Evaluation Of Black Turmeric (*Curcuma Caesia*) Genotypes for Growth, Yield and Quality

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Abstract

The field experiment was conducted at Vadapalani village of Erode district to evaluate twenty black turmeric genotypes for their growth, yield and quality. The study revealed that significant difference exists among the genotypes collected and the genotype BTG 12 collected from Mekkarai, Tenkasi of Tamilnadu state showed better results among all growth, yield and quality parameters such as Plant height (139.20 cm), No. of leaves plant^{-1} (11.7), Number of tillers plant^{-1}(1.45), Chlorophyll content (33.86 SPAD units), Number of rhizomes plant^{-1} (15.90), Number of primary fingers plant^{-1}(5.95) , Fresh rhizome yield plant $^{-1}$(321 g), Estimated yield ha^{-1} (23.6 t ha^{-1}), Days taken for maturity (267) and Curcumin content (2.05 %) followed by the genotype BTG 6 collected from Ariyankavu, Kerala and the least performance was observed from the genotype BTG 13 which was collected from Panjagutta, Hyderabad. From the invest

Keywords: Black turmeric, genotypes, evaluation, growth, yield, quality.

Introduction

Curcuma is a large genus belonging to the family Zingiberaceae, which comprises over 70 species of rhizomatous herbs (Narendhiran and Gayathiri, 2020). *Curcuma caesia* (Roxb.) popularly known as Kali Haldi (Black turmeric) is an uncommon endemic and perennial herb with bluish-black rhizome. It is a non-conventional and lesser known medicinal plant; herb is not in cultivation. Presently it has gained the status of endangered species and is on the verge of extinction due to various unfavorable factors and over exploitation (Chitra *et al.*, 2020). In India, it is found in Chhattisgarh, Madhya Pradesh, Odisha, Uttar Pradesh and West Bengal. *C. caesia* (Roxb.) has been utilised as a remedy by numerous indigenous cultures. According to a list of 112 plants released by the Ministry of the Environment in 1997, the National Medicinal Plant Board of India prohibits exporting these species without prior authorization. Similar methods of growing and harvesting are used for *Curcuma longa*. The plant's underground short and thick rhizome serves as its means of reproduction. The crop is raised in warm, humid climates. The soil should be humus-rich, sandy, or clay loam (Patrick, 2015). The maximum altitude at which it may be grown is 4000 feet above sea level. Between April and August, little pieces of rhizome with a bud are placed into the ground three inches deep. The crop is mature when the leaves start to turn yellow and fall in December or January. The performance of any crop or variety largely depends upon its genetic makeup. Further, the performance of the crop depends upon climatic conditions of the region under which they are grown. As a result, genotypes which perform well in one region may not perform well in other regions of varying climatic conditions. Hence, it is very much necessary to collect and evaluate all the available genotypes in order to select suitable and high yielding genotypes for a given agro-climatic condition. Considering the importance of black turmeric, research on this crop is very much necessary to find out the suitability of different genotypes for a particular region. Hence there is a need to identify the promising black turmeric genotype with better growth, yield and quality and the present study also has an effort to identify the promising genotype from the collected genotypes among based on the growth, yield and quality.

Materials and Methods

The present investigation on Evaluation of the collected black turmeric genotypes for identifying the best genotype based on growth, yield and quality was carried out during December 2020 to April 2022 in a farmer's field at Vadapalani village of Erode district. Totally seed rhizomes of twenty genotypes were collected from different parts of the country (Table 1) and used for the study. The package of practices was followed based on the recommendations made for *Curcuma longa*. The collected seed rhizomes were graded to 20 – 25 grams of weight and treated with 30 ppm Benzyl Adenine for 24 hours. The field was ploughed to a fine tilth and seed rhizomes of each genotype were planted with a spacing of 45 x 30 cm in a plot size of 4m. The experiment was laid out as per Randomized Block Design (RBD) with three replications. Performance of the genotypes were evaluated with several growth, yield and quality parameters such as Number of days taken for sprouting, Plant height, Number of tillers plant^{-1}, Fresh rhizome yield plant $^{-1}$,Number of rhizomes plant^{-1}, Length of rhizomes, Number of primary and secondary fingers, days taken for maturity and curcumin content. Growth parameters were recorded at the time of harvest whereas the yield and quality parameters were recorded after harvesting. Data on various characters studied during the investigation were subjected to an analysis of various (F-test) as per the methods suggested by Gomez and Gomez (2010). Wherever statistical significance was observed, critical difference (CD) at 0.05 level of probability was worked out for comparison.

