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Correlation analysis of turmeric (*Curcuma longa* L.) genotypes of North Eastern region of India

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Abstract
Thirty-two (32) genotypes of turmeric from all the North Eastern state of India along with Duggirala Red as check variety were analyzed to study the correlation between yield and yield attributing characters for 44 traits. The study showed that the leaf length, leaf width, and plant height at 105, 135 and 165 DAP showed a significant and positive correlation with rhizome yield. The weight of mother rhizome plant^{-1}, leaf area index (LAI) at 135 DAP and leaf area duration (LAD) at 135 & 165 were found significant and positively correlated with rhizome yield plant^{-1}. Thus, these characters might be considered as important factors in selecting the genotypes for increasing the yield of turmeric in any crop improvement programmes.

Keywords: Correlation, yield, yield attributes, physiological parameters

Introduction
Turmeric (*Curcuma longa* L.) is a rhizomatous crop belonging to the family *Zingiberaceae*. The processed and dried turmeric is used as spice and condiment, dye stuff, in drugs and cosmetic industries. It is rich in minerals and vitamins. Besides, it contains curcumin, the pungent aromatic flavour. Though wide genetic variability of turmeric exists in the North Eastern Region of India, not much attention has been laid by the researchers to characterize and evaluate these cultivars for its genetic potential and local recommendation with respect to growth, yield and their correlations among the turmeric genotypes of North Eastern region of India. The present study was carried out to analyze the correlation between yield and yield attributing characters as well as the correlation between yield and physiological parameters of thirty three turmeric germplasms collected from all the North Eastern state of India so that it can help in crop improvement through the simple selection of potential genotypes.

Methods and Materials
The experiment was conducted at Horticulture Experimental Farm, AAU, Jorhat, Assam during 2016. The experimental materials were collected farmers field from all the eight (8) North Eastern state of India. The treatments comprised of 33 genotypes which were replicated thrice under Randomized Block Design (RBD). Plot size of 1.5 m x 1.5 m (2.25 sq. m) was laid out with plant to plant spacing of 30 cm x 30 cm accommodating 25 plants per plot. The mean data was subjected to study of correlation as suggested by Miller *et al*. (1958) [2] and Dewey and Lu (1950) [1] respectively.

Results and Discussion
Phenotypic and genotypic correlations between yield and yield attributing characters for 44 characters presented in Table. 1 revealed that the fresh rhizome yield plant^{-1} and leaf length at 105 DAP, 135 DAP and 165 DAP were found positively correlated and significant at both levels. Similar trend of observations was recorded for leaf width significant at 0.05 level. The number of leaves hill^{-1} at the initial stage of growth was found negatively correlated but in the later stage it was positively correlated with fresh rhizome yield plant^{-1} but non-significant. Similar trend of observation was recorded for number of leaves per main shoot. The number of leaves tiller^{-1} and tillers hill^{-1} in all the stages of growth was found positively correlated with fresh rhizome yield plant^{-1} but found to be non-significant. Plant height was observed positively correlated with fresh rhizome yield plant^{-1} but was non-significant at 75 DAP.

The number of days taken to maturity, girth of primary rhizome and girth of secondary rhizome were found negatively correlated with fresh rhizome yield plant^{-1}.

However, girth of mother rhizome, harvest index, length of mother rhizome, length of primary rhizome, length of secondary rhizome, number of primary rhizome, weight of mother rhizome, weight of primary rhizome, weight of secondary rhizome, dry rhizome yield hectare^{-1}, dry rhizome yield plant^{-1} and fresh rhizome yield hectare^{-1} were found to be positively correlated with fresh rhizome yield plant^{-1} but the correlation was non significant for girth of mother rhizome, harvest index and length of secondary rhizome. The study also indicated that most of the characters showed positive correlations with fresh rhizome yield plant^{-1}. Significantly negative correlations were also found in the number of days to maturity with leaf length at 75 DAP, leaf width at 75 DAP and 135 DAP. The length of primary rhizome also showed negative significant correlation with number of leaves hill^{-1} in all the stages of growth and the girth of secondary rhizome.

