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Studies on correlation and path coefficient analysis in turmeric (*Curcuma longa* L.)

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Abstract
An investigation was carried out at Horticultural Research station, Kovvur to study the correlation and path coefficient analysis in turmeric germplasm. The experiment was laid out in augmented block design with 83 germplasm lines including three checks. The rhizome yield per plant exerted a significant and positive correlation both at phenotypic and genotypic levels for all the characters studied and is highly and significantly correlated with number of primary rhizomes, plant height, basal stem diameter, number of leaves, leaf length, leaf width, leaf area, number of tillers per plant, length of mother rhizome, length of primary rhizome, girth of primary rhizome, number of secondary rhizomes, length of secondary rhizome, girth of secondary rhizome, curcumin content and days to maturity. Path coefficient analysis projected basal diameter, number of primary rhizomes, girth of mother rhizome, leaf width and number of secondary rhizomes per plant as major contributors towards yield due to high positive effects and hence these traits are to be taken into consideration in turmeric crop improvement programme.

Keywords: *Curcuma longa*, Kovvur, turmeric germplasm

Introduction
Turmeric (*Curcuma longa* L. Syn. *C. domestica* Valet.) known as "golden spice" as well as "spice of life" and has been used in India as medicinal plant and held sacred from time immemorial (Ravindran *et al.* 2007) [6]. Turmeric belongs to the family *Zingiberaceae* and is considered to have been originated from South East Asia. The highest diversity is concentrated in India and Thailand with at least 40 species in each area followed by Myanmar, Bangladesh, Indonesia and Vietnam (Velayudhan *et al.* 2012) [14]. Turmeric is gaining importance globally as the potential source of new drugs to combat a variety of ailments. India is the major producer (93.7% of the world production), consumer (92% of the consumption) and exporter of turmeric. India is having the largest share in world exports. The top export destinations of Indian turmeric are U.A.E, Bangladesh, Malaysia, Iran, U.K and U.S.A. Many of the developed countries like U.S.A, U.K and Japan are taking much interest in purchasing Indian turmeric due to high degree of quality and high curcumin content. In view of its ever increasing demand in both food and pharmaceutical industries, there is pressing need to further increase the productivity of turmeric. Since knowledge of the genetic variation in the turmeric germplasm is essential to increase the efficiency of selection in breeding programme as well as to direct conservation strategies in germplasm collection, the data will be useful for the sake of efficient management and differentiation of various land races. It would also be helpful for the plant breeders to select readily varied parents which will add new germplasm base for future turmeric breeding programmes for increased curcumin, oleoresin and essential oil production to meet the ever increasing demand of turmeric for industrial and pharmaceutical uses.
In view of the above a study was undertaken to determine the relationship between yield and yield contributing characters through correlation analysis and to study the direct and indirect effects on yield components on rhizome yield through path coefficient analysis.

Correlation studies
The ultimate goal of crop improvement in turmeric is to achieve a higher level of rhizome yield. Being a complex trait, the rhizome yield is largely influenced by many component characters. So information on strength and direction of correlation of these component characters on rhizome yield and association among the characters would be useful in designing breeding programmes for the improvement of yield.
The relationship between yield and its component characters is likely to vary according the genetic material used, environment under which the material is evaluated as well as due to interaction of the factors. Therefore it is worthwhile to study the association between the variables for identification of important yield components, so that the weightage can be given to the characters of importance in further breeding programmes (Johnson *et al.* 1955) [4].

In the present study, the interrelationships between twenty-one characters were established through their correlations both at phenotypic and genotypic levels and observed that, for all the characters studied, the genotypic correlation coefficients were higher than phenotypic correlation coefficients thus revealing a strong association among the characters (Tables 1 and 2).

The rhizome yield per plant exerted a positive correlation both at phenotypic and genotypic levels for all the characters studied and is highly and significantly correlated with number of primary rhizomes, plant height, basal stem diameter, number of leaves leaf length leaf width leaf area length of mother rhizome length of primary rhizome girth of primary rhizome number of secondary rhizomes length of secondary rhizome girth of secondary rhizome curcumin content and days to maturity. The accessions with more height, longer and broader leaves with more number of primary and secondary rhizomes would be an ideal plant type for high rhizome yield. These correlations were in support of the studies conducted by Hazra *et al.* (2000) [2], Tomar *et al.* 2005) [13], Shoba *et al.* (2011) [10], Roy *et al.* (2011) [7] Singh (2013) [10] and Verma *et al.* (2015) [16].

