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Correlation Coefficients and Occurrence of Pest and Diseases in Turmeric (*Curcuma longa* L.) Cultivars under Southern Dry Zone of Karnataka

Siddalingayya Salimath*, J. Venkatesha, Y. K. Kotikal, Raviraja Shetty and K. N. Kattimani

*Ph.D Student at COH, UHS, Bagalkot 2 Retired Director of Research, UHS, Bagalkot [3]DOE [4]HOD PSMAC, COH, Mudigere, DSW UHS, Bagalkot

College of Horticulture Bagalkot,-587 103, Karnataka

University of Horticultural Sciences, Bagalkot-587102, India

*Corresponding Author E-mail: salimath.salimath@gmail.com

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ABSTRACT

*An field experiment was conducted to evaluate correlation coefficients among the quantitative characters with growth and yield characters in turmeric cultivars results reveled that, fresh rhizome yield per hectare had significant and positively correlated with plant height (+0.731**0), number of tillers (+0.726**), number of leaves (+0.325*), petiole length (+0.658**), leaf area index (+0.648**), number of mother rhizome(+0.394**), number of primary fingers(+0.600**), number of secondary fingers(+0.613**), weight of mother rhizome(+0.543**), weight of primary fingers (+0.614**), weight of secondary fingers(+0.684**), length of primary fingers(+0.771**), yield per plant(+0.773**) most susceptible to leaf blotch Cuddapah (25.23%) and higher incidence was recorded in Cuddapah (24.01%) followed by Belgaum Local (23.90%) and Bidar-4 (23.53%) and also lowest incidence of leaf blotch, shoot borer was observed in Salem, Rajapuri, Prathibha and CLT-325 were found to be superior in terms of growth, yield and quality parameters.*

Key words: *Correlation, Yield, Growth, Cultivars.*

INTRODUCTION

Turmeric (*Curcuma longa* L.) is one of the important spice and dye yielding crops grown in India since time immemorial. Turmeric of commerce is the dried underground rhizome of *Curcuma longa* L. It is an erect herbaceous perennial belonging to the family Zingiberaceae and native to South East Asia[3]. It is also an important condiment which finds a unique place in culinary arts and as colouring agent in textile, food, confectionary, cosmetics and drug industries, besides its use in the preparation of anticancer and medicines.

In India, it is mainly grown in Andra Pradesh, Orissa, West Bengal, Tamil Nadu, Assam, Maharashtra, Karnataka, Bihar and Kerala. However, Andra Pradesh occupies 38 percent of total area and 58.5 percent of total production of the country.

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The national productivity of the crop is 5100 kg per ha[6] in Karnataka, turmeric is being cultivated in an area of 15,320 hectare with an annual production of 93,817 metric tonnes of cured turmeric. The southern dry zone areas of Karnataka comprising of Chamrajanagar (3379 ha), Mysore (1246 ha), Mandya (639 ha) and Hassan (486 ha) are the important districts, growing turmeric over area of 5750 ha which accounts for more than 38 per cent of the state's area under turmeric[1].

In Mysore (southern dry zone of Karnataka) the crops is mainly cultivated under rainfed condition, taking the advantage of rain fall, better distribution from June to november with protective irrigation kaveri reaver basin water June-November.the residual moisture in the soil and availability of irrigation facilities are limited during rest of the months. Therefore, growers need a suitable high yielding short duration turmeric variety so as to harvest the crops before depilation of moisture in the soil and commencement of summer. The performances of any crop or variety largely depend upon its genetical make up. Further, the performances of the crop depend upon climatic condition. Hence, it is very much necessary to collect and evaluate all the available cultivars in order to select suitable and high yielding cultivars.

MATERIALS AND METHODS

The field experiment was carried out on the sixteen turmeric promising cultivars, Co-1,Salem, Prabha, Krishna, Rajapuri, Prathibha, PTS-24, Cuddapah, Alleppey, Bidar-1, Bidar-4, CLI-327, CLI-14, CLT-325, Belgaum local, and Erode local these were evaluated for their performance in RCBD with three replications (Table 1) at College of Horticulture, Mysore (Karnataka) during 2012-13.Recommended package of practices and plant protection measures were followed to raise a healthy crop[2]. The observations were recorded for various growths, yield parameters [Table 1]. Correlation studies were made between the fresh rhizome yield components. The correlation coefficients (r) were calculated and tested for significance as per procedures described [Table2].

