ISSN: 2455-3794

Contents lists available at http://www.albertscience.com

ASIO Journal of Engineering & Technological Perspective Research (ASIO-JETPR)

Volume 1, Issue 1, 2015, 06-10

GENETIC UNPREDICTABILITY, HERITABILITY AND CORRELATION COEFFICIENT IN TURMERIC (*CURCUMA LONGA* L.) IN ALLAHABAD AGRO-CLIMATIC CONDITION

Sumit Sharma[1], Devi Singh[1] and Sanjive Kumar Singh[2†]

[1]Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Deemed to be University, Allahabad-211007, U.P.,India

[2†]C. S. A. U. A. & T., Kanpur, India.

ARTICLE INFO

Short Article History (Research)

Received: 27 August, 2015
Accepted: 12 November, 2015

Corresponding Author:

†Sanjive Kumar Singh

C. S. A. U. A. & T., Kanpur, U.P., India.

Mail ID: sumitsharma20j@gmail.com

ABSTRACT

The present study on genetic unpredictability, 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 performed on genetically diverse nineteen genotypes of Turmeric. KTS-2 in 13 genotypes was found superior in terms of rhizome yield per ha. Large amount of variability exhibited in the genotypes for selection. Considerable differences were found among the genotypes for all the traits. The phenotypic coefficient of variation (PCV) was much greater than genotypic coefficient of variation (GCV) for all the traits. 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. As per genetic advance, it was found in 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 preposition in the genotypes included in the study.

Keywords:- turmeric, curcumin content, genotypes, unpredictability

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 [1-3].

India is popularly known as the "Spice Bowl of the World" as a wide variety 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 the Golden Spice is widely cultivated in different countries such as India, China, Myanmar, Nigeria, Bangladesh, Pakistan, Sri Lanka, Taiwan, Burma, Indonesia, etc.

dids no.: 01.2016-19818151, dids Link: http://dids.info/didslink/01.2016-96917894/

Among these countries, India occupies the first position in area, viz.1, 75,300 ha and also in production, viz.7, 94,400 tones during 2007-08. In India, turmeric is grown in its 18 states. The states like Andhra Pradesh, Tamil Nadu, Karnataka, Orissa 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 [2, 4-6].

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 [7-9].

MATERIAL AND METHODS

In this current experiment entitled "Genetic variability, Heritability and coefficient correlation in turmeric (*Curcuma longa* L.) in Allahabad Ago-climatic Condition." was conducted for the duration of 2012 at Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad. The materials used, techniques adopted and observations recorded during the course of investigation are indicated in this chapter. Allahabad situated in the south eastern portion of Uttar Pradesh has an elevation of 78 meters above sea level at 25.85^0 N and 81.15^0 E longitudes. The experiment was conducted in the Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad in the rainy season.

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 1^0 C in the month of Dec – Jan. and rises as high as 48^0 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. The average monthly rainfall, maximum and minimum temperature and relative humidity recorded at SHIATS, Allahabad during the observatory period are shown in the meteorological data.

Table 1: Details of layout

Design	RBD
Number of treatment (germplasm)	13
Replication	3
Total no of plots	39
Size of each plots	1.5 x 2.0m
Width of main irrigation channel	1.0m
Width of sub irrigation channel	0.5m
Length of field	37.5m
Width of fie	10.5m
Spacing (Row to Row)	40-60cm
(Plant to Plant)	25cm
Width of bund	0.3m

dids no.: 01.2016-19818151, dids Link: http://dids.info/didslink/01.2016-96917894/

RESULTS AND DISCUSSION

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

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**

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 Pathania *et al.* (1988) 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 Ranjan Jalgaonkar *et al.* (1990). The lowest GCV for days to sprouting followed by days to maturity 8.13and 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.

These characters may provide the chance of selection from further improvement due to high genotypic coefficient of variability.

dids no.: 01.2016-19818151, dids Link: http://dids.info/didslink/01.2016-96917894/

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. Ramanujam and Thirumalachar (1967) indicated the limitations of estimating heritability in narrow sense, as it included both additive and epistatic gene effects and suggested that heritability estimates in broad sense will be reliable if accompanied by a high genetic advance.

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

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

Character Min.-max.	Range	Mean	PCV (%)	GCV (%)	h^2 (b) 5%-1%	Genetic Advance 5%-1%	Genetic gain (as % of mean)
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

CONCLUSION

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

1. 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 cucumin content and days to maturity.
2. Te estimate of the phenotypic coefficient of variation was higher than the genotypic coefficient of variation for the all traits.
3. 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%.
4. The estimation of genotypic correlation was much greater than the phenotypic correlation for all the traits.
5. 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 (gm/plant) except days to sprouting at phenotypic level.
6. 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.
7. Yield (q/ha) was significantly and positively correlated with curcumin content at genotypic and phenotypic level.
8. 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.
9. 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.

dids no.: 01.2016-19818151, dids Link: http://dids.info/didslink/01.2016-96917894/

From this investigation, it was 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 of Rajendra Sonia, it 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 respectively.

REFERENCES

1. Allard, R.W. 1960. Principles of plant breeding. New York, John Wiley and Sons, pp. 89-98.
2. Burton, G.W. 1952. Quantitative inheritance in grasses. 6th Int. Grassland Congress, 1: 277-83.
3. Johnson, H.W.; Robinson, H.F. and Comstock, R.E. 1955. Genotypic and phenotypic correlations in Soybeans and their implication in selection. Agronomy. Journal. 47: 477-483.
4. Panse, V.G. 1957. Genetics of quantitative characters in relation to Plant Breeding. Indian Journal of. Genetics and Plant Breeding. 17: 318-28.
5. Panse, V.G. and Sukhatme, P.V. 1985. Statistical Methods for Agricultural Workers, Indian Council of Agricultural Research, New Delhi.
6. Pathania, N.; Singh, M. and Arya, P.S. 1988. Genetic evaluation of some economic traits in turmeric (Curcuma longa L.). Himachal J. Agricultural Research. 14 (1): 38-43.
7. Ramanujam, S. and Thirumalachar, D.K. 1967. Genetic variability certain characters in red pepper (*Capsicum annum).Mysore Journal of Agriculture Science*. 1: 30-36.
8. Ranjan Jagaonkar, Jamadagni, B.M. and Salvi,M.J. 1990. Genetic variability and correlation studies in turmeric. *Indian Cocoa, Arecanut and spices Journal.* Vol. XIV (1): 20-22.
9. Singh, R.K. and Chaudhary, B.D. 1977. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Pub., Ludh.

dids no.: 01.2016-19818151, dids Link: http://dids.info/didslink/01.2016-96917894/