The negative correlation was expressed with number of tillers per plant at phenotypic level, length of leaf petiole, number of mother rhizome girth of mother rhizome and curing percentage. A similar trend was noticed for simple correlation coefficients (Table 3) indicating that the rhizome yield is significantly and positively associated with number of secondary rhizomes (0.345) followed by basal stem diameter (0.304), number of primary rhizomes (0.268), plant height (0.242), number of leaves (0.233), girth of primary rhizome (0.122), leaf area (0.083), leaf length (0.068), leaf width (0.059), number of tillers (0.033), length of mother rhizome (0.122), girth of mother rhizome (0.023), curcumin content (0.251) and days to maturity (0.129). The negative association was found with length of leaf petiole (-0.032), number of mother rhizomes (-0.136), length of primary rhizomes (-0.159), length of secondary rhizomes (-0.003), girth of secondary rhizomes (-0.154) and curing percentage (-0.071). Similar results were reported by Shanmugasundaram *et al*. (2001) [8].

PATH coefficient analysis

The correlation coefficient between yield and a particular yield component is the net result of direct effect of that attribute and indirect effect through other yield contributing traits. Information on the direct and indirect effects on yield is important which is explicable by path analysis proposed by Wright (1921) [16] and illustrated by Dewey and Lu (1959) [1]. The inter relationships of the component characters on yield provides likely consequences of their selection for simultaneous improvement of desirable characters with yield.

In turmeric, the yield of rhizome per plant is the result of direct and indirect effects of several yield contributing characters. (Table 4). In the present study positive and direct effects on rhizome yield were high for basal stem diameter (0.370), number of primary rhizomes (0.278), followed by girth of mother rhizome (0.264), leaf width (0.220) and number of secondary rhizomes per plant (0.189), while it was low for leaf length (0.179), number of leaves (0.137) and negligible for plant height (0.097), length of leaf petiole (0.049) and girth of primary rhizome (0.072) (Table 4). Hence, direct selection based on basal stem diameter, number of primary and secondary rhizomes and leaf width would be most effective and reliable tool to identify productive genotypes of turmeric. Singh and Ramakrishna (2014) [12] opined that positive direct effects on rhizome yield were high for leaf length and curcumin content, whereas, Shoba *et al*. (2011) [9] reported that positive and direct effect on rhizome yield was maximum for weight of primary rhizomes followed by leaf length, number of leaves and weight of mother rhizomes.

The characters, leaf area exhibited direct and high negative correlation (-0.734) whereas length of primary rhizome (-0.307), girth of secondary rhizome (0.271) and length of mother rhizomes (-0.152) exhibited moderate to low direct negative path coefficients on yield, while, number of tillers per plant (-0.01), number of mother rhizomes (-0.004), length of secondary rhizomes (-0.018), curing percentage(-0.009), curcumin content (-0.01) and days to maturity (-0.082) exhibited negligible direct negative effect on yield. Though, leaf area and length of primary rhizomes exhibited negative correlation they have direct contribution towards yield.

Similar results were confirmed by various workers (Radha Krishnan *et al.* (1995) [6], Hazra *et al*. (2000) [2], Singh *et al*. (2008) [12], Shobha *et al*. (2011) [10], Jan *et al.* (2012) [3], Prajapati *et al*. (2014) [5], Verma *et al*. (2015) [16] and Singh and Ramakrishna (2014) [13].

Table 1: Phenotypic correlation co-efficients among yield and its components in turmeric

