Int.J.Curr.Microbiol.App.Sci (2020) *9*(2): 200-207

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 2 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.902.025

Correlation and Path Coefficient Analysis for Seed Cotton Yield, Yield Attributing and Fibre Quality Traits in Cotton (*Gossypium hirsutum* L.)

Shruti[1], H. C. Sowmya[1], J. M. Nidagundi[1], R. Lokesha[1], B. Arunkumar[1] and Shankar M. Murthy[2]

[1]Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Raichur – 584101, Karnataka, India
[2]Department of Entomology, College of Agriculture, University of Agricultural Sciences, Raichur – 584101, Karnataka, India

**Corresponding author*

A B S T R A C T

Keywords

Correlation, Path coefficient, Seed cotton, Yield

Article Info

Accepted:
05 January 2020
Available Online:
10 February 2020

The present study was conducted on correlation and path coefficient analysis for seed cotton yield, its components and fibre quality traits in 20 cotton genotypes collected from Main Agricultural Research Station, UAS, Raichur, which was carried out during *kharif* 2018. The study revealed that plant height at harvest, number of sympodia, inter nodal length, number of bolls per plant and seed index had significant positive correlation with seed cotton yield whereas traits fibre strength and micronaire value exhibited negative correlation with seed cotton yield. Similarly path coefficient analysis revealed that number of sympodia exhibited maximum direct effect on yield.

Introduction

Cotton (*Gossypium hirsutum L.*) is an important commercial crop grown all over the world which is mainly grown for its fibre. Cotton referred as “White gold” is premier cash and fibre crop cotton, the world’s most important non-food agricultural commodity used for textile purpose. Worldwide cotton is grown over an area of 33.30 m ha with productivity of 792 kg per ha as per USDA, 2018. India ranks first in global scenario (about 33% of the world cotton area). The average productivity of cotton in India is low (560 kg lint per ha) when compared to the world average (792 kg per ha) and some of the leading producers of lint are namely, Australia (1781 kg per ha), China (1761 kg per ha), Brazil (1522 kg per ha), USA (974 kg per ha), and Pakistan (699 kg per ha). Development of cotton varieties and hybrids having greater yield potential with acceptable fibre characteristics is the main objective of cotton breeders. Seed cotton yield, its components and fibre quality characters of a plant are heritable in nature (Poehlman and Sleper, 1995) and thus genetic improvement in all these characters through selection and breeding is possible. Correlation coefficient analysis measures the magnitude of relationship between various plant characters and determines the component character on which selection can be based for improvement in seed cotton yield and fibre quality. Hence, the present investigation was carried out to find the nature of correlation among various characters and their direct and indirect influence on seed cotton yield of *Gossypium hirsutum* L.

Materials and Methods

During *kharif* (2018) 20 cotton genotypes were evaluated at Experimental block of Agricultural College, Bheemarayanagudi, Karnataka in a Randomised Complete Block Design with three replications and spacing of 90×30 cm.

Five plants at random were taken in each genotype and data on Plant height at harvest, number of monopodia per plant, number of sympodia per plant, sympodial length at ground level, sympodial length at 50% plant height, inter-nodal length, number of bolls per plant, boll weight, upper half mean length (UHML), fibre strength and micronaire value, ginning outturn, seed index, lint index and seed cotton yield were recorded. Correlation coefficients between different characters were worked out as per Singh and Narayanan (1993). Phenotypic correlation coefficients were further partitioned into direct and indirect effects by path analysis as suggested by Dewey and Lu (1959). This study was conducted to find the interrelationship of various yield attributing traits on seed cotton yield.

