Journal of Spices and Aromatic Crops
Vol. 22 (1) : 104–107 (2013)
www.indianspicesociety.in/josac/index.php/josac

Indian Society for Spices

Genetic variability, correlation and path coefficient analysis in turmeric (*Curcuma longa* L.)

R Rajyalakshmi, L N Naidu, M Rajasekhar & V Sudhavani

Horticultural Research Station, Dr. Y.S.R Horticultural University,
Venkataramannagudem-534 101, West Godavari Dist., Andhra Pradesh, India.
E-mail: rajlaxmi_vzm@rediffmail.com

Received 26 May 2012; Revised 21 June 2012; Accepted 9 January 2013

Abstract

Eight turmeric genotypes were raised in a randomized block design to study the variability, heritability with genetic advance, correlation, direct and indirect effects of characters on rhizome yield for a period of four year. Variability accompanied by higher values for genetic coefficient of variation was recorded for rhizome yield. Heritability and genetic advance were high for rhizome yield and number of tillers per plant. In general, genotypic correlations were higher than phenotypic correlations for all the characters studied. Rhizome yield was positively and significantly correlated with plant height, number of tillers plant^{-1} and number of leaves plant^{-1}. Number of tillers plant^{-1} followed by plant height exerted the highest positive direct effect on rhizome yield, which indicated that selection for these characters would directly improve the yield in turmeric.

Keywords: *Curcuma longa*, genetic variability, path analysis, turmeric

Turmeric (*Curcuma longa* L.) is mainly grown in the states of Andhra Pradesh, Tripura, Tamil Nadu, Orissa, Assam, Maharashtra and to a little extent in Karnataka and Kerala. There are large number of cultivars available in turmeric and considerable variability exists with regard to morphological and yield characters and several attempts have been made to assess this variability (Pillai & Nambiar 1974; Subbarayudu *et al*. 1976; Chaudhary *et al*. 2006). The present study is an attempt to understand the variability existing among popular turmeric cultivars of Andhra Pradesh.

The investigation was carried out at the Agricultural Research Station, Seethampeta, Srikakulam District of Andhra Pradesh using eight genotypes of turmeric *viz*., Rajendra Sonia, PTS-12, ACC-361, ACC-360, PTS-43, BSR-1 PTS-62 and local variety during 2005–2008. The experiment was set to a randomized block design with three replications. The finger rhizomes were planted on ridges adopting a spacing of 45 × 20 cm and recommended agronomic package of practices were followed. Data recorded on various characters were subjected to analysis of variance. Genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) was estimated by the formula given by Burton (1952). Heritability and genetic advance were calculated by following Allard (1960) and

Table 1. Estimation of variability and genetic parameters for yield and its components in turmeric

Character	Mean	Range	Genotypic variance	Phenotypic variance	Heritability broad sense	Genetic advance as % of mean
Plant height (m)	0.95	0.73-1.00	0.007	0.009	0.8073	16.79
No. of tillers plant^{-1}	2.34	1.63-2.62	0.123	0.134	0.9126	29.43
No. of leaves plant^{-1}	9.21	6.97-9.75	0.809	0.924	0.8765	18.84
Rhizome yield (t ha^{-1})	18.93	8.49-23.96	26.524	31.469	0.8429	51.45

Johnson *et al.* (1955). The phenotypic and genotypic correlation coefficients were calculated by working out the variance components for each character and the covariance components for each pair of characters using the formulae suggested by Alji *et al.* (1979) and path coefficient of various characters was calculated as per Dewey & Lu (1959).

Significant variability was observed for all the characters studied. In general the PCV estimates were higher than GCV estimates indicating the role of environment. These results are supported by Yadav & Singh (1996) and Manohar *et al.* (2004) in turmeric.

High estimates of heritability were observed for the characters *viz*., plant height (80.73 cm), no. of tillers plant^{-1} (91.26), no. of leaves plant^{-1} (87.65) and rhizome yield (84.29) indicating that a major part of the phenotypic variability in these characters was contributed by additive gene effects and hence improvement can be made by simple selection. Similar results have been reported by Philips & Nair (1986) and Pathania *et al.* (1988). Low heritability values suggested the involvement of environmental component in the expression of the character. Hence, direct selection of a particular character would be futile. Therefore, indirect selections need to be adopted.

In the present study, yield and its components were highly heritable with moderate to high level of genetic advance. Hence, there is a scope to isolate superior genotypes for improving yield through simple selection procedures. These results are supported by Jalgankar *et al.* (1990) and Indiresh *et al.* (1992).

In general genotypic correlation coefficients were higher than phenotypic correlation coefficients, which might be due to the masking effect of environment in the total expression of the genotypes resulting in reduced phenotypic association (Table 2). Similar higher genotypic correlation was also reported in turmeric by Mohanty (1979). The yield displayed significant and positive association with plant height, number of tillers plant^{-1} and number of leaves plant^{-1} both at phenotypic and genotypic levels.