S. No	Character	Plant height(cm)	Basal stem diameter (cm)	No of leaves	Leaf length (cm)	Leaf width (cm)	No of tillers	Leaf area (cm^2)	Length of leaf petiole (cm)	No of mother rhizomes	Length of mother rhizome (cm)	Girth of mother rhizome (cm)	No of primary rhizomes
1	Plant height(cm)	1.00	0.593 *	0.509	0.744 **	0.253	0.136	0.638*	-0.126	-0.135	0.565*	0.616*	0.114
2	Basal stem diameter (cm)		1	0.521	0.596 *	0.488	-0.091	0.68 **	0.067	-0.224	0.399	0.479	-0.116
3	No of leaves			1.000	0.445	0.480	0.062	0.554 *	-0.100	-0.294	0.306	0.346	0.137
4	Leaf length(cm)				1.000	0.354	0.009	0.872 ***	-0.098	-0.107	0.423	0.56*	0.097
5	Leaf width(cm)					1.000	-0.109	0.761 **	0.185	-0.129	0.214	0.342	0.093
6	No of tillers						1.000	-0.04	-0.094	-0.070	0.080	-0.027	-0.017
7	Leaf area(cm^2)							1.00	0.028	-0.153	0.402	0.557*	0.026
8	Length of leaf petiole(cm)								1.000	0.086	-0.024	-0.025	0.008
9	No of mother rhizomes									1.000	-0.036	-0.046	0.195
10	Length of mother rhizome (cm)										1.000	0.527	-0.039
11	Girth of mother rhizome (cm)											1.000	-0.213
12	No of primary rhizomes												1.000
13	Length of primary rhizome (cm)												
14	Girth of primary rhizome (cm)												
15	No of secondary rhizomes												
16	Length of secondary rhizome(cm)												
17	Girth of secondary rhizome(cm)												
18	Yield per plant (g)												
19	Rhizome yield (tha^{-1})												
20	Curing %												
21	Curcumin content(%)												
22	Days to maturity												

Table 1: Cont...

Character	Length of primary rhizome (cm)	Girth of primary rhizome (cm)	No of secondary rhizomes	Length of secondary rhizome(cm)	Girth of secondary rhizome (cm)	Yield per plant (g)	Yield (tha^{-1})	Curing %	Curcumin content (%)	Days to maturity
Plant height(cm)	0.242	0.548 *	0.075	-0.008	0.347	0.477	0.477	-0.23	0.326	0.108
Basal stem diameter (cm)	0.336	0.369	0.249	0.129	0.300	0.491	0.491	-0.027	0.067	0.131
No of leaves	0.255	0.325	0.076	0.019	0.211	0.209	0.209	0.004	0.212	0.070
Leaf length(cm)	0.245	0.412	0.074	0.056	0.290	0.321	0.321	-0.109	0.079	0.051
Leaf width(cm)	0.277	0.209	0.130	0.157	0.151	0.119	0.119	0.145	-0.153	-0.131
No of tillers	-0.175	-0.111	-0.204	-0.198	-0.070	-0.013	-0.013	-0.015	0.156	-0.125
Leaf area(cm^2)	0.297	0.394	0.134	0.117	0.281	0.290	0.290	-0.003	-0.015	-0.027
Length of leaf petiole(cm)	0.325	-0.011	-0.021	0.142	0.114	-0.037	-0.037	0.064	-0.164	-0.071
No of mother rhizomes	-0.033	-0.129	-0.089	-0.101	-0.123	-0.185	-0.185	0.008	-0.085	-0.007
Length of mother rhizome (cm)	0.102	0.220	0.043	0.016	0.141	0.298	0.298	-0.242	0.296	0.255
Girth of mother rhizome (cm)	0.409	0.504	0.207	0.037	0.297	-0.012	-0.012	-0.314	0.320	0.161
No of primary rhizomes	-0.113	-0.115	-0.063	0.074	-0.025	0.534*	0.534*	0.204	-0.051	-0.097
Length of primary rhizome (cm)	1.000	0.406	0.182	0.224	0.424	0.195	0.195	-0.004	-0.132	-0.172
Girth of primary rhizome(cm)		1.000	0.241	0.068	0.517	0.391	0.391	-0.280	0.097	0.126
No of secondary rhizomes			1.000	0.036	0.199	0.249	0.249	-0.076	0.014	0.046

Length of secondary rhizome (cm)				1.000	0.155	0.045	0.045	-0.053	-0.143	-0.177
Girth of secondary rhizome (cm)					1.000	0.282	0.282	-0.253	0.091	-0.012
Yield per plant (g)						1.000	1 ***	-0.263	0.325	0.138
Rhizome yield (tha^{-1})							1.000	-0.263	0.325	0.138
Curing %								1.000	-0.305	-0.162
Curcumin content(%)									1.000	0.257
Days to maturity										1.000

Table 2: Genotypic correlation coefficients among yield and its components in turmeric