The weight of mother rhizome, weight of primary rhizome, weight of secondary rhizome and number of primary rhizome plant^{-1} were found significant and were positively correlated with fresh rhizome yield plant^{-1}. The weight of primary rhizome exhibited very high and significant positive correlation with weight of secondary rhizome and fresh rhizome yield plant^{-1} at both the levels. This finding is in agreement with Yadav *et al*. (2006) [7], Yadav & Singh (1987) [6], Nandi *et al*. (1994) [3] and Shashidhar & Sulikeri (1997) [5]. It is also worthwhile to mention the work of Panja *et al*. (2002) [4] who found that number and weight of secondary fingers were highly significant and positively correlated with yield plant^{-1}. Thus, the length and weight of mother, primary and secondary rhizome may be considered very important factors in selecting the genotypes for increasing the yield of turmeric in any crop improvement programmes.

Though negative correlations were also found among few characters, those characters were non-significant and showed low value of negative correlation which may not be a problem in increasing the yield of turmeric. The characters like leaf length at 75 DAP, leaf width at 75 DAP, number of leaves hill^{-1} at 135 DAP and 165 DAP, number of leaves per main shoot at 105 DAP, 135 DAP and 165 DAP, number of leaves tiller^{-1} and number of tillers hill^{-1} in all the stages of growth, plant height at 75 DAP, girth of mother rhizome, harvest index and length of secondary rhizome showed non significant correlation with fresh rhizome yield plant^{-1} but it was positively correlated. Therefore, all these characters were found to be helpful in increasing the yield of turmeric genotypes under study. Similar observation was also interpreted by Yadav *et al*. (2006) [7] in their correlation studies with forty one (41) turmeric genotypes. In the correlation study between the yield and physiological parameters presented in Table. 2 showed that the chlorophyll content, photosynthesis and transpiration rate have no significant correlation with the yield of turmeric. However, it was found that the internal CO_2 concentration is positively correlated with stomatal conductance at 0.01 level and the stomatal conductance was positively correlated with transpiration rate at 0.05 level. The leaf area index (LAI) at 135 DAP and leaf area duration (LAD) at 135 & 165 showed significant positive correlation with the fresh rhizome yield of turmeric. Therefore, these physiological characters maybe used for selecting the genotypes in increasing the yield of turmeric.

Conclusion

The weight of mother rhizome, weight of primary rhizome, weight of secondary rhizome, number of primary rhizome plant^{-1}, weight of primary rhizome, leaf area index (LAI) at 135 DAP, leaf area duration (LAD) at 135 & 165, and leaf length, leaf width and plant height at 105, 135 and 165 DAP showed significant and positive correlation with rhizome yield indicating the potentiality of these characters for increasing the yield of turmeric in future crop improvement programme.

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Table 1: Correlation between yield and yield attributing characters in turmeric genotypes

