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## Evaluation of genetic parameters of different varieties of Turmeric (*Curcuma longa* L.) under Ranchi condition

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#### Abstract

The present experimental work entitled “Evaluation of genetic parameters of different varieties of Turmeric (*Curcuma longa* L.) under Ranchi condition.” was carried out in the research field, Department of Horticulture, Birsra Agricultural University, Kanke, Ranchi (Jharkhand) during Kharif season, 2017, to evaluate 10 genotypes of turmeric including check Rajendra Sonia for different traits. The observations were recorded on number of tillers and leaves per plant and height, length, girth and weight of mother rhizome, primary and secondary rhizomes, number of primary and secondary rhizomes per plant, yield per plot, yield per ha. Analysis of variance showed significant differences among the genotypes for all the traits studied. Three genotypes Pratibha (23.88 t/ha), BSR-I (21.03 t/ha) and Punjab Haldi (17.96 t/ha) Excelled over the check, Rajendra Sonia (12.81 t/ha) for most of the characters including rhizome yield per hectare. The correlation coefficients among the different characters at phenotypic and genotypic levels revealed that yield per plot was having significantly positive association with number of tillers per plant, number of leaves per plant, leaf length, leaf width, plant height, length of mother rhizome, girth and weight of mother rhizome. High heritability coupled with high genetic gain were estimated for weight of secondary and mother rhizomes and yield per plot.

**Keywords:** Turmeric, varieties, primary rhizome, secondary rhizome, mother rhizome, productivity, phenotypic, genotypic, heritability, genetic gain

#### Introduction

Turmeric (*Curcuma longa* L.) is a native of Tropical south Asia and its cultivation is mostly confined to South East Asian countries such as India, Sri Lanka, China, Indonesia, Australia, Africa, Peru and West Indies. It is one of the most important spice and medicinal crop that play a vital role in Indian economy. In India turmeric is cultivated in area of 1.93 lakh ha with 10.51 lakh ton production in 2016-17 and it accounts for 78% of total world production and has 60% share in world export share. (Statistics of spices, Spice board India, Ministry of Commerce & Industry, Govt. of India). The main growing states in India are Telangana, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Orissa, and Kerala. Telangana ranks 1<sup>st</sup> in production (255000 tonnes) as well as in area (50000 ha). In Jharkhand, turmeric has not attained significant status among spice crops probably due to poor yield and also for being a long duration crop. However, some growers especially in Ranchi, Hazaribagh and Ramgarh have started showing interest in the crop and the area under it is steadily increasing as it can be successfully planted under rainfed conditions under minimal care and attention. Turmeric is mainly propagated through rhizomes and hybridization is very rare, occurs in areas where flowering occurs. The scope of improvement of germplasm depends upon the magnitude of genetic variability present in the available germplasm. So, in order to bring out the desired improvement, there is a great need of proper screening of turmeric germplasm for the best genotypes with higher yield and improved quality parameter for the selection purpose. Therefore, keeping in view of the aforesaid considerations, the present investigation entitled “Genetic parameter studies & performance of different varieties of Turmeric (*Curcuma longa* L.) Under Ranchi condition” with regards to vegetative growth parameters, yield and yield

attributing parameters in different turmeric cultivars has been carried out.

### Materials and Methods

The present investigation was carried out in the Experimental farm of Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi. The trials were laid out in randomized block design (RBD) with three replications using ten varieties of turmeric namely Megha Haldi, BSR-I, Punjab Haldi, Ranga, BSR-II, Prabha, Sobha, Pratibha, Rajendra Sonia and Narendra Haldi. The plot size was 3 m x 2 m (100 plants/plot) and rhizomes were planted during third week of June on ridge and furrow method with a spacing of 30 cm x 20 cm. The observations on vegetative growth, yield and yield attributes were recorded. Agronomic practices *viz.*, irrigation, fertilizer application, manuring were done according to the recommendation of Department of Horticulture, Birsa Agricultural University for turmeric production. The crop was harvested on the basis of maturity indices like leaf drying and falling of plants from January to March. Vegetative growth parameters like number of tillers, plant height, number of leaves, yield parameters like number of primary and secondary rhizomes, weight of primary and secondary rhizome, length, girth and weight of mother rhizome, were recorded from five randomly selected and tagged plants in each replication. The statistical analysis was carried out for each observed character under the study using MS-Excel and Indostat software packages.