Results and Discussion

Significant variations for the growth, yield and quality traits were observed among the collected black turmeric genotypes (Table 2.). The genotype which shows better performance for growth parameters such as Plant height (139.20 cm), No. of leaves plant^{-1} (11.7), Number of tillers plant^{-1}(1.45), Chlorophyll content (33.86 SPAD units), Days taken for maturity (267 days) was the genotype BTG 12 collected from Mekkarai, Tenkasi of Tamilnadu. It was followed by BTG 6 with an average Plant height (131.80 cm), No. of leaves plant^{-1} (10.7), Number of tillers plant^{-1}(1.425), Chlorophyll content (32.13 SPAD units), Days taken for maturity (272 days) and the least performance on growth parameters was observed from the genotype BTG 13 with a Plant height of 102.75 cm, No. of leaves plant^{-1} (4.2), Number of tillers plant^{-1}(0.69), Chlorophyll content (20.00 SPAD units). The variations for plant height among the genotypes varied in the range of 102.75 cm to 139.20 cm. The variation in the growth parameters is of great importance in crop improvement as it is a prime morphological trait. When comparing the yield and quality attributes (Table 3.), among all collected black turmeric genotypes, genotype BTG 12 showed better results with maximum Fresh rhizome yield plant $^{-1}$(321 g), Estimated yield ha^{-1} (23.6 t ha^{-1}), Number of rhizomes plant^{-1} (15.90), Number of primary fingers plant^{-1}(5.95) , and Curcumin content (2.05 %) followed by BTG 6 which yields Fresh rhizome yield plant $^{-1}$(292.66 g), Estimated yield ha^{-1} (21.6 t ha^{-1}), Number of rhizomes plant^{-1} (14.70), Number of primary fingers plant^{-1}(4.5) and curcumin content of 1.73 % and the least values for the yield traits were observed from the genotype BTG 13 with Fresh rhizome yield plant $^{-1}$ of 279 g, Estimated yield of 13.32 t ha^{-1}, Number of rhizomes plant^{-1} (9), Number of primary fingers plant^{-1} (3) and 0.39 % curcumin.

The better performance of BTG 12 may be due the nativity of the genotype and the almost similar climatic and environmental conditions. This may enhance the growth and the increased plant height, more number of leaves and tillers enhances the yield parameters of the turmeric genotype (Vinodhini *et al*., 2018). Ravindran *et al*., 2007, also stated that plant height is an important influential trait in determining the final yield of the crop. The performance on growth and yield parameters makes the crop suitable to be standardized for the cultivation in an area and the crop can be used for further breeding approaches as it shows better quality traits also (Rajyalakshmi *et al*., 2013). Hence from the study, it is concluded significant variations exists among the twenty black turmeric genotypes collected and the

genotype BTG 12 was identified as the promising genotype based on the performance on growth, yield and quality traits.