Characters	LL75	LL105	LL135	LL165	LW75	LW105	LW135	LW165	L/H75	L/H105	L/H135	L/H165	L/MS75	L/MS105	L/MS135	L/MS165	L/T75	L/T105	L/T135	L/T165	T/H75
LL75	1	.455**	.428*	.304	.633**	.546**	.554**	.521**	.027	.031	.042	.033	.314	.338	.190	.129	-.053	.007	-.058	-.089	.138
LL105		1	.928**	.878**	.553**	.575**	.546**	.548**	-.002	-.182	-.067	-.029	.159	.149	.175	-.079	-.173	-.130	-.101	-.074	.071
LL 135			1	.949**	.509**	.590**	.549**	.560**	-.165	-.247	-.110	-.089	.086	.247	.280	.025	-.270	-.176	-.175	-.145	.020
LL165				1	.389*	.462**	.438*	.463**	-.158	-.260	-.131	-.096	.092	.297	.332	.084	-.257	-.171	-.215	-.165	-.005
LW75					1	.820**	.841**	.811**	-.095	-.358*	-.370*	-.350*	.166	.004	-.142	-.303	-.266	-.246	-.257	-.365*	-.185
LW105						1	.962**	.963**	-.303	-.526**	-.408*	-.398*	.032	.120	.079	-.138	-.304	-.330	-.242	-.340	-.173
LW135							1	.984**	-.270	-.487**	-.455**	-.450**	.076	.144	.090	-.134	-.337	-.338	-.286	-.379*	-.230
LW165								1	-.288	-.485**	-.424*	-.416*	.042	.171	.099	-.131	-.310	-.335	-.263	-.346*	-.208
L/H75									1	.662**	.466**	.432*	.521**	-.190	-.036	-.018	.524**	.378*	.309	.359*	.320
L/H105										1	.860**	.786**	.333	.008	.077	.257	.703**	.809**	.686**	.742**	.652**
L/H135											1	.918**	.139	.063	.188	.334	.652**	.798**	.822**	.847**	.729**
L/H165												1	.029	-.012	.115	.209	.717**	.777**	.767**	.908**	.779**
L/MS75													1	.125	.127	.278	.105	.095	.048	.025	.089
L/MS105														1	.830**	.737**	-.056	.027	-.021	-.024	-.059
L/MS135															1	.852**	-.045	.091	.098	.105	.066
L/MS165																1	.008	.209	.148	.159	.157
L/T75																	1	.759**	.658**	.715**	.747**
L/T105																		1	.806**	.820**	.753**
L/T135																			1	.908**	.638**
L/T165																				1	.712**
T/H75																					1
T/H105																					
T/H135																					
T/H165																					
PH75																					
PH105																					
PH135																					
PH165																					
DM																					
GMR																					
GPR																					
GSR																					
HI																					
LMR																					
LPR																					
LSR																					
N.PR																					
WMR																					
WPR																					
WSR																					
DY/ha																					
DY/pl																					
FY/ha																					
FY/pl																					