The per cent disease intensity (PDI) was calculated by the formula:

$$PDI = \frac{\text{Sum of all disease ratings}}{\text{Totale number of leaves X maximum disease grade}} \times 100$$

Scoring of pest incident (shoot borer) was done at 90, 120, 150 Days after planting and calculated by using this formula.

$$\text{Pest Incidence (\%)} = \frac{\text{Total number of affected plant}}{\text{Total number of plant}} \times 100$$

RESULTS AND DISCUSSION

In his present study the yield is governed by genetic constituent and the environmental factors under which cultivar is grown, hence the knowledge of association and interaction of these characters will provide necessary information in understanding the variation [Table 1 & 3]. Further, the relationships between various yield characters and their effect on ultimate productivity of a cultivar could be ascertained by making correlation studies.

In the present study fresh rhizome yield had positive and significant correlation with plant height, number of tillers, number of leaves, petiole length, number of mother rhizomes, number of primary fingers, number of secondary fingers, weight of mother rhizome, weight of primary finger, weight of secondary finger, length of primary finger,

length of secondary finger and yield per plant respectively. These results are in agreement with findings of Panja *et al*[5]., Rao *et al*[7]., Yadav *et al*[11]., Tomar *et al*[10].

Plant height had highly significant and positive correlation with number of tillers per plant (+0.731), number of leaves per plant (+0.726), number of mother rhizomes (+0.658), number of primary fingers (+0.648), number of secondary fingers (+0.394), weight of mother rhizomes (+0.600), weight of primary fingers (+0.613), weight of secondary fingers (+0.543), length of primary fingers (+0.614), length of secondary fingers (+0.684), fresh rhizomes yield per plant (+0.771), fresh rhizomes yield per hectare (+0.773).cured rhizomes yield per hectare (+0.633), Whereas significant and positive association and petiole length (+0.289), leaf area index (+0.325). [Table, 3]. Number of tillers per plant had shown highly significant and positive correlation with number of leaves per plant (+0.607), number of mother rhizomes (+0.720), number of primary fingers (+0.579), number of secondary fingers (+0.398), weight of mother rhizomes (+0.572), weight of primary fingers (+0.603), weight of secondary fingers (+0.692), length of primary fingers (+0.647), length of secondary fingers (+0.611), fresh rhizomes yield per plant (+0.690), fresh rhizomes yield per hectare (+0.689) and cured yield per hectare (+0.530) whereas significant with leaf area index (+0.306) and non significant with petiole length (+0.074). Number of leaves had shown highly significant and positive correlation with leaf number of mother rhizomes (+0.487), number of primary fingers (+0.385), weight of mother rhizomes (+0.510), weight of primary fingers (+0.549), weight of secondary fingers (+0.590), length of primary fingers (+0.569), length of secondary fingers (+0.506), fresh rhizomes yield per plant (+0.704), fresh rhizomes yield per hectare (+0.725) and cured rhizomes yield per hectare (+0.611), whereas negatively significant with petiole length (+0.217), leaf area index (+ 0.154), number of secondary fingers (+0.132).

Petiole length had shown highly significant and positive correlation with leaf area index weight of mother rhizomes (+0.390), weight of primary fingers (+0.427), length of primary fingers (+0.428), whereas significant with fresh rhizomes yield per plant (+0.305), fresh rhizomes yield per hectare (+0.293) and non significant with leaf area index (+0.158), number of mother rhizomes (+0.192), number of primary fingers (+0.133), number of secondary fingers (+0.174), weight of secondary fingers (+0.204), length of secondary fingers (+0.205), cured rhizomes yield per hectare (+0.213). Leaf area index had shown highly significant and positive correlation with weight of mother rhizomes (+0.677), weight of primary rhizomes (+0.622), and length of primary finger (+0.445), fresh rhizomes yield per plant (+0.514), fresh rhizomes yield per hectare (+0.510) and cured rhizomes yield per hectare (+0.411), whereas significant with number of mother rhizomes (+0.316), number of primary fingers (+0.362), weight of secondary fingers (+0.296) and non significant with number of secondary fingers (+0.185), length of secondary fingers (+0.268). Number of mother rhizomes had shown highly significant and positive correlation with number of primary fingers (+0.743), number of secondary fingers (+0.505), weight of mother rhizomes (+0.630), weight of primary fingers (+0.668), weight of secondary fingers (+0.630), length of primary fingers (+0.602), length of secondary fingers (+0.650), fresh rhizomes yield per plant (+0.599), fresh rhizomes yield per hectare (+0.609) and cured rhizomes yield per hectare (+0.416).

