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Evaluation of Turmeric Cultivars for Curcumin under Konkan Condition, Maharashtra, India

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***Abstract*:** The experiment was undertaken to screen the different cultivars of turmeric on the basis of curcumin content under Konkan condition. The eight cultivars having high curcumin *viz*., Roma, Pragati, Waigaon, Megha-1, BSR-2, Prathibha, Salem and Phule Swarupa were screened. The various growth parameters, yield parameters, curcumin and essential oil were considered for screening. Upon screening for different parameters, Pragati early variety having high curcumin and essential oil was suitable for the Konkan region.

Keywords: Turmeric, Curcumin, Essential oil, Konkan region, Cultivars screening

Turmeric (*Curcuma longa* L.), known as golden spice, is one of the important crops of Maharashtra. The area under turmeric in Konkan region is increasing as it is nine months crop which escapes water shortage period during the summer. It is shade loving crop and sustains well under partial shade (Singh and Edison 2003). The cultivation of turmeric as intercrop in the coconut and arecanut gardens helps to farmers in Konkan region for getting additional returns. Presently the marketing of turmeric is done based on size and shape. In the new era of marketing the demand of turmeric in the international market on the basis of curcumin content is increasing as 'curcumin' is having its own medicinal uses. In Maharashtra, Salem variety have major share in the turmeric cultivation and curcumin content of this variety is ranging from 3.5 to 4.5 % (Salimath et al 2014). The extraction of the curcumin from the Salem variety is uneconomical as is having less curcumin as compared to the other improved varieties. Hence, there is demand from the turmeric processing industries to screen the high curcumin content variety suitable for cultivation in the Maharashtra so that the traditional Salem variety can be replaced by the improved variety. Crop improvement studies undertaken at various research organizations have resulted in the release of several improved varieties (Naidu and Murthy 2013). The commercial improved varieties released by different organizations in turmeric are location specific (Maurya et al 2018). Curcumin content in these varieties is governed by G x E interaction. The soil health is also play an important role (Mondal and Hore 2022). Therefore, screening of high curcumin varieties released by different organizations in India is undertaken to find out the suitable cultivar having highest curcumin content for Konkan region.

MATERIAL AND METHODS

The commercial improved varieties released by different organizations in India were collected and planted at Post Graduate Institute of Post Harvest Technology and Management, Killa Roha , Raigad, Maharashtra, India. The eight high curcumin varieties *viz*., Roma, Pragati, Waigaon, Megha-1, BSR-2, Prathibha, Salem and Phule Swarupa were used for screening. The experiment was carried out in randomized block design with eight treatments and three replications for three consecutive years during 2019 to 2021.

Growth parameters observed were leaf area (cm^2), leaf area index, number of tillers $plant^{-1}$, number of leaves main $shoot^{-1}$, height of plant 150 days after planting (cm) and duration (days) of the variety. The leaf area was measured with the help of leaf area meter. The yield parameters recorded were weight of mother rhizome $plant^{-1}$(g), number of primary rhizomes $plant^{-1}$, weight of primary rhizomes $plant^{-1}$(g), number of secondary rhizomes $plant^{-1}$, weight of secondary rhizomes $plant^{-1}$(g), fresh yield (q ha^{-1}), dry rhizome yield (q ha^{-1}) and dry recovery percentage. The curcumin was estimated by spectrophotometric method (Geethanjali et al 2016). Percentage curcumin in samples was calculated as: Curcumin % = (Ds x AS/100 x Ws x 1650) x 100; where, Ds- dilution volume of the sample, Ws-weight of the sample, As,-Abosrbance of the sample, 1650-calculated standard value. The essential oil was estimated by steam distillation method (Ching et al 2014).

RESULTS AND DISCUSSION

Growth parameters: The significantly maximum leaf area was of Salem (7815.01 cm^2) followed by Prathibha and Phule

Swarupa and Roma were at par with each other (Table 1). The leaf area index is important indicator of radiation and precipitation, interception, energy conversion and water balance. The significantly maximum leaf area index was of Salem (10.8) and lowest in Waigaon. Leaf area index vary with the variety (Padmapriya et al 2016). The highest number of tillers per plant were observed in Salem (4.1) which was at par with BSR-2, Prathibha, Phule Swarupa, Pragati and Roma. Maximum number of leaves were in Salem (11.8) which was at par with Phule Swarupa, Prathibha and BSR-2. Height at 150 days was maximum of Salem (120.5 cm) which was at par with Phule Swarupa. Waigon matured at minimum days (181 days) after planting which was at par with Pragati. The growth parameters are mainly responsible for vegetative structure of the plant (Li et al 2011).