Characters	T/H_105	T/H135	T/H165	PH75	PH105	PH135	PH165	DM	GMR	GPR	GSR	HI	LMR	LPR	LSR	N. PR	WMR	WPR	WSR	DY/ha	DY/pl	FY/ha	FY/pl
LL75	.114	-.008	-.057	.649**	.497**	.374*	.341	-.351*	.264	-.114	-.298	-.168	.266	.302	-.015	.048	.443**	.259	-.010	.084	.083	.266	.256
LL105	.082	.044	.084	.639**	.891**	.885**	.851**	-.146	.391*	.229	.283	.039	.204	.241	-.068	.332	.637**	.475**	.418*	.498**	.502**	.535**	.552**
LL 135	.000	-.024	.014	.554**	.878**	.958**	.933**	-.088	.354*	.196	.302	.067	.234	.322	-.036	.419*	.646**	.553**	.407*	.539**	.543**	.587**	.599**
LL165	-.116	-.119	-.078	.419*	.810**	.917**	.924**	.024	.376*	.262	.369*	.106	.209	.273	-.022	.390*	.609**	.545**	.469**	.586**	.590**	.592**	.604**
LW75	.061	-.003	.001	.806**	.606**	.487**	.414*	-.363*	.112	-.116	-.225	-.169	.166	.446**	-.025	.040	.442**	.287	.018	.151	.153	.253	.281
LW105	.050	-.054	-.052	.635**	.653**	.597**	.515**	-.328	.093	-.236	-.120	-.273	.043	.656**	-.080	.034	.519**	.420*	.137	.256	.257	.401*	.413*
LW135	.013	-.092	-.116	.668**	.678**	.598**	.519**	-.351*	.075	-.226	-.134	-.322	.007	.620**	-.190	.014	.510**	.372*	.067	.216	.216	.357*	.361*
LW165	.007	-.089	-.100	.611**	.677**	.614**	.537**	-.309	.110	-.196	-.144	-.319	.002	.669**	-.114	.004	.509**	.415*	.108	.234	.234	.394*	.398*
L/H75	.201	.194	.264	.090	-.037	-.158	-.198	.006	-.004	.068	-.020	.285	-.017	-.364*	-.004	-.088	-.146	-.290	-.126	-.257	-.258	-.239	-.249
L/H105	.472**	.381*	.373*	-.112	-.218	-.241	-.231	.173	.178	.113	-.090	.301	.264	-.500**	-.052	.207	-.097	-.178	-.075	-.168	-.167	-.132	-.157
L/H135	.552**	.426*	.395*	-.189	-.190	-.156	-.150	.246	.345*	.117	-.008	.244	.376*	-.378*	.036	.282	.067	-.010	.066	-.084	-.081	.039	.023
L/H165	.528**	.407*	.399*	-.186	-.183	-.154	-.124	.231	.328	.087	-.056	.280	.375*	-.435*	.118	.350*	.118	.082	.155	.048	.045	.122	.113
L/MS75	.184	.159	.221	.336	.211	.090	.061	-.096	.020	-.032	.046	.202	.228	-.005	.082	-.297	-.049	-.302	-.119	-.084	-.079	-.232	-.229
L/MS105	-.107	-.257	-.263	-.036	.107	.197	.226	.174	.238	.118	.076	-.293	.145	.336	.091	.019	.364*	.180	.174	.109	.113	.256	.242
L/MS135	-.055	-.164	-.171	-.130	.100	.232	.258	.164	.303	.212	.206	-.201	.107	.141	-.049	.065	.348*	.109	.137	.109	.111	.190	.185
L/MS165	-.054	-.137	-.145	-.316	-.135	-.034	.012	.214	.221	.100	.134	-.125	.265	.153	.058	-.054	.109	-.002	.033	-.011	-.006	.048	.034
L/T75	.470**	.299	.361*	-.154	-.251	-.248	-.223	.230	.092	-.033	-.206	.238	.077	-.347*	.028	.262	.099	-.019	.183	.075	.073	.079	.053
L/T105	.586**	.391*	.387*	-.121	-.250	-.208	-.186	.337	.234	-.004	-.201	.242	.252	-.400*	-.035	.375*	.063	.014	.193	.092	.092	.069	.074
L/T135	.805**	.671**	.657**	-.051	-.203	-.201	-.225	.152	.247	.017	-.103	.248	.202	-.370*	-.098	.319	.121	-.001	.206	.041	.043	.077	.082
L/T165	.704**	.628**	.626**	-.135	-.197	-.187	-.188	.226	.269	.029	-.080	.302	.281	-.450**	.030	.324	.119	.035	.244	.098	.095	.108	.110
T/H75	.448**	.305	.368*	-.103	-.024	.004	.030	.061	.286	.158	-.120	.374*	.373*	-.276	.148	.385*	.185	.167	.296	.255	.251	.249	.224
T/H105	1	.800**	.750**	.329	.059	-.003	-.067	.075	.334	-.075	-.218	.127	.337	-.284	-.179	.157	.223	-.020	.190	.110	.114	.063	.086
T/H135		1	.931**	.297	.043	-.052	-.148	-.016	.183	-.002	-.191	.381*	.299	-.399*	-.150	.091	.152	-.026	.269	.157	.158	.054	.093
T/H165			1	.302	.066	-.027	-.105	-.024	.140	.079	-.114	.504**	.220	-.362*	-.036	.078	.103	-.101	.264	.153	.153	-.002	.036
PH75				1	.716**	.543**	.472**	-.308	.170	-.007	-.089	.058	.149	.120	-.283	.039	.452**	.074	.010	.152	.153	.129	.152
PH105					1	.931**	.867**	-.212	.364*	.210	.219	.020	.190	.369*	-.195	.200	.612**	.421*	.278	.416*	.420*	.477**	.474**
PH135						1	.972**	-.086	.345*	.195	.296	.015	.161	.359*	-.148	.379*	.624**	.523**	.345*	.508**	.513**	.560**	.557**
PH165							1	-.001	.326	.233	.364*	.047	.119	.321	-.130	.396*	.572**	.484**	.304	.515**	.520**	.517**	.510**
DM								1	.085	.131	.270	-.092	-.111	-.137	.012	-.169	-.131	-.205	.075	-.127	-.122	-.166	-.136
GMR									1	.546**	-.011	-.066	.587**	-.063	.020	.018	.445**	.135	.169	.180	.186	.222	.226
GPR										1	.483**	.163	.206	-.263	.099	-.085	.081	-.173	.026	.012	.012	-.080	-.075
GSR											1	.071	-.102	-.088	.007	.046	-.002	-.075	-.006	-.039	-.037	-.042	-.046
HI												1	.133	-.376*	.034	.267	-.084	-.057	.184	.303	.299	-.002	.003
LMR													1	.027	.315	.160	.401*	.300	.263	.317	.321	.341	.345*
LPR														1	.217	-.097	.278	.444**	.143	.180	.185	.392*	.374*
LSR															1	-.078	-.091	.167	.205	.084	.082	.122	.138
N.PR																1	.489**	.675**	.483**	.616**	.618**	.663**	.656**
WMR																	1	.651**	.604**	.644**	.647**	.782**	.789**
WPR																		1	.718**	.731**	.731**	.960**	.956**
WSR																			1	.836**	.835**	.830**	.856**
DY/ha																				1	1.000**	.808**	.825**
DY/pl																					1	.807**	.826**
FY/ha																						1	.993**
FY/pl																							1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2: Correlation between yield and physiological parameters in turmeric genotypes