Number of primary fingers had shown highly significant and positive association with

number of secondary fingers (+0.756), weight of mother rhizomes (+0.638), weight of primary fingers (+0.671), weight of secondary fingers (+0.648), length of primary fingers (+0.491), length of secondary fingers (+0.755), fresh rhizomes yield per plant (+0.695), fresh rhizomes yield per hectare (+0.686) and cured rhizomes yield per hectare (+0.531). Number of secondary fingers had shown highly significant and positive correlation with weight of mother rhizomes (+0.499), weight of primary fingers (+0.372), weight of secondary fingers (+0.608), length of secondary fingers (+0.431), fresh rhizomes yield hectare (+0.415), fresh rhizomes yield per plant (+0.408), significant in cured rhizomes yield per hectare (+0.337) and non significant length of primary fingers (+0.196)

Weight of mother rhizomes had shown highly significant and positive correlation with weight of primary fingers (+0.828), weight of secondary fingers (+0.605), length of primary fingers (+0.697), length of secondary fingers (+0.474), fresh rhizomes yield per plant (+0.782), fresh rhizomes yield per hectare (+0.778) and cured rhizomes yield per hectare (+0.668). Weight of primary fingers had shown highly significant and positive correlation with weight of secondary fingers (+0.605), length of primary fingers (+0.832), length of secondary fingers (+0.675), fresh rhizomes per plant (+0.812), fresh rhizomes yield per hectare (+0.819), cured yield per hectare (+0.663).

Weight of secondary fingers had shown highly significant and positive correlation with length of primary fingers (+0.538), length of secondary fingers (+0.593), fresh rhizomes yield per plant (+0.733), fresh rhizomes yield per hectare (+0.724) and cured rhizomes yield per hectare (+0.604). Length of primary fingers had shown highly significant and positive correlation with length of secondary fingers (+0.596), fresh rhizomes yield per plant (+0.684), fresh rhizomes yield per hectare (+0.687) and cured rhizomes yield per hectare (+0.582). Length of secondary fingers had shown highly significant and positive correlation with fresh rhizomes yield per plant (+0.706), fresh rhizomes yield per hectare (+0.700) and cured rhizomes yield per hectare (+0.605).

Fresh rhizomes yield per plant had shown highly significant and positive correlation with fresh rhizomes yield per hectare (+0.988) and cured rhizomes yield per hectare (+0.833). Fresh rhizomes yield per hectare had shown highly significant and positive correlation with cured rhizomes yield per hectare (+0.833).

The data on pest and disease incidence was recorded under natural conditions at different stages of crop growth (90,120,150)

The incidence of shoot borer and leaf blotch disease was noticed during August and September**.** The data on disease and pest incidence was recorded under natural conditions at different stages of crop growth (90, 120, 150 DAP) and are presented [Table 4]. Higher leaf blotch disease incidence was observed in Cuddapah (22.97 %, 27.50 % and 28.33 %) at 90, 120 and 150 DAP, respectively, while the minimum disease incidence was noticed in the cultivars PTS-24 (13.97 %, 15.93 % and 17.00 %) which was on par with Rajapuri (12.73 %, 20.60 % and 17.67 %) at 60, 120 and 150 DAP, respectively[8].

In the present study maximum incidence of shoot borer (23.42 %, 24.17 % and 24.42 %) in cultivar Cuddapah, which was on par with Belgaum Local (25.00 %, 22.25 %, and 24.42 %), while the minimum incidence was in PTS-24 (5.33 %, 10.92 % and 12.50 %) and Bidar-1 (10.17 %, 12.17 % and 14.25 %) at 90, 120 and 150 DAP, respectively at different stages of crop growth Devasahayam *et al*[4].

Table 1: Correlation coefficients among quantitative characters with yield in turmeric cultivars