### Results and Discussion

#### Vegetative growth

Significant differences were noticed among the varieties with respect to plant height, number of tillers and number of leaves at different stages of crop growth (Table 1). Maximum number of leaves per plant was observed in Pratibha (8.83) and). Ranga recorded minimum number of leaves (6.27). Maximum number of tillers (3.5) was found in genotype Pratibha. Minimum number of tillers was observed in Megha Haldi (2.12). BSR-I had maximum plant height i.e. 51.30cm followed by Pratibha (49.13). Minimum plant height was observed in Sobha (32.27 cm). The present study is in line

with those reported by Mukhopadhyay *et al.* (1986)<sup>[7]</sup>, Singh *et al.* (2000)<sup>[13]</sup>, Singh *et al.* (2003)<sup>[12]</sup>, Chattopadhyay *et al.* (2004)<sup>[2]</sup>, Chaturvedi *et al.* (2009)<sup>[3]</sup> and Jan *et al.* (2012)<sup>[5]</sup>.

**Table 1:** Mean performance of vegetative parameters

Varieties	Number of leaves per plant	Number of tillers per plant	Plant height(cm)
Megha haldi	6.33	2.12	34.20
BSR-1	7.27	3.13	51.30
Punjab Haldi	6.73	3.30	44.90
Ranga	6.27	2.63	38.13
BSR-2	6.97	2.87	45.67
Prabha	7.10	2.60	42.53
Sobha	6.83	2.23	32.27
Pratibha	8.83	3.50	49.13
Narendra Haldi	6.37	2.67	35.67
Rajendra Sonia(Check)	7.63	3.03	46.10
S.E (m)	0.41	0.26	3.33
CD (0.05)	1.22	0.77	9.91
CV (%)	10.09	16.03	13.75

**Table 2:** Mean performances of primary and secondary rhizomes

Varieties	Number of pri. rhizome	Weight (g) of pri. rhizome	Number of sec. rhizome	Weight (g) of sec. rhizome
Megha haldi	4.73	53.49	5.67	4.95
BSR-1	6.4	82.72	9.73	38.5
Punjab Haldi	6.3	57.62	6.03	10.19
Ranga	4.63	33.97	5.6	10.2
BSR-2	5	52.85	11.63	26.05
Prabha	4.47	51.85	8.2	25.41
Sobha	4	39.36	4.83	5.53
Pratibha	4.43	46.78	6.13	10.27
Narendra Haldi	3.6	36.05	6.47	25.17
Rajendra Sonia (Check)	4.27	30.3	4.3	6.16
S.E(m)±	0.40	5.16	0.50	1.77
CD(0.05)	1.19	15.34	1.47	5.25
CV(%)	14.45	18.44	12.52	18.84

**Table 3:** Mean performance of Mother rhizome and yield

Varieties	Length of mother rhizome(cm)	Girth of mother rhizome (cm)	Weight of mother rhizome (g)	Estimated Fresh rhizome yield per plot (kg)	Estimated rhizome yield per ha (t)
Megha haldi	6.53	12.47	35.02	6.56	10.88
BSR-1	7.90	13.27	54.78	12.67	21.03
Punjab Haldi	7.43	12.60	39.50	10.82	17.96
Ranga	6.76	12.53	31.73	6.47	10.74
BSR-2	6.00	11.8	25.77	7.41	12.30
Prabha	7.16	12.60	30.24	6.54	10.84
Sobha	6.13	12.00	25.86	6.20	10.29
Pratibha	10.54	14.10	68.85	14.39	23.88
Narendra Haldi	6.91	9.80	19.38	4.58	7.60
Rajendra Sonia (Check)	6.46	11.73	31.08	7.72	12.81
S.E(m)±	0.46	0.80	3.88	0.58	0.96
CD(0.05)	1.38	2.38	11.52	1.72	2.85
CV(%)	11.26	11.29	18.54	12.02	12.02

