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Performance of turmeric genotypes for growth, yield and foliar disease incidence under Terai region of West Bengal

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ABSTRACT

A field experiment was undertaken at ICAR-AICRP on Spices, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal for four consecutive years i.e., from 2016-17 to 2019-20 to study the performance of twelve turmeric genotypes namely LTS01, LTS02, RH80, RH9/90, IT10, IT23, IT36, NDH11, NDH128, TCP191, TCP2 (Local check) and Prathiba (National Check) for growth, yield, dry recovery and foliar disease incidence. The experiment was laid out in randomized block design with three replications. The pooled data of the experiment revealed that the highest yield (38.73 t/ha) was recorded by TCP191 followed by IT10 (24.65 t/ha) and the lowest yield was recorded by IT23 (16.96 t/ha). Among the different evaluated genotypes, the highest dry recovery (22.63%) was recorded in TCP191 followed by TCP2 (22.00%) and the lowest was recorded in RH 9/90 (20.23%). With respect to leaf spot and leaf blotch, the lowest disease incidence was recorded by TCP191 (3.15 PDI & 2.61 PDI, respectively) followed by LTS1 (8.36 PDI, & 9.46 PDI, respectively). Thus, considering the yield and reaction to disease incidence of turmeric genotypes, TCP191 may be recommended for cultivation in the Terai zone of West Bengal, India.

***Keywords*:** Dry recovery, leaf blotch, leaf spot, turmeric, yield

INTRODUCTION

Turmeric (*Curcuma longa*) is considered as one of the most useful and sacred medicinal spice crops of India since time immemorial. It holds a significant part in the history of India and its people and is relegated as "Indian saffron" (Pickersgill, 2005) considering its orange yellow colour dried rhizomes. It possesses several medicinal and antioxidant properties beneficial for humankind and holds a great importance in various religious and cultural ceremonies of the nation. India is the largest producer and exporter of turmeric which is contributing about 80% of total production and 45% of export (Nybe *et al.,* 2007). In India, it is mainly grown in Andhra Pradesh, Odisha, Tamil Nadu, Kerala and West Bengal. In pharmaceutical industries, it is valued for the anti-cancerous, anti-inflamatory and antiseptic properties for producing mono-terpenes and sesquiterpenes in dry and fresh rhizomes (Priyanka *et al.,* 2015). The production of turmeric is influenced by various diseases like soft rot, leaf blotch and leaf spot etc. Among the serious problems, leaf blotch is caused by *Taphrinamaculans* (Sharma *et al.,* 1994) and leaf spot is caused by *Colletotrichum capsici* are very common in turmeric growing belts. Due to its social and economic importance the crop is always on a great demand throughout the year. A lots of trial on fertilizer, spacing, date of planting, size of planting material, mulching material and irrigation schedule etc. have been conducted to standardize suitable package of practices and to fulfill the demand but very little work has so far been undertaken to identify the promising genotypes along with low incidence of foliar diseases for *Terai* region of West Bengal. Keeping this in view, an experiment was undertaken at ICAR-AICRP on Spices, Uttar Banga KrishiViswavidyalaya, Pundibari, Cooch Behar, West Bengalfor four consecutive years *i.e.*, from 2016-17 to 2019-20 to study the performance of twelve turmeric genotypes for selection of suitable turmeric genotype with respect to growth, yield and

disease resistance to leaf blotch and leaf spot incidence for *Terai* zone of West Bengal.

MATERIALS AND METHODS

The field experiment was carried out at AICRP on Spices, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India (26º 40′ N and 89º 38′E and 43 meter above the MSL) for four consecutive year from 2016-17 to 2019-20 to study the performance of twelve turmeric genotypes. The soil of the experimental plots was medium to upland, coarse, sandy loam, medium in water holding capacity with low p^H and good organic matter content. Twelve turmeric genotypes were taken as treatments. Twelve turmeric genotypes namely LTS 01, LTS 02, RH 80, RH 9/90, IT 10, IT 23, IT 36, NDH 11, NDH 128, TCP 191, TCP 2 (Local check) and Prathibha (National check), were evaluated in each year. Source of the genotypes studied in the experiment has been given in the following Table:

Source of the genotypes studied in the Experiment

Sl. No.	Genotypes	Place of origin	State
1.	IT 10	Raigarh	Chhattisgarh
2.	IT 23	Raigarh	Chhattisgarh
3.	IT 36	Raigarh	Chhattisgarh
4.	RH 9/90	Dholi	Bihar
5.	RH 80	Dholi	Bihar
6.	TCP 191	Pundibari	West Bengal
7.	NDH 11	Kumarganj	Uttar Pradesh
8.	NDH 128	Kumarganj	Uttar Pradesh
9.	LTS 1	Guntur	Andhra Pradesh
10.	LTS 2	Guntur	Andhra Pradesh
11.	TCP-2 (LC)	Pundibari	West Bengal
12.	Prathiba (NC)	ICAR-IISR	Kerala

Every year, planting was done in the last week of April and harvested in the first week of the February. The experiment was laid out in Randomised Block Design with 3 replications. Planting was done in raised beds of 3 m × 1 m plot size with a spacing of 30 cm row to row and 20 cm plant to plant. Recommended package of practices was followed to raise a healthy crop. Data were collected from five randomly selected plants from each replication. The observations on plant height (cm), number of tillers per plant, number of leaves per plant, pseudo-stem girth (cm), leaf length (cm), leaf breadth (cm), fresh rhizomes yield per plot (kg), fresh rhizome yield per hectare (t/ha) and dry recovery (%), leaf blotch incidence (PDI) and leaf spot incidence (PDI) were recorded. The mean values of the data were subjected to statistical analysis as per the method suggested by Gomez and Gomez (1984). For calculation of PDI the following scales were adopted for disease severity.

Severity scale for calculating Per cent Disease Index PDI:

0 : No disease on leaf
1 : Spot covering <1% leaf area
3 : Spots 1-10% leaf area
5 : Spots 11-25% leaf area
7 : Spots 26-50% leaf area
9 : Spots >51% leaf area

$$\text{Disease severity or Infection index} = \frac{\text{Sum of all disease rating}}{\text{Total number of rating} \times \text{maximum disease grade}} \times 100$$

Note:

Scale for disease severity : 0 to 9 scale

If there are 5 samples : Rating of 5 samples are 5, 1, 0, 0 and 1 scale, respectively.

$$\text{Then, PDI} = \frac{(5 + 1 + 0 + 0 + 1)}{5 \times 9} \times 100$$

PDI = 15.56

Disease Scale :

0% PDI (No reaction) -Total Resistant to the disease

1-10% PDI- Highly resistant or tolerant to the disease

11-20% PDI - Moderately resistant or tolerant to the disease

21-30% PDI- Highly susceptible to the disease

31% PDI>- Extremely susceptible to the disease

RESULTS AND DISCUSSION

The analysis of variance showed significant variations among the genotypes for all growth (Table 1), yield (Table 2) as well as disease incidence (Table 3). The plant height ranged from 114.73 to 144.66 cm. Among the turmeric genotypes, TCP 191 recorded the highest plant height (144.66 cm) followed IT 10 (139.30cm) and Pratibha (129.46 cm), whereas IT 23 recorded the lowest plant height (114.73 cm). The variation in plant height is probably due to genetic variation among the genotypes. The highest number of tillers per clump was produced by RH 9/90 (3.08) which was statistically *at par* with RH 80 (2.97), NDH 128 (2.94), LTS 1 (2.79), TCP 191 (2.79) and IT 36 (2.77), while the lowest tillers per plant produced by IT 23 (2.45) and LTS 2 (2.45). A range of 0-7 number of tillers was reported by Vinodhini *et al*. (2019) which was in accordance with the present findings.

The number of leaves among the turmeric genotypes ranged from 7.58 to 8.42 (Table 1). The maximum number of leaves per clump (8.42) was registered in the genotype TCP 191 which was *at par* with RH 9/90 (8.33) and RH 80 (8.17). The pseudo-stem girth ranged between 6.55 cm to 7.56 cm among the genotypes (Table 1). On the pooled results, the highest pseudo-stem girth was valued in the genotype RH 9/90 (7.56 cm) which was statistically *at par* with RH 80 (7.48 cm), LTS 2 (7.45 cm), NDH 11 (7.49 cm), IT 10 (7.35 cm), LTS 1 (7.29 cm and TCP 2 (7.22 cm). It is clear from the results that pseudo-stem girth varied significantly among the genotypes and positively associated with the rhizome yield per plant. Mamatha (2016) also reported that pseudo-stem girth has high direct effect on rhizome yield which was in accordance with the present findings. Hence, greater pseudo-stem girth supports better source sink relationships which ultimately increases the yield.