Character	Plant height (cm)	Basal stem diameter (cm)	No of leaves	Leaf length (cm)	Leaf width (cm)	No of tillers	Leaf area (cm^2)	Length of leaf petiole (cm)	No of mother rhizomes	Length of mother rhizome (cm)	Girth of mother rhizome (cm)
Plant height(cm)	1.000	0.611	0.579	0.768	0.268	0.154	0.664	-0.181	-0.202	0.747	0.745
Basal stem diameter (cm)		1.000	0.598	0.648	0.524	-0.068	0.739	0.106	-0.310	0.698	0.497
No of leaves			1.000	0.471	0.513	0.074	0.592	-0.149	-0.296	0.530	0.416
Leaf length(cm)				1.000	0.352	0.002	0.866	-0.152	-0.120	0.881	0.671
Leaf width(cm)					1.000	-0.112	0.767	0.206	-0.100	0.438	0.407
No of tillers						1.000	-0.048	-0.059	-0.167	0.226	-0.047
Leaf area(cm^2)							1.000	0.001	-0.142	0.823	0.667
Length of leaf petiole(cm)								1.000	0.209	0.190	0.089
No of mother rhizomes									1.000	-0.271	0.056
Length of mother rhizome (cm)										1.000	0.533
Girth of mother rhizome (cm)											1.000
No of primary rhizomes											
Length of primary rhizome (cm)											
Girth of primary rhizome (cm)											
No of secondary rhizomes											
Length of secondary rhizome (cm)											
Girth of secondary rhizome (cm)											
Yield per plant (g)											
Rhizome yield (tha^{-1})											
Curing %											
Curcumin content(%)											
Days to maturity											

Table 2: cont…..

Character	No of primary rhizomes	Length of primary rhizome (cm)	Girth of primary rhizome (cm)	No of secondary rhizomes	Length of secondary rhizome (cm)	Girth of secondary rhizome(cm)	Yield per plant (g)	Yield (t ha^{-1})	Curing %	Curcumin content (%)	Days to maturity
Plant height(cm)	0.082	0.311	0.611	0.084	0.009	0.441	0.509	0.509	-0.232	0.337	0.333
Basal stem diameter cm)	-0.166	0.384	0.392	0.247	0.146	0.436	0.540	0.540	-0.017	0.072	0.205
No of leaves	0.348	0.382	0.880	0.046	0.146	0.475	0.204	0.204	-0.016	0.225	0.164
Leaf length(cm)	0.082	0.406	0.469	0.080	0.160	0.464	0.380	0.380	-0.125	0.082	0.096

Leaf width(cm)	0.256	0.363	0.627	0.132	0.225	0.289	0.145	0.145	0.140	-0.155	-0.253
No of tillers	0.003	-0.214	-0.191	-0.188	-0.318	-0.024	0.081	0.081	-0.027	0.159	-0.215
Leaf area(cm²)	0.184	0.461	0.388	0.141	0.228	0.478	0.345	0.345	-0.016	-0.016	-0.063
Length of leaf petiole(cm)	-0.083	0.417	-0.695	-0.024	0.173	-0.436	-0.196	-0.196	0.067	-0.181	0.223
No of mother rhizomes	0.871	-0.234	-0.210	-0.117	0.046	-0.323	-0.070	-0.070	0.056	-0.116	-0.434
Length of mother rhizome (cm)	-0.873	0.895	0.289	0.014	0.766	0.310	0.569	0.569	-0.461	0.552	-0.956
Girth of mother rhizome (cm)	-0.106	0.506	0.619	0.251	-0.023	0.521	-0.054	-0.054	-0.355	0.380	0.107
No of primary rhizomes	1.000	-0.735	-0.802	0.220	-0.353	-0.936	0.688	0.688	0.561	-0.138	0.974
Length of primary rhizome (cm)		1.000	0.732	0.212	0.115	0.313	0.288	0.288	0.037	-0.156	-0.221
Girth of primary rhizome (cm)			1.000	0.956	0.330	-0.070	0.740	0.740	-0.782	0.306	0.174
No of secondary rhizomes				1.000	0.072	0.496	0.276	0.276	-0.092	0.017	-0.149
Length of secondary rhizome (cm)					1.000	-0.368	0.092	0.092	-0.090	-0.201	0.117
Girth of secondary rhizome (cm)						1.000	0.169	0.169	-0.349	0.162	0.962
Yield per plant (g)							1.000	1.000	-0.287	0.365	0.483
Rhizome yield (tha^{-1})								1.000	-0.287	0.365	0.483
Curing %									1.000	-0.308	-0.258
Curcumin content(%)										1.000	0.459
Days to maturity											1.000

Table 3: Simple correlation coefficients among yield and its components in turmeric

