



## **Evaluation of Different Germplasms of Turmeric (*Curcuma longa* L.) for Growth, Yield and Quality Attributes in New Alluvial Zone of West Bengal**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author SD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author FHR managed the analyses of the study and edited the manuscript. Authors SM and KN managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

A field experiment on Turmeric (*Curcuma longa* L.) was conducted to study and evaluate different germplasms for growth, yield and quality characters under New Alluvial Zone of West Bengal at Instructional Farm, Jaguli, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during 2013-14 and 2014-15. The design adopted was Randomised Block Design (RBD) having three replications with seven germplasms namely Rajendra Sonia, Alleppy Supreme, Roma, Pratibha, Kedaram, Rashmi and Midnapur local as check. Among seven germplasms evaluated, the genotype Pratibha was found superior in terms of maximum plant height (100.93 cm), highest number of primary fingers (24.0), highest value for the trait weight of primary fingers (204.10 g) as well as secondary fingers (60.23 g), maximum yield/ plant (369.9 g) and maximum yield (25 ton/ha). Minimum plant height (82.60 cm) and lowest number of primary fingers (9.3) were recorded in case of Midnapur local. Maximum leaf length was recorded in Roma (52.29 cm). In respect of

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number of mother rhizome/plant, Rajendra Sonia recorded the highest quantity (1.98 nos.) whereas Kedaram recorded the lowest (1.42 nos.). Kedaram also produced minimum trait weight of secondary fingers (33.89 g). In qualitative character, the curcumin percentage was recorded highest with germplasm Alleppy Supreme (5.2%) followed by Rajendra Sonia (4.1%) and it was minimum in Kedaram (3.4%). The germplasms Pratibha and Alleppy supreme recorded with highest oleoresin (11.9%) and essential oil (7.0%) content, respectively.

**Keywords:** Curcumin; essential oil; germplasms; oleoresin; turmeric; yield.

## 1. INTRODUCTION

Turmeric (*Curcuma longa* L.) is a tropical perennial herb belonging to the family *Zingiberaceae* [1]. It is one of the important spice and medicinal crop that plays a vital role in Indian economy. Turmeric powder obtained from *C. longa* rhizomes, which, after drying and processing, result in a bright yellow powder valued as a natural food dye is usually used as a spice, cosmetic, coloring agent, flavourant and preservative, and also ascribed universally to its aromatic, stimulative and carminative properties. Commercially, it is traded as a spice, dye, oleoresin and source of industrial starch [2]. Turmeric powder prepared from the dried rhizomes of *Curcuma longa* has also been widely used as spice, cosmetic, medicine [3] in Asian countries particularly in India, Bangladesh, Myanmar, Pakistan, Sri Lanka and Thailand [4]. The importance of turmeric in medicine took a new twist when it was discovered that the dried rhizome of *Curcuma longa* is very rich in phenolic compounds whose structures have been identified as curcuminoids (curcumin, demethoxycurcumin and bis demethoxycurcumin) that have anti-oxidant properties [5]. Curcumin, the main active ingredient of turmeric, functions as a medicine with anti-inflammatory, anti mutagenic, anti-carcinogenic, anti-tumor, anti-bacterial, anti-oxidant, anti fungal, anti-parasitic and detoxifying properties [6]. Turmeric is very important spice in India, which produces nearly entire whole world's crop and consumes 80% of it. India is by far the largest producer and exporter of turmeric in the world. Turmeric occupies about 6% of the total area under spices and condiments in India. In India it is being cultivated in more than 20 states in an area of 2.37 lakh ha with an annual production of 11.63 MT and earning 1241.89 crores by exporting 1.16 MT to other countries. In India, it is mainly grown in Telangana, Andhra Pradesh, Odisha, West Bengal, Tamil Nadu, Assam, Maharashtra, Karnataka, Bihar and Kerala. Among these, Telangana occupies 50,000 ha of total area and 2.55 MT of total

production of the country. The national productivity of crop is 5 t /ha [7].

Some efforts have been reported to identify the genetic potential of turmeric germplasm from India; however, very few investigations have been reported about the characterization and evaluation of turmeric from north-eastern India [8,9]. Though wide genetic variability exists in this crop, very less work has been done on crop improvement through the selection of superior genotypes with high yield in this eastern part of India where inferior local clones are under cultivation resulting in low profitability thus making its cultivation less remunerative. Keeping in view of this problem, an investigation was carried out to identify suitable germplasm in the Gangetic alluvial plains of West Bengal.

## 2. MATERIALS AND METHODS

Field experiments were conducted for two consecutive years during 2013-14 and 2014-15 at Instructional Farm, Jaguli, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, under the Gangetic Alluvial Plains of West Bengal, situated at 22.93°N latitude and 88.53°E longitudes with an elevation of 9.75 above MSL.

The experiment was undertaken as Randomized Block Design (RBD) with seven genotypes, viz., Rajendra Sonia, Alleppy Supreme, Roma, Pratibha, Kedaram, Rashmi and Midnapur local and replicated thrice. The genotypes were compared with the pre-existing cultivar 'Midnapur local' which has been included as a local check. Mother rhizomes were used as the planting material for the above-said purpose and planting was done in raised beds of 3 sq. m plot size with a spacing of 30 cm x 25 cm. during the second fortnight of May with proper irrigation facilities in both the years, observations on different growth, yield and yield attributed qualitative parameters were recorded and subjected to statistical analysis as per the standard procedures outlined by Gomez and Gomez [10].