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Table. 1. List of black turmeric genotypes

S. No.	Genotype Coded	Place of collection	State
1	BTG1	Trivandrum	Kerala
2	BTG2	Vellanikara	Kerala
3	BTG3	Chamundi hills	Karnataka
4	BTG4	Pathinamthitta	Kerala
5	BTG5	Ranchi	Jharkhand
6	BTG6	Ariyankavu	Kerala
7	BTG7	Tinsukia	Assam
8	BTG8	Kothamangalam	Kerala
9	BTG9	Bijuli	Assam
10	BTG10	Agasthiyarkoodam	Kerala
11	BTG11	Satara	Maharastra
12	BTG12	Mekkarai, Tenkasi	Tamilnadu
13	BTG13	Panjagutta, Hyderabad	Telengana
14	BTG14	Tiruppati	Andhra pradesh
15	BTG15	Thrissur	Kerala
16	BTG16	Panpozhi, Shencottai	Tamilnadu
17	BTG17	Haddi	Andaman
18	BTG18	Pune	Maharsatra
19	BTG19	Yelandur	Karnataka
20	BTG20	Thengana	Kerala

Table. 2. Performance of black turmeric genotypes for growth parameters

Genotypes	Plant height (cm)	No. of leaves plant^{-1}	No. of tillers plant^{-1} (Nos.)	Total Chlorophyll content (SPAD units)	Days taken to maturity
BTG1	120.96	7.0	0.89	27.33	276
BTG2	113.33	6.5	0.83	25.20	274
BTG3	110.66	6.43	0.81	25.66	276
BTG4	123.35	6.67	1.04	27.20	276
BTG5	120.00	6.9	0.89	24.33	274
BTG6	131.80	10.7	1.25	32.13	272
BTG7	109.98	7.4	0.86	24.67	279
BTG8	112.00	6.9	0.82	25.68	279
BTG9	113.30	6.3	0.89	23.33	274
BTG10	113.33	6.1	0.87	26.00	277
BTG11	129.01	8.9	1.17	29.67	270
BTG12	139.20	11.7	1.45	33.86	267
BTG13	102.75	4.2	0.69	20.00	279
BTG14	106.90	5.9	0.65	25.00	276
BTG15	129.26	9.7	1.80	30.33	273
BTG16	120.33	6.3	0.90	24.68	276
BTG17	122.34	6.7	0.99	24.79	276
BTG18	118.13	6.3	0.79	25.33	276
BTG19	129.69	8.0	1.04	28.77	276
BTG20	125.00	6.4	0.66	25.67	276
S. Ed.	0.60	0.40	0.16	1.08	-
CD (0.05)	1.18	0.79	0.30	2.27	-

Table 3. Performance of black turmeric genotypes for yield and quality parameters

Genotypes	No. of rhizomes plant^{-1}	No. of primary fingers plant $^{-1}$	Fresh rhizome yield plant^{-1} (g plant^{-1})	Estimated Yield ha^{-1} (t ha$^{-1)}$	Curcumin content (%)
BTG1	11.33	3.08	254.33	18.76	2.05
BTG2	10.30	3.86	230.61	17.02	0.57
BTG3	9	3.94	216.00	15.91	0.43
BTG4	12.17	3.96	275.34	20.42	0.7
BTG5	10.83	3.60	239.66	17.77	0.48
BTG6	14.70	4.50	292.66	21.60	1.73
BTG7	8.66	3.04	201.76	14.94	0.6
BTG8	9	3.08	225.33	16.66	0.58
BTG9	9.60	3.36	219.41	16.2	0.56
BTG10	10	3.61	209.00	15.54	1.13
BTG11	12.80	4.07	292.62	21.45	1.33
BTG12	15.90	5.95	321	23.60	2.05
BTG13	9	3.00	180.56	13.32	0.39

BTG14	8.96	3.13	196.54	14.51	0.41
BTG15	14.90	4.87	301.33	22.2	1.4
BTG16	11.23	3.11	246	18.05	0.54
BTG17	11.13	3.14	263	19.46	0.6
BTG18	10.06	3.07	237.34	17.46	0.40
BTG19	12.53	3.57	283.66	20.94	0.93
BTG20	11.66	3.65	269.87	19.99	0.46
S. Ed.	0.48	0.15	1.50	-	0.12
CD (0.05)	0.85	0.33	2.82	-	0.20