Character	Plant height (cm)	Basal stem diameter (cm)		No of leaves		Leaf length(cm)		Leaf width (cm)		No of tillers	Leaf area (cm²)		Length of leaf petiole (cm)		No of mother rhizomes		Length of mother rhizome (cm)	
Plant height(cm)	1.0000	0.6072	***	0.5885	***	0.6922	***	0.3460	**	0.0889	0.63	***	0.0057		-0.2850	**	0.3050	**
Basal stem diameter (cm)		1.0000		0.5791	***	0.5915	***	0.5601	***	-0.1113	0.70	***	0.1476		-0.3445	**	0.2474	*
No of leaves				1.0000		0.4657	***	0.5137	***	0.0438	0.58	***	-0.0307		-0.4708	***	0.0816	
Leaf length(cm)						1.0000		0.4123	***	-0.0545	0.87	***	-0.0977		-0.1736		0.2299	*
Leaf width(cm)								1.0000		-0.0979	0.80	***	0.2464	*	-0.2354	*	0.2142	
No of tillers										1.0000	-0.08		-0.0418		-0.0165		0.0948	
Leaf area(cm²)											1.000		0.0651		-0.2523	*	0.2558	*
Length of leaf petiole (cm)													1.0000		0.0844		-0.0036	
No of mother rhizomes															1.0000		-0.0741	
Length of mother rhizome (cm)																	1.0000	

Table 3: cont...

Character		No of primary rhizomes		Length of primary rhizome (cm)		Girth of primary rhizome (cm)		No of secondary rhizomes		Length of secondary rhizome (cm)	
Plant height(cm)		0.4445	***	0.0759		0.5059	***	0.2556	*	0.0819	
Basal stem diameter (cm)	*	0.3829	***	0.2068		0.3881	***	0.3731	***	0.2371	*
No of leaves		0.2509	*	0.0613		0.3194	**	0.2483	*	0.2096	

Leaf length(cm)	**	0.2897	**	0.0814		0.3452	**	0.2609	*	0.2328	*
Leaf width(cm)	***	0.3681	***	0.3021	**	0.3000	**	0.0742		0.2607	*
No of tillers		0.1033		-0.1547		-0.1114		-0.1286		-0.1735	
Leaf area(cm²)	***	0.3810	***	0.1977		0.3883	***	0.2302	*	0.3050	**
Length of leaf petiole(cm)		0.2109		0.4468	***	0.1125		-0.2595	*	-0.0033	
No of mother rhizomes		-0.1152		0.0499		-0.1475		-0.3155	**	-0.1873	
Length of mother rhizome (cm)	***	0.3176	**	0.1456		0.1874		0.2412	*	0.1643	
Girth of mother rhizome (cm)		0.1936		0.3706	***	0.3897	***	-0.0235		0.4858	***
No of primary rhizomes		1.0000		0.3359	**	0.4319	***	0.1744		0.2611	*
Length of primary rhizome (cm)				1.0000		0.4737	***	-0.2249	*	0.1933	
Girth of primary rhizome (cm)						1.0000		0.1768		0.1639	
No of secondary rhizomes								1.0000		0.0515	
Length of secondary rhizome (cm)										1.0000	
Girth of secondary rhizome (cm)											
Yield per plant (g)											
Rhizome yield (tha^{-1})											
Curing %											
Curcumin content(%)											
Days to maturity											

Table 3: cont...

