteen genotypes of turmeric (*Curcuma longa* L.) from five states of India were evaluated for yield and curcumin content. Among them, PTS-43 yielded 33.86 t ha^{-1} fresh rhizome, 7.17 t ha^{-1} cured rhizome, 5.36 % curcumin and 21.17 % recovery of cured rhizome as against 28.00 t ha^{-1}, 4.48 t ha^{-1}, 3.56 % and 16.00 % respectively in BSR-2, the local check and 26.69 t ha^{-1}, 5.69 t ha^{-1}, 4.84 % and 21.33%, respectively in the national check (var. Roma).

Key words: *Curcuma longa*, curcumin, genotype, turmeric, yield.

Introduction

Turmeric (*Curcuma longa* L.) is largely grown in Andhra Pradesh, Tamil Nadu, Kerala, Bihar, Orissa and Maharashtra in India. However, the productivity and quality are not up to the expected levels in Tamil Nadu, though it is the second leading state in turmeric production and many new varieties have been released. Even now farmers cultivate local genotypes, which fetch low prices in the market. Hence, to identify a variety with high yield and quality, suitable for Erode and Coimbatore conditions (where more than 50% of the area under turmeric in Tamil Nadu is located), a trial was conducted with 15 genotypes from five principal turmeric growing states of India.

Materials and methods

Fifteen genotypes, from five principal turmeric growing states of India were evaluated for selection of a high yielding, good quality turmeric line (Table 1). The trials were undertaken at the Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 1997-98. The trial was laid out in a Randomised Block Design with three replications under irrigated conditions. The cv. BSR-2 (local check) released by the Tamil Nadu Agricultural University, performing satisfactorily in Tamil Nadu and the cv. Roma (national check) released by the High Altitude Research Station, Pottangi, Orissa, performing well in major turmeric growing states of India were included in the study for comparison. The plants were spaced at 45 cm x 30 cm and the plot size was 3 m^2. Uniform sized seed rhizomes (20 g each) with well-developed buds were selected and planted during last week of May 1997. Standard cultural practices recommended for the crop were followed uniformly in all the treatments (Anonymous 1994). Biometric characters were recorded 6 months after planting. For leaf area estimation, the conversion factor 0.72 was used as proposed by Jalgoankar *et al.* (1988). The rhizome characters were recorded at maturity. The data were analyzed statistically for their significance (Panse & Sukhatme 1985). Standard procedures

Table 1. Phenotypic and yield characters of turmeric genotypes

Genotype	Source	Plant height (cm)	No. of tillers	No. of leaves	Leaf area (cm^2)	Duration (days)	Fresh rhizome yield (kg $plot^{-1}$)	Estimated yield (t ha^{-1})	Curing per cent (%)	Cured rhizome yield (t ha^{-1})	Curcumin content (%)
Roma	High Altitude Research Station, Pottangi, Orissa	91.70	4.68	24.53	496.62	274.00	8.00	26.69	21.33	5.69	4.84
PTS-12	High Altitude Research Station, Pottangi, Orissa	99.38	2.73	19.64	575.83	273.33	8.74	29.14	21.33	6.21	4.36
PTS-43	High Altitude Research Station, Pottangi, Orissa	102.85	4.49	25.56	602.39	274.00	10.16	33.86	21.17	7.17	5.36
PTS-62	High Altitude Research Station, Pottangi, Orissa	98.65	4.20	24.22	571.43	275.00	8.48	28.28	20.33	5.75	4.49
JTS-1	Regional Agricultural Research Station, Jagtial, A. P.	97.19	2.06	17.96	519.17	272.67	11.06	36.86	16.00	5.90	2.61
JTS-2	Regional Agricultural Research Station, Jagtial, A. P.	74.46	4.41	24.62	317.01	288.00	6.03	20.11	16.00	3.22	5.23
Acc.360	Indian Institute of Spices Research, Calicut, Kerala.	86.36	3.98	22.37	379.07	262.67	6.75	25.50	22.33	5.03	5.02
Acc.361	Indian Institute of Spices Research, Calicut, Kerala.	71.73	3.10	21.07	310.19	260.00	5.62	18.72	21.83	4.09	4.72
Alleppey	Spices Board, Coimbatore, T. N.	64.83	3.73	19.54	250.06	260.00	3.13	12.78	22.50	2.88	4.29
Shoba	Kerala Agricultural University, Vellanikkara	75.32	4.54	20.54	285.34	261.33	5.29	17.64	22.67	4.00	4.62
Kanthi	Kerala Agricultural University, Vellanikkara	55.61	4.88	19.38	225.57	256.67	4.10	15.34	22.00	3.37	4.81
VK-5	Kerala Agricultural University, Vellanikkara	42.13	1.65	10.73	176.18	223.33	2.08	6.94	22.00	1.46	1.23
RH-5	Tirhut College of Agriculture, Dholi, Bihar	45.60	2.43	12.14	172.57	228.33	2.65	8.83	21.50	1.90	5.67
Rajendra Sonia	Tirhut College of Agriculture, Dholi, Bihar	50.64	2.63	12.51	198.41	239.33	3.71	12.36	21.57	2.60	4.23
BSR-2	Regional Research Station, Bhavanisagar, T. N.	72.09	3.35	21.84	298.56	288.00	8.40	28.00	16.00	4.48	3.56
SE		4.45	6.57	0.83	9.87	0.94	0.17	0.56	0.35	0.13	-
CD at 5%		9.12	1.16	1.79	19.94	1.92	0.34	1.14	0.73	0.27	-