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1.000	0.731**	0.726**	0.289*	0.325*	0.658**	0.648**	0.394**	0.600**	0.613**	0.543**	0.614**	0.684**	0.771**	0.773**	0.633**
2		1.000	0.607**	0.074	0.306*	0.720**	0.579**	0.398**	0.572**	0.603**	0.692**	0.647**	0.611**	0.690**	0.689**	0.530**
3			1.000	0.217	0.154	0.487**	0.385**	0.132	0.510**	0.549**	0.590**	0.569**	0.506**	0.704**	0.725**	0.611**
4				1.000	0.158	0.192	0.133	0.174	0.390**	0.427**	0.204	0.428**	0.205	0.305*	0.293*	0.213
5					1.000	0.316*	0.362*	0.185	0.677**	0.622**	0.296*	0.445**	0.268	0.514**	0.510**	0.411**
6						1.000	0.743**	0.505**	0.630**	0.668**	0.630**	0.602**	0.650**	0.599**	0.609**	0.416**
7							1.000	0.756**	0.638**	0.671**	0.648**	0.491**	0.755**	0.695**	0.686**	0.531**
8								1.000	0.499**	0.372**	0.608**	0.196	0.431**	0.415**	0.408**	0.337*
9									1.000	0.828**	0.605**	0.697**	0.474**	0.782**	0.778**	0.668**
10										1.000	0.605**	0.832**	0.675**	0.812**	0.819**	0.663**
11											1.000	0.538**	0.593**	0.733**	0.724**	0.604**
12												1.000	0.596**	0.684**	0.687**	0.582**
13													1.000	0.706**	0.700**	0.605**
14														1.000	0.988**	0.833**
15															1.000	0.833**
16																1.000

±Table 'r' at 5% 0.289 at 1% 0.367

*-Significant at 5% level **-Significant at 1% level

1. Plant height (cm)
2. Number tillers per plant
3. Number of leaves per plant
4. Petiole length (cm)
5. Leaf area index
6. Number of mother rhizomes
7. Number of primary fingers
8. Number of secondary fingers
9. Weight of mother rhizomes (g)
10. Weight of primary fingers (g)
11. Weight of secondary fingers (g)
12. Length of primary fingers (cm)
13. Length of secondary fingers (cm)
14. Fresh rhizome per plant (g)
15. Fresh rhizome Yield per hectare (t ha^{-1})
16. Cured yield per hectare (t ha^{-1})

Table 2: Leaf blotch & Shoot borer incidence recorded in turmeric cultivars during 2013

Sl. No	Cultivars	Leaf blotch incidence(%)				Shoot borer incidence (%)			
		90 DAP	120 DAP	150 DAP	Mean	90 DAP	120 DAP	150 DAP	Mean
1.	Co-1	15.73	27.83	17.30	20.28	17.92	18.42	19.50	18.64
2.	Salem	14.60	23.87	18.00	18.82	18.58	22.50	24.50	21.84
3.	Prabha	15.07	15.23	23.33	17.87	12.67	14.92	13.17	13.60
4.	Krishna	15.97	24.13	22.00	20.92	18.92	19.92	19.92	19.59
5.	Rajapuri	12.73	20.60	17.67	16.99	20.50	20.50	21.25	20.75
6.	Prathibha	14.07	24.17	21.33	19.85	17.58	18.17	21.00	18.90
7.	PTS-24	13.97	15.93	17.00	15.62	5.33	10.92	12.50	9.583
8.	Cuddapah	22.97	27.50	28.33	25.23	23.42	24.17	24.42	24.01
9.	Alleppey	15.67	26.03	23.00	21.55	16.92	22.00	23.33	20.74
10	Bidar-1	20.07	27.77	26.33	24.72	10.17	12.17	14.25	12.19
11	Bidar-4	15.30	28.63	18.67	20.86	24.25	23.58	22.83	23.53
12	CLI-327	13.87	25.70	19.67	19.72	12.50	18.58	19.92	16.99
13	CLI-14	14.97	26.73	19.33	20.33	13.17	14.50	15.17	14.44
14	CLT-325	14.42	27.93	18.00	20.11	18.67	18.58	18.08	18.33
15	BelgaumLocal	15.63	29.03	26.33	23.67	25.00	22.25	24.42	23.90
16	Erode Local	16.57	26.50	24.00	22.35	20.08	19.75	22.25	20.67
	S Em ±	0.752	1.11	1.22		1.20	1.24	0.87	
	CD @ 5%	2.12.	3.21	3.5		3.47	3.59	2.51	
	CV (%)	12.0	11.44	7.61		8.30	7.74	9.94	

*DAP-days after plantings

CONCLUSION

PTS-24, Rajapuri, Salem, Prabha, Prathibha, CLI-325, found tolerant with the incidences of both diseases and pest incident on different cultivars of turmeric was studied and reported that PTS series shown resistance.

In the present investigation, it is evident that all the sixteen turmeric cultivars evaluated were found adaptive, however, the Cultivars Salem, Rajapuri, Prathibha and CLT-325 were found to be profitability in terms of growth, yield and quality parameters(Table.1 &3) hence these cultivars can be recommended for growers of this southern dry zone of Karnataka, India.

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