Character	Girth of secondary rhizome(cm)		Curing %		Curcumin content%		Days to maturity		Rhizome yield (t/ha)		Yield per plant (g)	
Plant height(cm)	0.2540	*	-0.2439	*	0.3170	**	0.2274	*	0.2417	*	0.2416	*
Basal stem diameter (cm)	0.2667	*	-0.0399		0.0554		0.2172	*	0.3042	**	0.3042	**
No of leaves	0.2480	*	-0.0674		0.3245	**	0.1243		0.2332	*	0.2332	*
Leaf length(cm)	0.2564	*	-0.0754		-0.0404		0.1239		0.0684		0.0684	
Leaf width(cm)	0.3255	**	0.0791		-0.0741		-0.0996		0.0587		0.0588	
No of tillers	-0.1226		0.0184		0.1547		-0.1153		0.0328		0.0328	
Leaf area(cm²)	0.3499	**	-0.0089		-0.0598		0.0276		0.0832		0.0832	
Length of leaf petiole(cm)	0.0616		-0.0241		-0.0341		-0.0944		-0.0321		-0.0322	
No of mother rhizomes	-0.1718		0.1033		-0.2206	*	-0.1089		-0.1364		-0.1364	
Length of mother rhizome (cm)	-0.1371		-0.1584		0.0696		0.2317	*	0.1218		0.1219	
Girth of mother rhizome (cm)	0.3684	***	-0.0493		-0.1116		-0.0118		0.0231		0.0233	
No of primary rhizomes	0.1735		-0.1484		0.2471	*	0.0565		0.2676	*	0.2677	*
Length of primary rhizome (cm)	0.2955	**	0.0888		-0.2578	*	-0.1980		-0.1599		-0.1598	
Girth of primary rhizomes (cm)	0.3893	***	-0.2145		0.0709		0.1579		0.1219		0.1220	
No of secondary rhizomes	-0.0379		-0.1615		0.1894		0.2698	*	0.3452	**	0.3451	**
Length of secondary rhizomes (cm)	0.5061	***	-0.0355		-0.1029		-0.1212		-0.0035		-0.0034	
Girth of secondary rhizomes (cm)	1.0000		-0.2065		-0.0579		-0.0470		-0.1538		-0.1538	
Yield /plant (g)			1.0000		-0.3008	**	-0.2566	*	-0.0713		-0.0713	
Rhizome yield (tha^{-1})					1.0000		0.2569	*	0.2521	*	0.2521	*
Curing %							1.0000		0.1299		0.1299	
Curcumin content(%)									1.0000		1.0000	***

Table 4: Path co-efficients among yield and its components in turmeric

S. No	Character	Plant height(cm)	Basal stem diameter (cm)	No of leaves	Leaf length (cm)	Leaf width (cm)	No of tillers	Leaf area (cm^2)	Length of leaf petiole (cm)	No of mother rhizomes
1	Plant height(cm)	0.097	0.059	0.057	0.067	0.034	0.009	0.061	0.001	-0.028
2	Basal stem diameter (cm)	0.225	0.370	0.214	0.219	0.207	-0.041	0.259	0.055	-0.128
3	No of leaves	0.081	0.079	0.137	0.064	0.071	0.006	0.080	-0.004	-0.065
4	Leaf length(cm)	0.125	0.106	0.084	0.180	0.074	-0.010	0.156	-0.018	-0.031
5	Leaf width(cm)	0.076	0.123	0.113	0.091	0.220	-0.022	0.177	0.054	-0.052
6	No of tillers	-0.001	0.001	0.000	0.001	0.001	-0.010	0.001	0.000	0.000
7	Leaf area(cm^2)	-0.462	-0.514	-0.428	-0.637	-0.589	0.058	-0.734	-0.048	0.185
8	Length of leaf petiole(cm)	0.000	0.007	-0.002	-0.005	0.012	-0.002	0.003	0.049	0.004
9	No of mother rhizomes	0.001	0.001	0.002	0.001	0.001	0.000	0.001	0.000	-0.004
10	Length of mother rhizome (cm)	-0.046	-0.038	-0.012	-0.035	-0.032	-0.014	-0.039	0.001	0.011
11	Girth of mother rhizome (cm)	0.050	0.060	0.030	0.076	0.100	-0.029	0.102	0.006	0.028
12	No of primary rhizomes	0.124	0.107	0.070	0.081	0.102	0.029	0.106	0.059	-0.032
13	Length of primary rhizome (cm)	-0.023	-0.063	-0.019	-0.025	-0.093	0.047	-0.061	-0.137	-0.015
14	Girth of primary rhizome (cm)	0.037	0.028	0.023	0.025	0.022	-0.008	0.028	0.008	-0.011
15	No of secondary rhizomes	0.048	0.071	0.047	0.049	0.014	-0.024	0.044	-0.049	-0.060
16	Length of secondary rhizome(cm)	-0.001	-0.004	-0.004	-0.004	-0.005	0.003	-0.006	0.000	0.003
17	Girth of secondary rhizome (cm)	-0.069	-0.072	-0.067	-0.069	-0.088	0.033	-0.095	-0.017	0.047
18	Yield per plant (g)	0.002	0.000	0.001	0.001	-0.001	0.000	0.000	0.000	-0.001
19	Rhizome yield (tha^{-1})	-0.003	-0.001	-0.003	0.000	0.001	-0.001	0.001	0.000	0.002
20	Curing %	-0.019	-0.018	-0.010	-0.010	0.008	0.009	-0.002	0.008	0.009
21	Yield /plant (g)	0.242	0.304	0.233	0.068	0.059	0.033	0.083	-0.032	-0.136
	Partial R^2	0.023	0.113	0.032	0.012	0.013	0.000	-0.061	-0.002	0.001

Table 4: Cont...

