

Genetic Variability, Heritability and Correlation Coefficient in Turmeric (*Curcuma longa* L.) in Allahabad Agro-Climatic Condition

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ABSTRACT

The present investigation on genetic variability, heritability and correlation coefficient in turmeric (*Curcuma longa* L.) in Allahabad agro-climatic condition study including mean, genotypic and phenotypic variances, coefficient of variation, heritability, and genetic advance was conducted on genetically diverse thirteen genotypes of Turmeric. KTS-2 in 13 genotypes was found superior in terms of rhizome yield per ha. Traits like plant height (30, 60, 90 and 120 DAS), number of leaves (30, 60, 90, and 120 DAS), days to maturity, weight of rhizome (g/plant), dry matter recovery (g/plant), yield (q/ha), curcumin content (%), showed positive correlation with rhizome yield per ha, plant height after 120 DAS, days to sprouting, showed negative correlation at both phenotypic and genotypic level. Genetic advance at 1% was found high for plant height after 90 DAS plant height after 120 DAS, weight of rhizome per plant, rhizome yield per ha. Large amount of variability exhibited in the genotypes for selection. Significant differences were observed among the genotypes for all the traits. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the traits. Whereas genetic advance as percent of mean at 1% was noticed high for all the traits. Weight of rhizome per plant exhibited the highest positive direct effect followed by days to sprouting, curcumin content, plant height 120 DAS, at genotypic level. In view at the direct and indirect contributions of component traits towards rhizome yield/ha, selection on the basis of horticultural traits viz; would be a paying proposition in the genotypes included in the study.

INTRODUCTION

Turmeric is the dried rhizome of *Curcuma longa*, a rhizomatous herbaceous perennial plant, believed to be native of South East Asia. It is an important spice plant valued all over the world from ancient period for its use as spice, medicinal and cosmetic products.

India is popularly known as the "Spice Bowl of the World" as a wide range of spices with premium quality is grown in the country since ancient times. In Vedas, as early as 6000 BC, scruples evidences are available regarding various spices, their properties and utility. Among the commodities that were traded during that period, spices occupied a major portion due to their superior quality and diversity which attracted foreigners to India. Turmeric is widely cultivated in different countries such as India, China, Myanmar, Nigeria, Bangladesh, Pakistan, Sri Lanka, Taiwan, Burma, Indonesia, etc. Among these countries, India occupies the first position in area, viz. 193395 ha and also in production, viz. 943.30 tonnes during 2017-18. In India, turmeric is grown in its 18 states. The states like Andhra Pradesh, Tamil Nadu, Karnataka, Odisha and West Bengal are the major turmeric-producing states in India. The major countries that export turmeric are: India, China, Myanmar and Bangladesh. Indian quality is good in the international market. India has occupied around turmeric fetches a premium price due to its superior 60 per cent of the world trade in turmeric.

In India Turmeric also known as the 'Golden Spice', it is a traditional crop. It has been traditionally used in Ayurveda. India is the largest producer of turmeric. India leads production with around 80% of the global production, while other major producers are China, Myanmar, Vietnam, Bangladesh, Indonesia &

Cambodia. Due to a high production, India has exports turmeric in huge quantity across the globe. Last financial year 2011-12 led to record high exports of 79,500 MT for against 49,250 MT in year 2010-2011. The study will be helpful in analysing the genetic variability and several other parameters of turmeric and will be beneficial for the cultivation of the crop.

MATERIAL AND METHODS

The present experiment entitled "Genetic variability, Heritability and coefficient correlation in turmeric (*Curcuma longa* L.) in Allahabad Ago-climatic Condition." was carried out during 2012-13 at Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad.

This region has a subtropical climate with both the extremes in the temperature i.e. the summer and winter. In cold winter the temperature drops as low as 1^o C in the month of Dec - Jan. and rises as high as 48^o C during the months of May - June. Frost during winter and hot scorching winds in summer is a common feature. The average rainfall is about 850-1100 mm with maximum concentration during July - Sep and occasional shower in winter. Thirteen genotypes were growing in a Randomized Blok Design with 3 replications. The observation were recorded on the sprouting, plant height in 30 days intervals, no. of leaves in 30 days intervals, days to maturity, rhizome weight/plant, curcumin content (%) and yield (q/ha.)