Table 2. Phenotypic (P) and genotypic (G) correlations in turmeric

		Plant height	No. of tillers plant^{-1}	No. of leaves plant^{-1}	Rhizome yield
Plant height	P		0.77**	0.90**	0.82*
	G		0.88**	0.96**	0.85**
No. of tillers plant^{-1}	P			0.73*	0.86**
	G			0.79*	0.97**
No. of leaves plant^{-1}	P				0.74*
	G				0.77*

*=Significant at 1% level; **=Significant at 5% level

The results indicated that these traits have certain inherent relationship with yield and suggests their importance in determining rhizome yield. Similar results have been reported by Naresh *et al.* (1981) and Manohar *et al.* (2004). The study indicated that plant height was highly and significantly correlated with number of tillers plant^{-1} and number of leaves plant^{-1}. Similarly number of tillers plant^{-1} showed significant positive correlation with number of leaves plant^{-1} both at genotypic and phenotypic levels.

The path co-efficient analysis was worked out to get an insight into the direct and indirect effects of different characters on yield (Table 3). The residual effect of 0.1056 revealed that 89% of yield was contributed by the characters studied and thus indicated the adequacy of the character. Number of tillers plant^{-1} exerted the highest positive direct effect followed by plant height. Number of leaves had negative direct effect, but had maximum positive indirect effect via number of tillers plant^{-1}. These results are supported by Naresh *et al.* (1981).

Table 3. Direct and indirect effects obtained through path coefficient analysis in turmeric

		Plant height	Tillers plant^{-1}	Leaves plant^{-1}
Plant height	P	(0.47)	0.44	-0.08
	G	(0.06)	0.83	-0.04
Tillers plant^{-1}	P	0.36	(0.57)	-0.07
	G	0.06	(0.94)	-0.03
Leaves plant^{-1}	P	0.42	0.42	(-0.09)
	G	0.06	0.75	(-0.04)

Residual effect=0.10565 (Values in parentheses are direct effects)

Summarizing the association between different characters and path analysis, it can be concluded that due emphasis should be given to the genotypes which are tall and produce more number of tillers plant^{-1} in the selection process.

References

Alji Bouri H A, Miller P A & Robinson H F 1979 Genotypic and environmental variances and covariance and upland cotton crosses of interspecific origin. Agron. J. 50: 633–36.

Allard R W 1960 Principles of Plant Breeding. John wiley and sons, Inc., Newyork, pp.485.

Burton G W 1952 Quantitative inheritance in grasses. (pp.273–83) Proc. Sixth International Grassland Congress, August 17-23, 1952, Pennsylvania State College, USA.

Chaudhary A S, Sachan S K & Singh R L 2006 Studies on varietal performance of turmeric (*Curcuma longa* L). Ind. J. Crop Sci. 1: 189–190.

Dewey D R & Lu K H 1959 A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. 51: 515–518.

Indiresh K M, Uthaiah B C, Reddy M J & Rao K B 1992 Genetic variability and heritability studies in turmeric (*Curcuma Longa* L.). Ind. Cocoa Arec. Spices J. 27: 53.

Jalgankar R, Jamadagni B M & Selvi M J 1990 Genetic variability and correlation studies in turmeric. Ind. Cocoa Arec. Spices J. 14: 20–22.

Johnson H W, Robinson H F & Comstock R E 1955 Estimates of genetic and environmental variability in soybeans. Agron. J. 47: 314–318.

Manohar A, Venkata P, Reddy Y N & Ganesh M 2004 Variability and correlation studies in turmeric (*Curcuma Longa* L.). Crop Res. 27: 275–281.

Mohanty D C 1979 Genetic variability and inter relationship among rhizome yield and yield components in turmeric (*Curcuma Longa* L.). Progressive Hort. 19: 83–86.

Naresh P, Arya P S & Korl B N 1981 Path analysis in turmeric (*Curcuma Longa* Linn.). Madras Agri. J. 68: 676–678.

Pathania N K, Singh P & Singh M 1988 Variability studies in turmeric (*Curcuma Longa* Linn.). Ind. J. Agril. Res. 22: 176–178.

Philip J & Nair P C S 1986 Studies on variability, heritability and genetic advance in turmeric. Ind. Cocoa Arec. Spices J. 10: 29–30.

Pillai P K T & Nambair M C 1974 Germplasm collection and cataloguing of turmeric. Annual Report. Central Plantation Crops Research Institute, Kasaragod, pp.136.

Subbarayudu M, Reddy R K & Rao M R 1976 Studies on varietal performance of turmeric. Andhra Agri. J. 23: 195–198.

Yadav D S & Singh R 1996 Studies on genetic variability in turmeric (*Curcuma longa* L.). J. Hill Res. 9: 33–36.