Characters	Chlorophyll content	Internal CO_2 Conc.	Stomatal conductance	Photosynthesis rate	Transpiration rate	LAI 135 DAP	LAI 165 DAP	LAD 135 & 165 DAP	Fresh rhizome yield/pl	Fresh rhizome yield/ha	Dry rhizome yield/pl	Dry rhizome yield/ha
Chlorophyll content	1.000											
Internal CO2	-0.067	1.000										
Stomatal conductance	-0.079	0.564**	1.000									
Photosynthesis rate	0.226	-0.045	0.323	1.000								
Transpiration rate	-0.115	0.233	0.717*	0.271	1.000							
LAI 135 DAP	0.245	0.166	0.033	0.463	0.063	1.000						
LAI 165 DAP	0.186	0.078	-0.150	0.296	0.017	0.527	1.000					
LAD 135 & 165 DAP	0.259	0.145	-0.013	0.425	0.097	0.876*	0.842*	1.000				
Fresh rhizome yield/pl	0.322	0.228	0.322	0.418	0.403	0.540**	0.427	0.534**	1.000			
Fresh rhizome yield/ha	0.327	0.216	0.308	0.408	0.386	0.548**	0.406	0.527**	0.991*	1.000		
Dry rhizome yield/pl	0.199	0.395	0.298	0.096	0.366	0.300	0.237	0.258	0.762*	0.752*	1.000	
Dry rhizome yield/ha	0.199	0.389	0.298	0.100	0.371	0.301	0.238	0.259	0.769*	0.758*	0.999*	1.000

** Correlation is significant at 0.01 level

* Correlation is significant at 0.05 level

References

1. Dewey DR, LU KH. Correlation and path coefficient analysis of components of mustard, wheat and gram seed production. Agronomy Journal. 1950; 51:525-528.
2. Miller DA, Williams JC, Richardson HF, Comstock KB. Estimates of genotypic and environmental variances and covariance in upland cotton and their implication in selection. Agronomy Journal. 1958; 50:126-131.
3. Nandi A, Lenka D, Singh D. Path analysis in turmeric (*Curcuma longa* L.). Indian Cocoa Arecanut Spices Journal. 1994; 18:54-55.
4. Panja B, De DK, Basak S, Chattopadhyay SB. Correlation and path analysis in turmeric (*Curcuma longa* L.). Journal of Spices and Aromatic Plants. 2002; 11:70-73.
5. Shashidhar TR, Sulikeri GS. Correlation studies in turmeric (*Curcuma longa* L.). Karnataka Journal of Agricultural Sciences. 1997; 10:595-597.
6. Yadav DS, Singh R. Association analysis of yield and its components in turmeric. Indian Journal of Horticulture. 1987; 44:78-80.Yadav RK, Yadav DS, Rai N, Asati BS, Singh AK. Correlation and path coefficient analysis in turmeric (*Curcuma longa* L.). Indian Journal of Horticulture. 2006; 63(1):103-106.