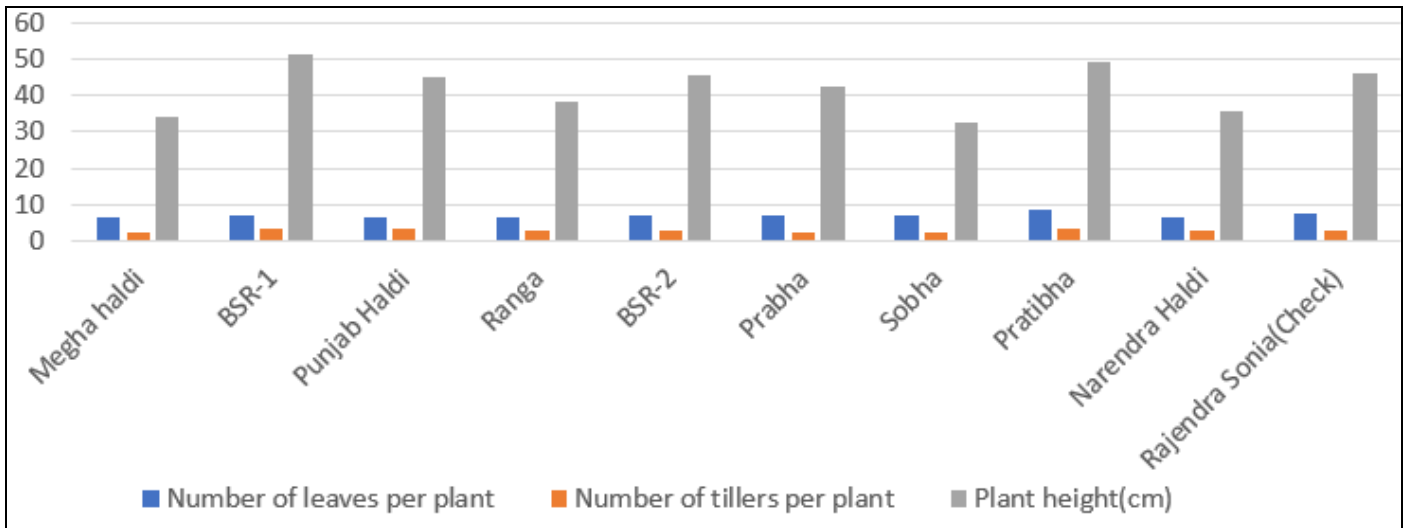


Fig 1: Graphical representation of mean performance of vegetative parameters.