RESULTS AND DISCUSSION

The information on genetic parameters of the population of 13 turmeric genotypes under study is given in *Table 1*. A wide

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range of variation was observed among different 13 genotypes of turmeric with regard to different characters. Largest variation was exhibited by the character weight of rhizome (g/plant) 152.33 - 250.66 g/plant followed by yield (q/ha.) 212.22 - 284.81 q/ha, days to maturity (187 - 227days), dry matter recovery (g/plant) 35.03 - 59.16 g/plant, plant height in 120 days (14.59 - 21.5 cm), number of leaves (8.26 - 13.31) and curcumin content (3.43 - 7.16) in different genotypes of turmeric. In general phenotypic coefficient of variability (PCV) was higher in magnitude than the genotypic coefficient of variability (GCV) for all the characters. This indicated larger influence of environment for the expression of these characters. The phenotypic coefficient of variability was maximum for curcumin content 20.57, yield q/ha 18.80, weight of rhizome gm/ha 17.86, Dry matter of recovery 17.05. The lowest phenotypic coefficient of variability was observed in days to maturity 9.32 followed The findings of present study are in agreement with (Datta *et al.*, 2006) have also reported the lowest PCV for plant height. The magnitudes of PCV for most of the characters were relatively close to the corresponding magnitudes of GCV. This suggested that environmental components had relatively less influence on these characters as compared to other characters under study. Similar results have also been reported by (Kumar, 2013). The lowest GCV for days to sprouting followed by days to maturity 8.13 and 9.27; respectively while the highest GCV was observed in curcumin content 19.99 followed by yield q/ha, weight of rhizome, dry matter recovery, number of leaves and plant height which were 18.48 q/ha, 17.66g/plant, 15.94 g/plant, 15.89 and 12.48 respectively this characters may provide the chance of selection from further improvement due to high genotypic coefficient of variability

High heritability estimates of a character provide a measure of the effectiveness of selection on phenotypic basis for that particular character. All the characters studies showed very high (above 80%) heritability except days to sprouting 74. Low heritability value combined with low GCV indicating the large influence of environment for the expression of this trait (Ravishanker *et al.*, 2013) indicated the limitations of estimating heritability in narrow sense, as it included both additive and

Table 2. Analysis of variance of variance for 14 characters of 13 turmeric genotypes

Characters	Replication df=2	Treatment df=12	Error df=24
Days of sprouting	0.2496	11.3764**	1.1938
Plant ht. in 30 days (cm)	0.0163	3.1168**	0.0162
Plant ht. in 60 days (cm)	0.0191	5.3951**	0.0166
Plant ht. in 90 days (c.m.)	0.0330	10.7724**	0.0385
Plant ht. in 120 days (c.m.)	0.1092	15.5700**	0.2761
Plant leaves in 30 days	0.0563	1.5075**	0.0422
Plant leaves in 60 days	0.0029	2.2125**	0.0539
Plant leaves in 90 days	0.0399	4.6280**	0.0480
Plant leaves in 120 days	0.0023	7.7767**	0.0587
Days of maturity	5.3333	1114.9146**	3.8889
Dry matter recovery (q/ha.)	3.2930	165.7874**	7.5852
Rhizome wt. per plant	113.2564	3572.0256**	27.5064
Yield (q/ha.)	47.0552	2138.6292**	24.6879
Curcumin content (%)	0.0011	3.0921**	0.0602

*Significant at 5 %

**Significant at 1% level

epistatic gene effects and suggested that heritability estimates in broad sense will be reliable if accompanied by a high genetic advance.

Thus results indicated that in turmeric individual plant selection based on curcumin content and weight of rhizome/plant.

SUMMARY AND CONCLUSION

The mean values were subject to statistical analysis and the salient features of the results are summarized below:

Significant difference among genotype for plant height 30 days intervals, no. of leaves 30 days intervals, days to sprouting, weight to rhizomes, dry matter of recovery, yield curcumin content and days to maturity (Yudhvir, 2003).

T_0 estimate of the phenotypic coefficient of variation was higher than the genotypic coefficient of variation for the all traits.