Leaf length and leaf width displayed significant variation among the 12 turmeric genotypes evaluated. According to the pooled results, leaf length ranged from 49.46 cm to 62.51 cm while, leaf breadth ranged from 13.00 cm to 15.89 cm (Table 1). Maximum length of leaf (62.51 cm) was recorded in Prathiba and it was statistically *at par* with IT 10 (62.28 cm). The minimum leaf length was recorded in IT 23 (49.46 cm). The broadest leaf (15.89 cm) was observed in NDH 11 and it was statistically *at par* with Prathiba (15.67 cm) followed by IT 10 (14.89 cm), LTS 1 (14.73 cm) and TCP 191 (14.04 cm). The genotype RH 80 recorded narrowest (13.00 cm) leaves, while the genotypes Prathiba, NDH 11, IT 10, LTS 1 RS 1 and TCP 191 have bigger leaves, as compared to other genotypes.

There was a significant difference among 12 turmeric genotypes with respect to fresh rhizome yield for both plot and hectare yield (Table 2). The maximum fresh rhizome yield per plot was recorded in genotype TCP 191 (18.90 kg/3 m^2) followed by IT 10 (12.33 kg/3 m^2), TCP 2 (11.62 kg/3 m^2) and Pratibha (11.52 kg/3 m^2). Based on pooled result, it was evident that the highest yield per hectare was

also recorded by TCP191 (38.73 t/ha) followed by IT10 (24.65 t/ha) and the lowest yield was recorded by IT23 (16.96 t/ha) followed by NDH128 (17.82 t/ha) and RH-80 (17.88 t/ha). Singh *et al.* (2003) reported wide variability for rhizome yield while studying variability among 65 exotic and indigenous genotypes of turmeric. The genotype TCP 191 recorded about 62.39% and 66.72% higher fresh rhizome yield over TCP 2 (local check) and Prathiba (National check), respectively. Among the different turmeric genotypes, the dry recovery percentage ranged between 20.23 to 22.63% (Table 3). The highest dry recovery was recorded in TCP-191 (22.63%) and it was lowest in RH 9/90 (20.23%).

Based on the pooled results on per cent disease incidence (PDI) (Table 3), among the turmeric genotypes, TCP 191 (3.15 PDI), LTS 1 (8.36 PDI) and RH 80 (9.92 PDI) were highly resistant to leaf blotch. The performance of LTS 2 (10.41 PDI), NDH 128 (12.85 PDI), NDH 11 (14.24 PDI) and Prathiba (18.52 PDI) were moderately tolerant against leaf blotch. The results on per cent disease incidence (PDI) of genotypes IT 23 (35.06 PDI), IT 36 (35.44 PDI) and RH 9/90 (32.21 PDI) indicated that these genotypes were extremely susceptible to leaf blotch disease as compared to other genotypes. Sharma and Krishnamurthy (1962) screened 4 short duration genotypes and 7 long duration genotypes of *Curcuma longa* for varietal resistance of turmeric crop against leaf spot and leaf blotch diseases and found there was considerable variability in the genotypes in the degree of tolerance to both the leaf diseases. Generally, the long duration types of *Curcuma longa* were susceptible to leaf spot while Kesari types of *Curcuma longa* are resistance to leaf blotch. The evaluation of 19 different varieties of turmeric against shoot borer, leaf spot and leaf blotch infestation by Joseph and Nair (1981) confirmed that the varieties exhibited significant variability in their reaction to the pest and diseases. The varietal resistance of *Curcuma longa* to leaf spot was reported by many workers (Anonymous, 1986).