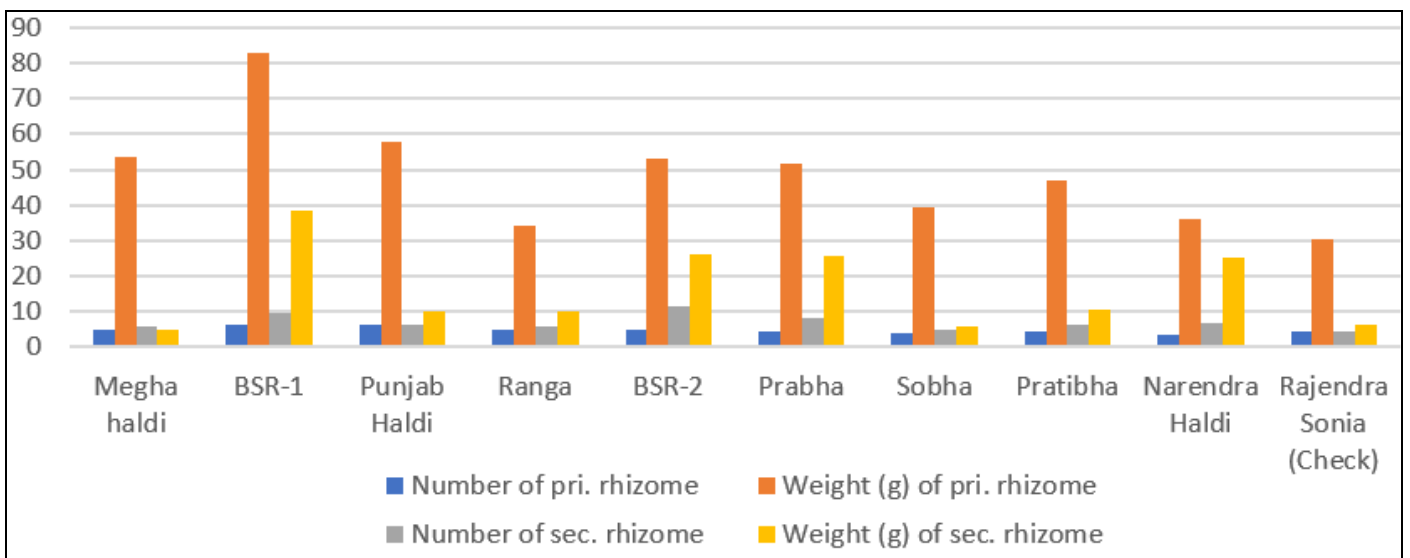


Fig 2: Graphical representation of mean performance of primary and secondary rhizomes.

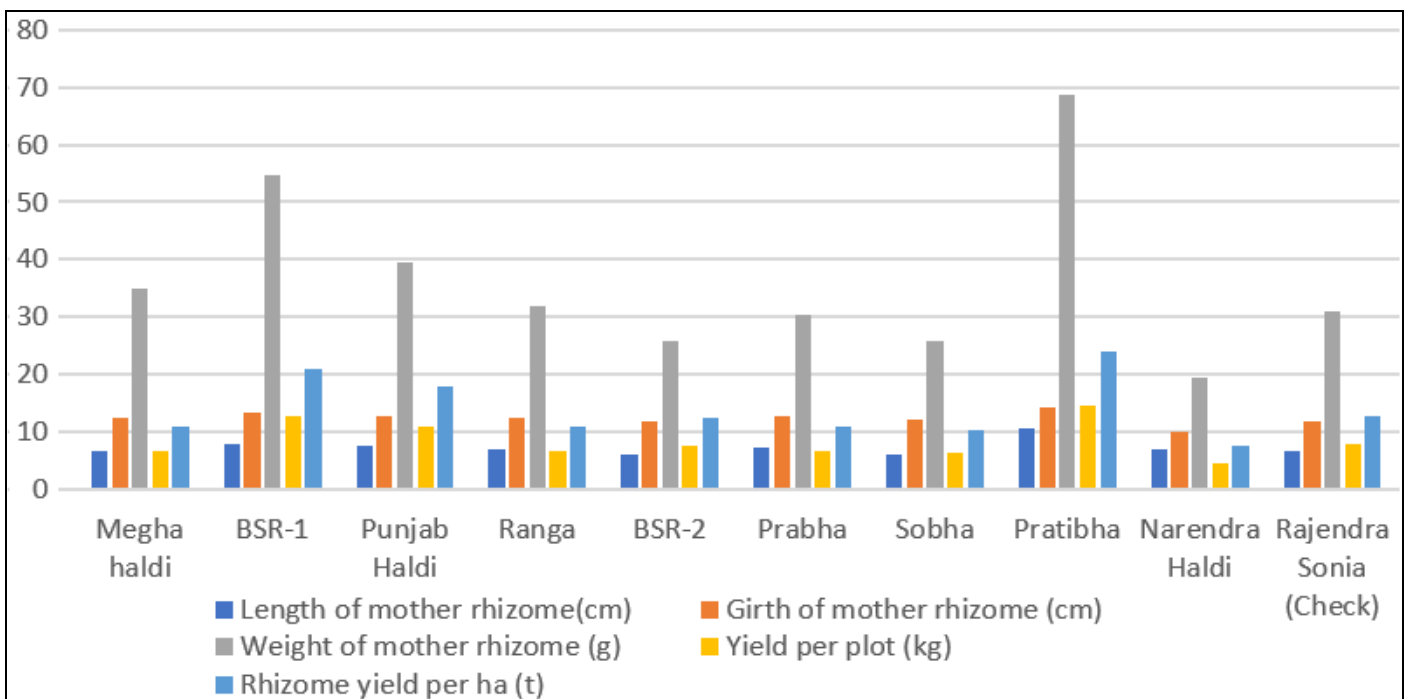


Fig 3: Graphical representation of mean performances of mother rhizome and yield.