were followed for estimation of curing per cent (Natarajan & Lewis 1980) and curcumin content (ASTA 1968).

Results and discussion

The growth characters varied significantly in various genotypes with regard to plant height, number of tillers, number of leaves and leaf area. All these characters, except for number of tillers, had significant positive correlation with yield. Among the genotypes, PTS-43, PTS-12, PTS-62, JTS-1, Roma and Acc. 361 recorded better growth in respect of plant height, number of leaves and leaf area compared to other genotypes (Table 1).

Plant height varied from 42.13 cm (VK-5) to 102.85 cm (PTS-43). PTS-43 was on par with PTS-12 (99.38 cm) and PTS-62 (98.65 cm). PTS-43 produced maximum number of leaves (25.56), which was on par with JTS-2 (24.62), Roma (24.53) and PTS-62 (24.62). The lowest number of leaves was produced by VK-5 (10.73), which was on par with RH-5 (12.14). Maximum leaf area was recorded in PTS-43 (602.39 cm^2) and it was minimum in RH-5 (172.57 cm^2). Though, no significant correlation was found between number of tillers per clump and yield, the highest number of tillers per clump was noticed in Kanthi (4.88) which was on par with Roma (4.68), Shoba (4.53), PTS-43 (4.49), JTS-2 (4.41), PTS- 62 (4.20) and Acc. 360 (3.98). The number of tillers was least in VK-5 (1.65), which was on par with Rajendra Sonia, RH-5 and JTS-1.

Crop duration is an important factor as it determines the cropping sequence of the region. The genotypes VK-5 (223.33 days), RH-5 (228.33 days) and Rajendra Sonia (239.33 days) are early maturing types and the genotypes PTS-12 (277.33 days), JTS-1 (272.76 days), Roma (274.00), PTS-43 (274.00 days), PTS-62 (275.00 days), BSR-2 and JTS-2 (288.00 days) are late maturing types, while the other genotypes are medium maturing types (Table 1). These findings corroborate with Reddy *et al.* (1988), Cholke (1993) and Sasikumar *et al.* (1994) who have observed considerable variation in the duration of different genotypes of turmeric.

The rhizome yield per plot (3 m^2) varied significantly. JTS-1 produced the highest yield of 11.06 kg per plot followed by PTS-43 (10.16 kg), PTS-12 (8.74 kg) and PTS-62 (8.48 kg). VK-5 recorded the lowest yield (2.08 kg). The local check, BSR-2 recorded only 8.4 kg per plot while the national check Roma recorded 8.0 kg per plot.

Significant differences in fresh and cured rhizome yield were observed in the trial (Table 1). The highest yield (fresh rhizomes) was in JTS-1 (36.86 t ha^{-1}) followed by PTS-43 (33.86 t ha^{-1}), PTS-12 and PTS-62 evidently showing a positive relationship between yield and important components of growth like plant height, leaf area and number of leaves. The lowest yield was recorded in VK-5 (6.94 t ha^{-1}) followed by RH-5. The local check, BSR-2 recorded 28.00 t ha^{-1} while in the national check, Roma the yield was 26.69 t ha^{-1}, which are less than the yields of JTS-1, PTS-43, PTS-12 and PTS-62.

PTS-43 recorded the highest yield of 7.17 t ha^{-1} cured rhizome followed by PTS-12, JTS-1, PTS-62 and Roma. Though, JTS-1 recorded the highest fresh rhizome yield, its cured rhizome yield was lower than that of the genotypes PTS-43 and PTS-12 due to its poor curing percentage (16.00%). The local check BSR-2 recorded only 16.00% and the national check Roma recorded 21.33% curing out turn. Shoba had the highest curing percent (22.67 %) and it was on par with Alleppey, Acc. 360 and Kanthi. In general, the curing percentage was higher in short duration types and significantly low in long duration types. This was in conformity with the results of Subbarayudu *et al.* (1976).