Table 1: Growth parameters of turmeric genotypes (Pooled data of 4 years)

Genotypes	Plant height (cm)	Number of tillers per plant	Number of leaves per plant	Pseudo-stem girth (cm)	Leaf length (cm)	Leaf breadth (cm)
IT 10	139.30	2.66	7.70	7.35	62.28	14.89
IT 23	114.73	2.45	7.97	7.21	49.46	13.54
IT 36	124.79	2.77	7.98	6.69	52.00	13.46
RH 9/90	121.37	3.08	8.33	7.56	50.08	13.59
RH 80	124.32	2.97	8.17	7.48	50.80	13.00
TCP 191	144.66	2.79	8.42	6.77	58.24	14.04
NDH 11	123.90	2.52	7.96	7.49	56.11	15.89
NDH 128	115.71	2.94	7.84	7.11	50.28	13.35
LTS 1	124.83	2.79	7.58	7.29	53.01	14.73
LTS 2	124.18	2.45	7.80	7.45	53.30	13.93
TCP-2 (LC)	125.27	2.51	7.84	7.22	51.28	13.88
Prathiba (NC)	129.46	2.53	7.97	6.55	62.51	15.67
S.Em (±)	**1.62**	**0.12**	**0.14**	**0.12**	**0.94**	**0.23**
CD at 5%	**4.54**	**0.36**	**0.39**	**0.34**	**2.65**	**0.63**

LC - Local Check, NC - National Check and NS – Non-significant

Table 2: Fresh rhizome yield per plot and hectare of turmeric genotypes

Genotypes	Yield per plot (kg/3 m^2)					Projected yield (t/ha)				
	2016-17	2017-18	2018-19	2019-20	Pooled	2016-17	2017-18	2018-19	2019-20	Pooled
IT 10	11.57	14.55	12.43	10.77	12.33	23.31	28.52	25.07	21.71	24.65
IT 23	9.93	5.78	8.58	8.83	8.28	20.02	12.72	17.31	17.80	16.96
IT 36	12.47	5.90	7.71	9.05	8.78	25.13	12.60	15.55	18.25	17.89
RH 9/90	11.47	7.07	7.54	10.35	9.11	23.11	15.26	15.20	20.86	18.61
RH 80	11.43	6.76	8.20	9.23	8.91	23.05	13.35	16.52	18.61	17.88
TCP 191	15.67	21.13	19.73	19.07	18.90	31.58	45.14	39.78	38.44	38.73
NDH 11	10.90	10.45	10.78	11.15	10.82	21.97	21.15	21.73	22.49	21.84
NDH 128	10.30	6.15	9.15	8.85	8.61	20.76	14.21	18.45	17.84	17.82
LTS 1	9.63	7.97	8.64	10.29	9.13	19.42	16.31	17.42	20.75	18.47
LTS 2	12.53	7.80	8.51	8.78	9.41	25.26	16.87	17.16	17.71	19.25
TCP 2 (LC)	9.37	11.88	12.01	13.24	11.62	18.88	25.64	24.21	26.69	23.85
Prathiba (NC)	11.00	11.50	12.46	11.13	11.52	22.18	23.18	25.12	22.43	23.23
S.Em (±)	0.69	1.11	0.52	0.46	0.39	1.33	1.70	1.04	0.93	0.65
CD at 5%	2.05	3.28	1.52	1.35	1.10	3.93	5.02	3.07	2.73	1.83

LC - Local Check, NC - National Check and NS – Non-significant

Table 3: Dry recovery, leaf blotch and leaf spot diseases of turmeric genotypes

Genotypes	Dry recovery (%)					Leaf blotch incidence (PDI)	Leaf spot incidence (PDI)
	2016-17	2017-18	2018-19	2019-20	Pooled	Pooled	Pooled
IT 10	21.33	21.00	20.50	20.32	20.79	25.76	12.25
IT 23	21.00	22.00	21.53	20.97	21.37	35.06	14.41
IT 36	21.67	21.33	20.92	21.14	21.26	35.44	17.29
RH 9/90	22.00	19.00	19.74	20.19	20.23	32.21	19.19
RH 80	21.33	21.00	20.85	20.97	21.04	9.92	13.59
TCP 191	22.00	23.33	22.69	22.50	22.63	3.15	2.61
NDH 11	22.33	21.00	21.57	21.24	21.54	14.24	12.79
NDH 128	19.67	21.67	21.29	20.96	20.90	12.85	10.07
LTS 1	22.00	21.33	20.94	21.12	21.35	8.36	9.46
LTS 2	20.33	22.00	22.25	21.80	21.60	10.41	15.18
TCP-2 (LC)	22.00	22.67	21.86	21.47	22.00	23.32	14.83
Prathiba (NC)	20.67	21.00	21.17	21.35	21.05	18.52	13.57
S.Em (±)	**0.95**	**0.66**	**0.31**	**0.17**	**0.33**	**1.48**	**0.89**
CD at 5%	**N.S.**	**1.96**	**0.90**	**0.49**	**0.86**	**4.16**	**2.49**