**Table 4:** Estimates of phenotypic and genotypic coefficients of variability, heritability, genetic advance and genetic gain for different traits in Turmeric

Characters	Range	Mean ±SE(m)	Coefficients of variability (%)		Heritability (%)	Genetic Advance	Genetic gain (%)
			Phenotypic	Genotypic			
Number of tillers per plant	2.12-3.50	2.80 ±0.26	15.82	12.83	65.79	0.60	21.44
Number of leaves per plant	6.26-7.63	7.03 ±0.40	10.92	9.24	71.57	1.13	16.10
Plant height (cm)	32.26 -51.30	41.99± 3.33	15.61	13.44	74.15	10.01	23.85
Length of mother rhizome (cm)	6.00- 10.54	7.18± 0.46	18.30	17.10	87.37	2.36	32.94
Girth of mother rhizome (cm)	9.80-14.10	12.29± 0.80	9.13	6.40	49.10	1.13	9.24
Weight of mother rhizome (g)	19.38-68.85	36.22± 3.87	41.18	39.77	93.24	28.66	79.11
Number of primary rhizomes per plant	3.60-6.40	4.78 ± 0.39	19.07	17.14	80.86	1.51	31.76
Weight of primary rhizome (g)	30.30-82.72	48.49± 5.16	31.44	29.58	88.54	27.81	57.35
Number of secondary rhizomes per plant	4.30-11.63	6.86± 0.49	33.62	32.83	95.37	4.53	66.05
Weight of secondary rhizome (g)	4.95-38.5	16.24 ± 1.76	71.32	70.48	97.67	23.30	143.50
Yield per plot (kg)	4.58 – 14.39	8.33 ± 0.57	38.22	37.58	96.70	6.34	76.13

### Yield parameters of turmeric

Maximum length of mother rhizome was recorded in Pratibha (10.54cm). Minimum was recorded in genotype BSR –II (6.00). Maximum girth of mother rhizome was recorded in Pratibha (14.10cm). Minimum girth was recorded in Narendra Haldi (9.8). Maximum weight of mother rhizome was recorded in Pratibha (68.85g). Minimum weight was recorded in Narendra Haldi (19.38g).

Maximum number of primary fingers is observed in BSR-I (6.4). Minimum number of primary fingers is recorded in Narendra Haldi (3.6). Maximum weight of Primary rhizome is recorded in BSR-I (82.72g) and minimum was recorded in the Rajendra Sonia (30.30g).

Maximum number of secondary fingers was recorded in genotype BSR-II (11.63) and minimum number is recorded in Rajendra Sonia (4.30). Maximum weight of secondary fingers was recorded in genotype BSR-I (38.5g) and minimum weight was recorded in Sobha (5.53g).

Maximum yield per plot was recorded in Pratibha (14.39kg). BSR-1 (12.66kg) was at par with it and followed by Punjab Haldi (10.82kg). Minimum yield per plot was recorded in Narendra Haldi (4.58 kg).

Maximum yield per hectare was recorded in Pratibha (23.88 t). BSR-I (21.03 t) was at par with it and followed by Punjab Haldi (17.96 t). Minimum yield per hectare was recorded in Narendra Haldi (7.60 t). The present study of yield attributes is in agreement with earlier reports by Muthuswamy and Shah (1982)<sup>[8]</sup>, Philip and Nair (1983)<sup>[10]</sup>.

The phenotypic coefficients of variation (PCV) was recorded high (>30%) for weight of secondary rhizome (71.32%), weight of mother rhizome (41.18%), Yield per plot (38.22%), number of secondary rhizome (33.62%) and weight of Primary rhizome (31.44%). Whereas, moderate (15-30%) phenotypic coefficients of variation (PCV) were recorded for Number of primary rhizomes per plant (19.07%), Length of mother rhizome (18.30%), Plant girth (17.93%), Number of tillers per plant (15.82%), Plant height (15.61%) and number of leaves per plant (10.92%). Phenotypic coefficients of variation (PCV) were low (<15%) for Dry matter recovery (12.94%), Girth of mother rhizome (9.13%), leaf length (8.18%), emergence (7.63%) and leaf width (5.05%).