S. No	Character	Length of mother rhizome (cm)	Girth of mother rhizome (cm)	No of primary rhizomes	Length of primary rhizome (cm)	Girth of primary rhizome (cm)	No of secondary rhizomes	Length of secondary rhizome (cm)	Girth of secondary rhizome(cm)	Curing %	Curcumin content (%)	Days to maturity
1	Plant Height(cm)	0.030	0.018	0.043	0.007	0.049	0.025	0.008	0.025	-0.024	0.031	0.022
2	Basal Stem Diameter (cm)	0.092	0.084	0.142	0.077	0.144	0.138	0.088	0.099	-0.015	0.021	0.080
3	No of Leaves	0.011	0.016	0.034	0.008	0.044	0.034	0.029	0.034	-0.009	0.045	0.017
4	Leaf Length(cm)	0.041	0.052	0.052	0.015	0.062	0.047	0.042	0.046	-0.014	-0.007	0.022
5	Leaf Width(cm)	0.047	0.083	0.081	0.066	0.066	0.016	0.057	0.072	0.017	-0.016	-0.022
6	No of Tillers	-0.001	0.001	-0.001	0.002	0.001	0.001	0.002	0.001	0.000	-0.002	0.001
7	Leaf Area(cm^2)	-0.188	-0.284	-0.279	-0.145	-0.285	-0.169	-0.224	-0.257	0.007	0.044	-0.020
8	Length of Leaf Petiole(cm)	0.000	0.001	0.010	0.022	0.006	-0.013	0.000	0.003	-0.001	-0.002	-0.005
9	No of Mother Rhizomes	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.000
10	Length of Mother Rhizome (cm)	-0.152	-0.070	-0.048	-0.022	-0.028	-0.037	-0.025	0.021	0.024	-0.011	-0.035
11	Girth of Mother Rhizome (cm)	0.122	0.264	0.051	0.098	0.103	-0.006	0.128	0.097	-0.013	-0.029	-0.003
12	No of Primary Rhizomes	0.088	0.054	0.278	0.093	0.120	0.048	0.073	0.048	-0.041	0.069	0.016
13	Length of Primary Rhizome (cm)	-0.045	-0.114	-0.103	-0.307	-0.145	0.069	-0.059	-0.091	-0.027	0.079	0.061
14	Girth of Primary Rhizomes (cm)	0.014	0.028	0.031	0.034	0.072	0.013	0.012	0.028	-0.015	0.005	0.011
15	No of Secondary Rhizomes	0.046	-0.004	0.033	-0.043	0.034	0.190	0.010	-0.007	-0.031	0.036	0.051

16	Length of Secondary Rhizomes (cm)	-0.003	-0.009	-0.005	-0.004	-0.003	-0.001	-0.018	-0.009	0.001	0.002	0.002
17	Girth of Secondary Rhizomes (cm)	0.037	-0.100	-0.047	-0.080	-0.105	0.010	-0.137	-0.271	0.056	0.016	0.013
18	Curing %	0.001	0.000	0.001	-0.001	0.002	0.001	0.000	0.002	-0.009	0.003	0.002
19	Curcumin Content (%)	-0.001	0.001	-0.002	0.002	-0.001	-0.002	0.001	0.001	0.003	-0.010	-0.002
20	Days to maturity	-0.019	0.001	-0.005	0.016	-0.013	-0.022	0.010	0.004	0.021	-0.021	-0.082
21	Yield per Plant (g)	0.122	0.023	0.268	-0.160	0.122	0.345	-0.003	-0.154	-0.071	0.252	0.130
	Partial R^2	-0.018	0.006	0.074	0.049	0.009	0.065	0.000	0.042	0.001	-0.002	-0.011

R SQUARE = 0.3455 RESIDUAL EFFECT = 0.8090

Conclusion

Hence it can be concluded that characters like basal stem diameter, number of primary and secondary rhizomes are having strong influence on rhizome yield and importance should be given to these traits while attempting crop improvement programme in turmeric.

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