LC - Local Check, NC - National Check, PDI – Percent Disease Index

Table 4: Correlation coefficient analysis on growth, yield and disease incidence of turmeric genotypes

	PH	NTPP	NLPP	PSG	LL	LB	DR	LBI	LSI	YPP
PH	1.000	-0.026	0.218	-0.319	0.766**	0.341	0.423	-0.342	-0.560	0.875**
NTPP		1.000	0.420	0.135	-0.310	-0.480	-0.450	-0.082	-0.041	-0.085
NLPP			1.000	-0.139	-0.086	-0.302	0.114	0.002	-0.082	0.414
PSG				1.000	-0.394	-0.126	-0.317	-0.041	0.296	0.382
LL					1.000	0.752**	0.125	-0.224	-0.366	0.601*
LB						1.000	0.078	-0.185	-0.175	0.277
DR							1.000	-0.464	-0.616*	0.658*
LBI								1.000	0.727**	-0.420
LSI									1.000	-0.716**
YPP										1.000

*Significant at 5% probability level, **Significant at 1% probability level. PH - Plant height (cm), NTPP - Number of tillers per plant, NLPP - Number of leaves per plant, PSG - Pseudo-stem girth (cm), LL - Leaf length (cm), LB - Leaf breadth (cm), DR - Dry recovery (%), LDI - Leaf blotch incidence (PDI), LSI - Leaf spot incidence (PDI), YPP - Yield per plot (kg/3m^2)

The pooled data of leaf spot in Table 3 revealed that TCP 191 (2.61 PDI) and LTS 1 (9.46 PDI) showed highly resistant reaction against leaf spot disease. While other genotypes NDH 128 (10.07 PDI), IT 10 (12.25 PDI), NDH 11 (12.79 PDI), Prathiba (13.57 PDI), RH 80 (13.59 PDI), IT 23 (14.41 PDI), TCP 2 (14.83 PDI), LTS 2 (15.18 PDI), IT 36 (17.29 PDI) and RH 9/90 (19.19 PDI) showed moderate resistance to leaf spot disease. Kar and Mahapatra (1981) reported the occurrence of different species of *Colletotrichum* on the leaves of various host plants including turmeric plant in West Bengal. Palarpawar and Ghurde (1997) reported heavy losses in the yield of turmeric rhizome due to leaf spot disease incited by *C. capsici* and *C. curcumae* in Maharashtra state.

Result of the correlation coefficient analysis (Table 4) revealed that the rhizome yield per plot showed positive and significant correlation with plant height (0.875**) followed by dry recovery percentage (0.658*) and leaf length (0.601*). As the findings are in desirable direction and indicated certain inherent relationship between plant height, leaf length, dry recovery percentage and rhizome yield these traits may be further studied or utilized in future turmeric crop improvement program. Similar findings were also reported by Luiram *et al.* (2019), Dhanalakshmi *et al.* (2021) and Poonam *et al.* (2022) in turmeric. On the other hand, both leaf blotch incidence (PDI) (-0.420) and leaf spot incidence (PDI) (-0.716**) showed negative correlation with the rhizome yield per plot. However, the significant negative correlation was observed between leaf spot incidence (PDI) (-0.716**) and rhizome yield per plot. This finding is in agreement with Santosh and Simon (2020) and Kumar *et al.* (2020) in turmeric.