Yield parameters: The maximum mother rhizome weight (84 g) per plant was of Salem which was at par with BSR-2 (Table 2). The maximum number of primary rhizomes were developed by Salem (4.1) and varieties BSR-2, Prathibha, Phule Swarupa, Pragati and Roma were at par with each other for number of primary rhizomes. Significantly maximum primary rhizomes weight (159.6 g) was attained by Salem followed by Megha-1 and Pragati. The highest number of secondary rhizomes (12.4) per plant were formed in Salem cultivar which was at par with BSR-2, Prathibha, Phule Swarupa, Pragati and Roma. The maximum weight of secondary rhizomes per plant was observed in Salem (403 g) while the varieties BSR-2, Prathibha, Phule Swarupa, Pragati and Roma were at par with each other for secondary weight of rhizomes. The maximum fresh yield of rhizomes was observed in Salem (320.71 q ha^{-1}) which was at par with BSR-2, while the maximum dry yield was in Salem (64.14 q ha^{-1}) which was at par with BSR-2, Prathibha and Pragati. Significantly maximum dry recovery percentage was in Waigaon (22.23 %) followed by Phule Swarupa. The dry recovery percentage of Phule Swarupa, Prathibha, Pragati and BSR-2 were at par with each other. The processing of turmeric has several effects like it promotes gelatinization of starch, increase dehydration rate and distributes pigments uniformly. All these contributes in dry recovery of turmeric (Bambirra et al 2002).

Table 1. Growth performance of different turmeric cultivars grown at Konkan condition

Treatments	Leaf area (cm^2)	Leaf area Index	No of tillers/ plant	No of leaves per main shoot	Plant height (cm) (150 DAP)	Duration (days)
T_1: Roma	7363.07	9.80	3.10	9.40	84.70	246.00
T_2: Pragati	6040.87	8.10	3.20	8.50	101.90	192.00
T_3: Waigaon	5589.93	7.50	2.70	7.70	72.60	181.00
T_4: Megha-1	6960.73	9.30	2.90	9.50	102.50	257.00
T_5: BSR-2	6334.87	8.40	4.00	10.30	104.50	240.00
T_6: Prathibha	7653.67	10.20	3.90	10.40	95.00	221.00
T_7: Salem	8120.87	10.80	4.10	11.80	120.50	264.00
T_8: Phule Swarupa	7510.53	10.00	3.40	10.60	112.50	243.00
CD (p=0.05)	305.85	0.40	1.10	1.53	10.54	11.54

Table 2. Yield contributing and quality parameters of different turmeric cultivars grown at Konkan condition

Cultivars	Mother rhizome Weight g/plant	No. of primary rhizomes/ plant	Primary rhizomes Weight g/plant	No. of secondary rhizomes/ plant	Secondary rhizomes weight g/plant	Fresh rhizome yield q/ha	Dry Rhizome yeld q/ha	Dry recovery (%)	Curcumin (%)	Curcumin yield (kg/ ha	Essential oil (%)	B:C Ratio
T_1	63.00	3.10	98.50	9.20	299.00	228.39	47.58	20.84	4.88	232.04	4.10	1.92
T_2	65.00	3.20	111.60	9.60	312.00	242.35	51.56	21.28	5.55	286.35	5.90	2.54
T_3	42.00	2.70	57.90	8.00	260.00	178.49	38.80	22.23	4.90	190.01	4.90	1.68
T_4	68.00	2.90	112.30	8.80	286.00	231.27	48.18	20.76	4.19	201.88	4.50	1.67
T_5	76.00	4.00	100.50	12.00	390.00	281.00	58.54	21.06	4.07	238.07	3.70	1.97
T_6	49.00	3.90	74.70	11.80	383.50	251.59	53.53	21.28	5.00	267.65	5.80	2.22
T_7	84.00	4.10	159.60	12.40	403.00	320.71	64.14	19.80	4.63	296.77	3.70	2.45
T_8	52.00	3.40	73.60	10.20	331.50	226.72	48.24	21.58	5.10	246.18	4.40	2.04
CD (p=0.05)	12.24	1.10	43.06	3.31	107.51	63.39	13.15	0.60	0.21	65.00	0.40	0.07

See Table 1 for details

Quality parameters: Curcumin is the phenolic compound having medicinal value. The significantly maximum curcumin was in Pragati (5.5 %) followed by Phule Swrupa and Prathibha. The biosynthesis of curcumin take place in shoot and rhizome acts as a storage organ (Pawar et al 2014, Hazra et al 2015 and Kadam et al 2018). The maximum essential oil was in Pragati (5.9 %) which was at par with Prathibha (Ching et al 2014). Chandalinga et al (2016) reported highest curcumin and volatile oil from mother rhizomes. The significantly maximum B:C ratio was recorded in Pragati (2.54) followed by Salem.

CONCLUSIONS

In present study by comparing all the yield contributing and quality parameters as well as B:C ratio of the cultivars under study it was observed that 'Pragati' early variety of turmeric was best suited for higher curcumin and essential oil yield in Konkan condition.

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