The genotypic coefficients of variation (GCV) were high (>30%) for Weight of secondary rhizome (70.48%), Weight of mother rhizome (39.77%), Yield per plot (37.58%) and Number of secondary rhizomes per plant (32.83%). Moderate (15-30%) genotypic coefficients of variation (GCV) were recorded for Weight of primary rhizome (29.58%), Number of primary rhizomes per plant (17.14%) Length of mother rhizome (17.10%) and Plant girth (16.58%). Genotypic

coefficients of variation (GCV) were low (<15%) for Emergence percent (2.43%), Leaf width (4.62%), Leaf length (5.73%), Girth of mother rhizome (6.40%), Number of leaves per plant (9.24%) and Number of tillers per plant (12.83%). Similar results were reported by Babu *et al.* (1993)<sup>[1]</sup> and Singh *et al.* (2003)<sup>[12]</sup>. Also, Babu *et al.* (1993)<sup>[1]</sup> found high GCV for number and weight of secondary rhizomes per plant. The estimates of heritability (broad sense) varied from 10.16 – 97.67 % for different characters under study. It was found high (>80%) for the characters *viz.* Weight of secondary rhizome (97.67%), Yield per plot (96.70%), Number of secondary rhizomes per plant (95.37%), Weight of mother rhizome (93.24%), Weight of primary rhizome (88.54%), Length of mother rhizome (87.37%), Plant girth (85.48%) and Number of primary rhizomes per plant (80.86%). Indires *et al.* (1992)<sup>[4]</sup>, who reported high heritability for rhizome yield; Lynrah *et al.* (1998)<sup>[6]</sup>, who analysed that mother and finger rhizome yield components showed high broad-sense heritability, Chattopadhyay *et al.* (2004)<sup>[2]</sup> who also reported that weight of secondary rhizome have high heritability; Rao *et al.* (2004)<sup>[11]</sup> also revealed that weight of the mother rhizome and number of secondary rhizomes had moderate to high heritability.

Genetic Gain was found high (>50%) for the characters *viz.* weight of secondary rhizome (143.50%), weight of mother rhizome (79.11%), yield per plot (76.13%), number of secondary rhizomes per plant (66.05) and weight of primary rhizome (57.35%). These findings are in line with Babu *et al.* (1993)<sup>[1]</sup>, who reported high genetic gain for number and weight of secondary rhizomes and moderate genetic gain for plant girth and number of primary rhizomes; Singh *et al.* (2003)<sup>[12]</sup> also revealed high genetic gain for weight of mother and primary rhizomes and moderate genetic gain for length of mother rhizome and yield per hectare. Rao *et al.* (2004)<sup>[11]</sup> also revealed high genetic advance for weight of mother rhizome. Singh *et al.* (2012)<sup>[14]</sup> also reported high genetic advance for weight of mother and primary rhizomes and moderate for length and width of mother rhizome.

High heritability estimates coupled with high genetic gain were observed for weight of mother and primary rhizomes and girth of primary rhizome, which indicated that these characters are under additive gene effects and are more reliable for effective clonal selection (Panse, 1957)<sup>[9]</sup>. Singh *et al.* (2003)<sup>[12]</sup> and Singh *et al.* (2012)<sup>[14]</sup> have reported similar results for weight of mother and primary rhizomes.

### Conclusion

The present study revealed that Pratibha, BSR-I and Punjab haldi has more yield per plot than the check Rajendra Sonia.

In addition, these genotypes performed better for other horticultural traits viz. emergence, number of tillers per plant, plant girth, number of primary and secondary rhizomes per plant, length, girth, and weight of rhizome. Therefore, it can be suggested that, these genotypes can be utilized for the further commercial cultivation, but only after a few more years of evaluation.

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