CONCLUSION

From the above findings of the field experiment, it may be concluded that the turmeric genotype TCP-191 performed best amongst all the genotypes as well as over both the check varieties during the four consecutive years of the study with respect to fresh rhizome yield, dry recovery and tolerance to foliar diseases viz. leaf blotch and leaf spot in Terai agro-climatic conditions of West Bengal.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES :

Anonymous. 1986. Annual Report of Agricultural Research Station. Ananharajupet, A.P. Agri. Univ.

Dhanalakshmi, K., K. Chitra, R., Arulmozhiyan and Ambethgar, V. 2021. Correlation and path analysis studies in turmeric (Curcuma longa). *Int. J. Curr. Microbiol. App. Sci*.,**10**(10): 314-318.

Gomez, K. A. and Gomez, A. A. 1984. Statistical Procedures for Agricultural Research.2nd Edition. New York.pp. 680.

Joseph, P. and Nair, P. C. S. 1981. Field reaction of turmeric types to important pests and diseases. *Indian Cocoa Arecanut and Spices Journal*, **4**:107-109.

Kar, A. K. and Mahapatra, H. S. 1981. New host records of Colletotrichum species from India. *Indian Phytopath*.,**34**:219-221.

Kumar, M., Mishra, A.K., Kumar, P., Kumar, B. and Maurya, S. 2020. Capability of leaf blotch sickness of turmeric (*Taphrina maculans*) at the phenology of crop and its yield attributing characters. *Int. J. Curr. Microbiol. App. Sci*., **10**: 424-429.

Luiram, S., Barua, P. C., Luikham, S., Luchon, S., Khwairakpam, R. and Thangjam, R. 2019. Evaluation of turmeric (*Curcuma longa* L.) genotypes of North Eastern region of India.*Journal of Pharmacognosy and Phytochemistry*, **8**(5): 678-682.

Mamatha, K. 2016. Studies on genetic diversity in turmeric (*Curcuma longa* L.) Genotypes using morphological and molecular markers.(Doctoral dissertation, Dr. YSR Horticultural University, Solan, India).

Nybe, E. V., Mini, R. N. and Peter, K. V. 2007. Horticultural Science Series 5edited by Prof. K.V. Peter and published by New India Publishing Agency. PritamPura. New Delhi-110088. 91.

Palarpawar, M.Y. and V. R. Ghrude, 1997.Influence of different nitrogen sources on growth and sporulation of Colletotrichumcapsici and (*Colletotrichumcurcumae*) *J. of Mycol. And PI. Path.*, **27**:227-228.

Pickersgill, Barbara. 2005. Prance, Ghillean; Nesbitt, Mark (eds.). The Cultural History of Plants.Routledge.p. 170. ISBN 0415927463.

Poonam, Maurya, I. B., Kumawat, S. and Jakhar, R. 2022. Studies on correlation and path analysis in turmeric (*Curcuma longa* L.).*The Pharma Innovation Journal*,**11**(4): 888-892.

Priyanka, R., Vasundhara, M., Jayaram, A., Gge, R., Marappa, N. and Shanti, K. N. 2015.Effect of processing on volatile oil composition in turmeric (*C. longa* L.) varieties.*The Ecoscan*, **9**(3&4): 683-687.

Santosh, B. and Simon, S. 2020. Efficacy of bio - resources on Colletotrichumcapsici, plant growth and yield turmeric (Curcuma longa L.) in vivo. *Int. J. Curr. Microbiol. App. Sci*., **9**(11): 542-549.

Sharma, S. and Krishna Murthy, D. 1962. Varietal resistance against leaf spot diseases of turmeric. *Andhra Agric. J*., **9**: 6165.

Sharma, Y. R., Anadaraj, M. and Venugopal, M. N. 1994. In: Advances in Horticulture by K.L. Chadha and P. Rethinam. *Plantation and Spice Crops*, **10**(2):1015-1047.

Singh, Y., Mittal, P. and Katoch, V. 2003. Genetic variability and heritability in turmeric (*Curcuma longa* L.) *Himachal J.Agri Res*., **29**:31-34.

Vinodhini, V., Selvi, B. S., Balakrishnan, S. and Suresh, R., 2019. Evaluation of turmeric (*Curcuma longa* L.) genotypes for yield and curcumin content. *Journal of Agriculture and Ecology*,**7**:88-95.