Table 3. Genetic parameters for yield and yield determining characters in Turmeric

Character	Range Min.-max.	Mean	PCV (%)	GCV (%)	h^2 (b)	Genetic advance 5%-1%	Genetic gain (as % of mean) 5%-1%
1. days to sprouting	20.11-27..26	22.6	9.46	8.13	74	3.26-4.18	14.41-18.47
2. Plant Height (30 Days)	3.7-7.11	5.18	19.75	19.59	98	2.08-2.66	40.05-51.32
3. Plant Height (60 Days)	6.7-11.13	8.46	15.89	15.82	99	2.75-3.52	32.44-41.58
4. Plant Height (90 Days)	10.13-16.63	12.74	14.92	14.84	99	3.88-4.97	30.40-38.96
5. Plant Height (120 Days)	14.59-21.50	18.08	12.82	12.48	95	4.53-5.81	25.05-32.10
6. Plant Leaves (30 Days)	3.14-5.43	4.05	17.97	17.24	92	1.38-1.77	34.07-43.66
7. Plant Leaves (60 Days)	4.7-7.29	6.16	14.270	13.77	93	1.69-2.16	27.35-35.05
8. Plant Leaves (90 Days)	6.34-10.17	8.12	15.45	15.21	97	2.51-3.21	30.86-39.55
9. Plant Leaves (120 Days)	8.26-13.31	10.09	16.07	15.89	98	3.27-4.19	32.36-41.47
10. Days to Maturity	180-227.66	207.64	9.32	9.27	99	39.44-50.54	18.99-24.34
11. Weight of Rhizome (g/Plant)	152.33-250.66	194.64	17.86	17.66	98	70-89.71	35.96-46.09
12. Dry Matter of Recovery (g/Plant)	35.03-59.16	45.56	17.0	15.94	87	13.99-17.93	30.70-39.34
13. Yield (q/ha.)	112.22-184.81	143.66	18.80	18.48	97	53.75-68.88	37.41-47.95
14. Curcumin Content	3.43-7.16	5.02	20.57	19.99	94	2.01-2.58	40.00-51.26

Heritability in broad sense recoded highest in 99% (plant height at 60 and 90 days) and days of maturity followed by 98% (in plant height 30 days, no. of leaves 120 days and weight of rhizomes) while the lowest heritability was observed in days of sprouting 74%. The estimation of genotypic correlation was higher than the phenotypic correlation for all the traits (Rajalakshmi, 2013).

Yield (q/ha.) was significantly and positively correlation with plant height in 30 days intervals, number of leaves in 30 days intervals and weight of rhizomes (g/plant) except days to sprouting at phenotypic level. (Roy *et al.*, 12) Yield (q/ha.) was significantly and positively correlated with plant height in 30 days intervals, number of leaves at 30 days intervals and weight of rhizomes (gm/plant) except days to sprouting at genotypic level.

Yield (q/ha) was significantly and positively correlated with curcumin content at genotypic and phenotypic level (Sharon *et al.*, 13).

Based on the man performance KTS-2 (284.81q/ha.) closely followed by Pratibha (278.84 q/ha.) were founded then high yielded, while AAI-T3 and Chakrata recorded lowest 212.22 q/ha and 212.61q/ha. respectively.

Based on the quality of point of view in curcumin content Rajendra Sonia closely followed by Pratibha 7.16% and 6.23% recorded respectively. While the lowest curcumin content observed in 3.43% in 9803 genotype.

From the present investigation, it is concluded that among the 13 turmeric genotypes evaluated in Allahabad Agro-Climatic condition. The genotype KTS-2 gave maximum yield (i.e., 284.81q/ha. with 4.3% curcumin content). While the highest curcumin was observed in genotype Rajendra Sonia which was 7.16% with rhizome yield 270 q/ha. The high heritability was observed for plant height (120 days), days to maturity and weight of rhizome which was 99, 99, and 98 respectively and high genetic advance weight of rhizome 70% and yield/ha. 53% observed. The genotypic correlation for various observation showed the significant and positive correlation with yield like plant height (120 days) plant leaves (30 and 60 days), days to maturity, weight of rhizome and dry matter recovery which was 0.2370, 0.56, 0.44, 0.21, 0.99 and 0.86 respectivel

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