**Table 1. Growth and yield parameters of different germplasms of turmeric in Gangetic alluvial plains of West Bengal**

<b>Varieties</b>	<b>Plant height (cm)</b>	<b>Leaf length (cm)</b>	<b>Leaf breath (cm)</b>	<b>Yield/ plant (g)</b>	<b>No. of mother rhizome/plant</b>	<b>No of primary fingers</b>	<b>Weight of primary fingers (g)</b>	<b>Weight of secondary fingers (g)</b>	<b>Projected yield (t/ha)</b>
Rajendra Sonia	89.50	43.90	15.96	351.9	1.98	21.3	202.9	55.63	24.6
Rashmi	86.53	43.82	11.22	223.4	1.58	18.7	126.4	45.52	15.6
Alleppy Supreme	88.05	43.31	10.89	208.9	1.52	17.3	109.7	36.87	14.6
Pratibha	100.93	50.23	12.09	369.9	1.60	24.0	204.1	60.23	25.9
Roma	97.52	52.29	12.65	336.4	1.56	20.0	200.1	46.74	23.6
Kedaram	85.24	41.67	10.80	203.1	1.42	15.7	108.0	33.89	14.2
Midnapur local (Local check)	82.60	40.47	10.76	197.1	1.53	9.30	72.2	35.57	13.8
CD (P=0.05)	14.17	8.34	NS	52.4	0.32	NS	39.4	15.31	3.4

The important attributes like plant height, leaf length and breadth, number of mother rhizome per plant, weight of primary and secondary fingers etc. were recorded on ten randomly selected plants from each plot. Projected yield was estimated and expressed as ton /ha. Per cent dry recovery was evaluated by boiling and drying a sample of 2 kg of fresh rhizomes from each plot. Regarding different qualitative parameters; curcumin, oleoresin and essential oil percentage were taken into consideration. Similar overall characterization was done by Hikmat et al. [11].

### 3. RESULTS AND DISCUSSION

Significant differences among cultivars were observed for most of the characters studied during both the years. Analysis of pooled data of two years (2013-14 and 2014-15) for the different growth and yield parameters are presented in Table 1.

Analysis of data showed that Pratibha recorded tallest plant (100.93 cm) which have been earlier reported by Padmadevi et al. [12], Ravindrakumar et al. [13]. Narayanpur and Hanamashetti [14] found that plant height determines the yield potential of the turmeric genotype. So the plant height is a very important morphological character which determines the rhizome yield. Roma showed the highest mean value for leaf length (52.29 cm) while Midnapur local recorded the lowest (40.47 cm) which resembles the findings of Yadav et al. [15]. Leaf breadth (cm) was highest with Rajendra sonia (15.96 cm) and lowest with the genotype Midnapur local (10.76 cm). Similar results were found by Deshmukh et al. [16], Vamshi Krishna et al. [17]. Among different genotypes, Pratibha was found superior in terms of highest number of primary fingers (24.0) followed by Rajendra Sonia (21.3) and acknowledged with earlier

studies of Veena [18], Siddalingayya et al. [19] and Mohan et al. [20]. In respect of the weight of primary fingers (g) and weight of secondary fingers (g), Pratibha recorded the highest value 204.1 g and 60.23 g respectively. In respect of projected yield (t/ha), Pratibha showed the highest and Midnapur local lowest value (25.9 t/ha and 13.8 t/ha, respectively). In respect of yield/ plant (g), Pratibha recorded the highest (369.9 g) while Midnapur local showed the lowest (197.1 g). The projected yield/ha of genotype Pratibha (25.9 t/ha) was closely followed by Rajendra Sonia (24.6 t/ha). These findings are in accordance with those reported by Jana and Bhattacharya [21], Hriddek et al. [22] and Muhummad et al. [23].

The genotype Midnapur local which was taken as local check showed the lowest yield/ plant (197.1 g), lowest number of primary fingers (24.0), lowest value for primary trait weight (72.2 g) as well as lowest projected yield (13.8 t/ha). On the other hand in respect of number of mother rhizome/plant, Rajendra Sonia recorded the highest (1.98) and Kedaram recorded the lowest (1.42) which are similar to the findings of Chezhiyan and Shanmugasundaram [24]. In quality analysis data (Table 2), it was found that dry recovery percentage ranged from 23.1% to 26.6% and Rajendra sonia recorded highest value (26.6%), whereas, Midnapur local recorded lowest value (23.1%).

In the present study, the highest curcumin content (5.2%) was recorded with Alleppy Supreme followed by Rajendra Sonia (4.1%). A similar findings was also reported by Das et al. [25]. The genotype Alleppy Supreme was also recorded highest essential oil content of 7.0%. Regarding oleoresin content, highest quantity was observed with the genotype Pratibha (11.9%) followed by Rajendra Sonia (11.29%).

**Table 2. Qualitative parameters of different germplasms of turmeric in Gangetic Alluvial Plains of West Bengal**

Varieties	Dry recovery (%)	Curcumin (%)	Oleoresin (%)	Essential oil content (%)
Rajendra sonia	26.6	4.1	11.29	6.90
Rashmi	25.4	4.0	9.90	7.00
Alleppy Supreme	24.7	5.2	9.80	7.00
Pratibha	26.3	3.8	11.90	6.70
Roma	26.0	4.0	10.35	6.50
Kedaram	23.5	3.4	9.08	6.50
Midnapur local (Local check)	23.1	3.6	9.35	5.5
CD (P=0.05)	NS	1.3	NS	NS

#### 4. CONCLUSION

Based on the results obtained from the present investigation, it is recorded that Pratibha produced the highest yield followed by Rajendra Sonia and Roma. Investigation revealed that germplasm Pratibha, Rajendra Sonia, Roma can be made popular for cultivation in the Gangetic plains of West Bengal due to their better growth, highest yield and for appreciable curcumin content instead of less productive local cultivars like Midnapore local. So it can be concluded that Pratibha is most suitable and promising variety which can be recommended in these areas to enhance the production, productivity and higher return of the farmers.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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