Curcumin content has been found to vary depending upon soil organic carbon, available nitrogen and manganese (Vijayakumar *et al.* 1992). In the present study, the highest curcumin content (5.67 %) was recorded in RH-5, followed by PTS-43 (5.36 %) and JTS-2 (5.26 %) (Table 1). But the fresh rhizome yield of RH-5 was too low (8.83 t ha^{-1}). Contrary to this, JTS-1 topped the list in fresh rhizome yield (36.86 t ha^{-1}) but possessed a very low level of

curcumin (2.61%). The local check had only 3.56% curcumin. PTS-43 had good fresh rhizome yield (33.86 t ha^{-1}) and has a comparatively high curcumin content (5.36%). PTS-12 and PTS-62 possessed curcumin content below 5%, even though the yield was higher than in the local and national checks. Earlier report by Kurian and Valsala (1995) indicated the presence of higher level of curcumin (6.27%) in VK-5, contrary to a very low level of 1.23% curcumin in the present study. Similar differences were observed in Shoba and Kanthi, which were reported to have 7.39% and 7.18% curcumin content (KAU 1995), while in the present study these genotypes recorded curcumin content of only 4.62% and 4.81%, respectively. This variation is probably attributable to influence of climate, soil and nutrition (Vijayakumar *et al.* 1992). The variation in curcumin content among the genotypes under similar climatic conditions may be due to genetic factors (Ratnambal 1986). Among all the genotypes, PTS-43 registered its supremacy over the local check (BSR-2) in respect of fresh rhizome yield per hectare (20.93%), cured rhizome yield (60.00%), curing per cent (32.31%), curcumin content (40.00%) and maturity period (two weeks less) and over the national check (Roma) in respect of fresh rhizome yield per hectare (26.86%), cured rhizome yield (26.01%) and curcumin content (10.74%). So, PTS-43 is the most suitable turmeric variety for Coimbatore conditions and it can be recommended for cultivation in Tamil Nadu after confirming its performance in other turmeric areas of the state.

Acknowledgement

The authors express their sincere gratitude to the Director and Dr. T. John Zachariah, Senior Scientist, Indian Institute of Spices Research, Calicut for the training on quality analysis of turmeric imparted to the authors and for the confirmation of the results on quality parameters of turmeric.

References

American Spice Trade Association (ASTA) 1968 Official Analytical Methods, 3rd Edn. American Spice Trade Association, New York.

Anonymous 1994 Crop Production Guide, Department of Horticulture and Plantation Crops, Tamil Nadu.

Cholke S M 1993 Performance of turmeric (*Curcuma longa* L) genotypes, MSc. Thesis ,University of Agricultural Sciences, Dharwad.

Jalgoankar R, Patel M M & Rajput J C 1988 Performance of different varieties of turmeric (*Curcuma longa* L.) under Konkan conditions of Maharastra. Proceedings, National Seminar on Chillies, Ginger and Turmeric, (pp. 102-105). Andhra Pradesh Agricultural Univesity, Hyderabad.

Kerala Agricultural University (KAU) 1995 Research Highlights 1993-95, Kerala Agricultural University, Thrissur.

Kurian A & Valsala P A 1995 Evaluation of turmeric types for yield and quality. J. Tropical Agriculture 33 : 75-76.

Natarajan C P & Lewis Y S 1980 Technology of ginger and turmeric. Proceedings, National Seminar on Ginger and Turmeric, (pp. 143-146). Central Plantation Crops Research Institute, Regional Station, Calicut.

Panse V G & Sukhatme P V 1985 Statistical Methods for Agricultural Workers, 4th Edn. Indian Council of Agricultural Research, New Delhi.

Ratnambal M J 1986 Evaluation of turmeric accessions for quality. Plants Food Hum. Nutr. 36 : 243-252.

Reddy M L N, Rao A M & Reddy A K 1988 Studies on the performance of turmeric cultures under Northern Telangana zone of Andhra Pradesh. Proceedings, National Seminar on Chillies, Ginger and Turmeric, (pp. 100-101). Andhra Pradesh Agricultural University, Hyderabad.

Sasikumar B, Ravindran P N & George J K 1994 Breeding ginger and turmeric. Indian Cocoa, Arecanut & Spices J. 18 : 10-12.

Subbarayadu M, Reddy R R C & Rao M C 1976 Studies on varietal performance of turmeric. Andhra Agric. J. 23 : 195-98.

Vijayakumar G V, Reddy K S, Rao M S & Ramaavatharam M 1992 Soil and plant characters influencing curcumin content of turmeric. Indian Cocoa, Arecanut & Spices J. 15 : 102-104.