Results and Discussion

The results of phenotypic correlation and path coefficient analysis are presented in Table 1 and 2, respectively. Path diagram based on the phenotypic correlation is presented in Figure 1. Computation of correlation between yield and yield attributing traits is of considerable importance in plant selection. At phenotypic level, seed cotton yield has shown significant positive correlation with plant height (0.299), number of sympodia per plant (0.501), inter nodal length (0.535), number of bolls per plant (0.520) and seed index (0.495) indicating the increase in seed cotton yield is due to increase in one or more of the above traits. Therefore, selection on these traits will be useful in increasing the seed cotton yield. These results were in agreement with the findings of Ashok and Ravikesavan (2010), Shazia *et al.*, (2010), Thiyagu *et al.*, (2010), Patel *et al.*, (2013), Vinodhana *et al.*, *(*2013), Erande *et al.*, (2014), Farooq *et al.*, (2014), Ahsan *et al.*, (2015), Pradeep *et al.*, (2014), Padmavathi *et al.*, (2015), Reddy *et al.*, (2015), Abdullaah *et al.*, (2016), Angadi *et al.*, (2016), Memon *et al.*, (2017). Plant height exhibited significant positive correlation with number of monopodia per plant (0.379), number of sympodia per plant (0.573), sympodial length at ground level (0.285), sympodial length at fifty per cent of plant height (0.592), number of bolls per plant (0.389), seed index (0.333) and lint index (0.283). Number of monopodia exhibited significant positive correlation with sympodial length at fifty per cent of plant height (0.295).

The number of sympodia has shown significant positive correlation with sympodial length at ground level (0.319), sympodial length at fifty per cent of plant height (0.399), number of bolls per plant (0.483), boll weight (0.344) and seed index (0.344).

Table.1 Phenotypic correlation among 15 character in advanced lines of cotton (*Gossypium hirsutum* L.)

	PH	NM	NS	SLG	SLFPH	IND	NBP	BW	UHML	FS	MIC	GOT	SI	LI	SCY
PH	**1.000**	0.379**	0.573**	0.285*	0.592**	0.124	0.389**	0.218	-0.104	-0.137	0.084	0.166	0.333**	0.283*	**0.299***
NM		**1.000**	0.105	-0.140	0.295*	-0.153	0.002	0.004	-0.077	0.172	0.015	-0.297*	0.041	-0.150	**0.082**
NS			**1.000**	0.319*	0.399**	0.109	0.483**	0.344**	-0.047	0.017	0.023	0.021	0.344**	0.055	**0.501****
SLG				**1.000**	0.124	0.251*	0.260*	0.314*	-0.039	-0.087	0.147	0.086	0.274*	0.094	**0.230**
SLFPH					**1.000**	0.258*	0.237	0.215	-0.109	-0.052	0.237	0.120	0.058	0.179	**0.031**
INL						**1.000**	0.491*	0.116	-0.114	-0.328*	-0.088	0.195	0.371	0.188	**0.535****
NBP							**1.000**	0.431**	-0.107	-0.046	-0.050	0.295*	0.487**	0.311*	**0.520****
BW								**1.000**	-0.331**	0.137	-0.237	0.331 *	0.134	0.242	**0.209**
UHML									**1.000**	0.243	-0.027	-0.226*	-0.053	-0.086	**0.002**
FS										**1.000**	-0.125	-0.366**	-0.074	-0.221	**-0.162**
MIC											**1.000**	-0.104	-0.114	0.022	**-0.038**
GOT												**1.000**	0.016	0.780**	**0.057**
SI													**1.000**	0.330*	**0.495****
LI														**1.000**	**0.142**

* Significant at 5% (p = 0.05) ** Significant at 1% (p = 0.01)

PH- Plant height (cm), NM- Number of monopodia, NS- Number of sympodia, SLG- Sympodial length at ground level (cm), SLFPH- Sympodial length at 50% plant height (cm), INL- Inter nodal length (cm), NBP- Number of bolls per plant, BW- Boll weight (g), UHML- Upper half mean length (mm), FS- Fibre strength, MIC- Micronaire (µg/inch), GOT-Ginning outturn (%), SI-Seed index (g), LI-Lint index (g), SCY-Seed cotton yield (kg/ha

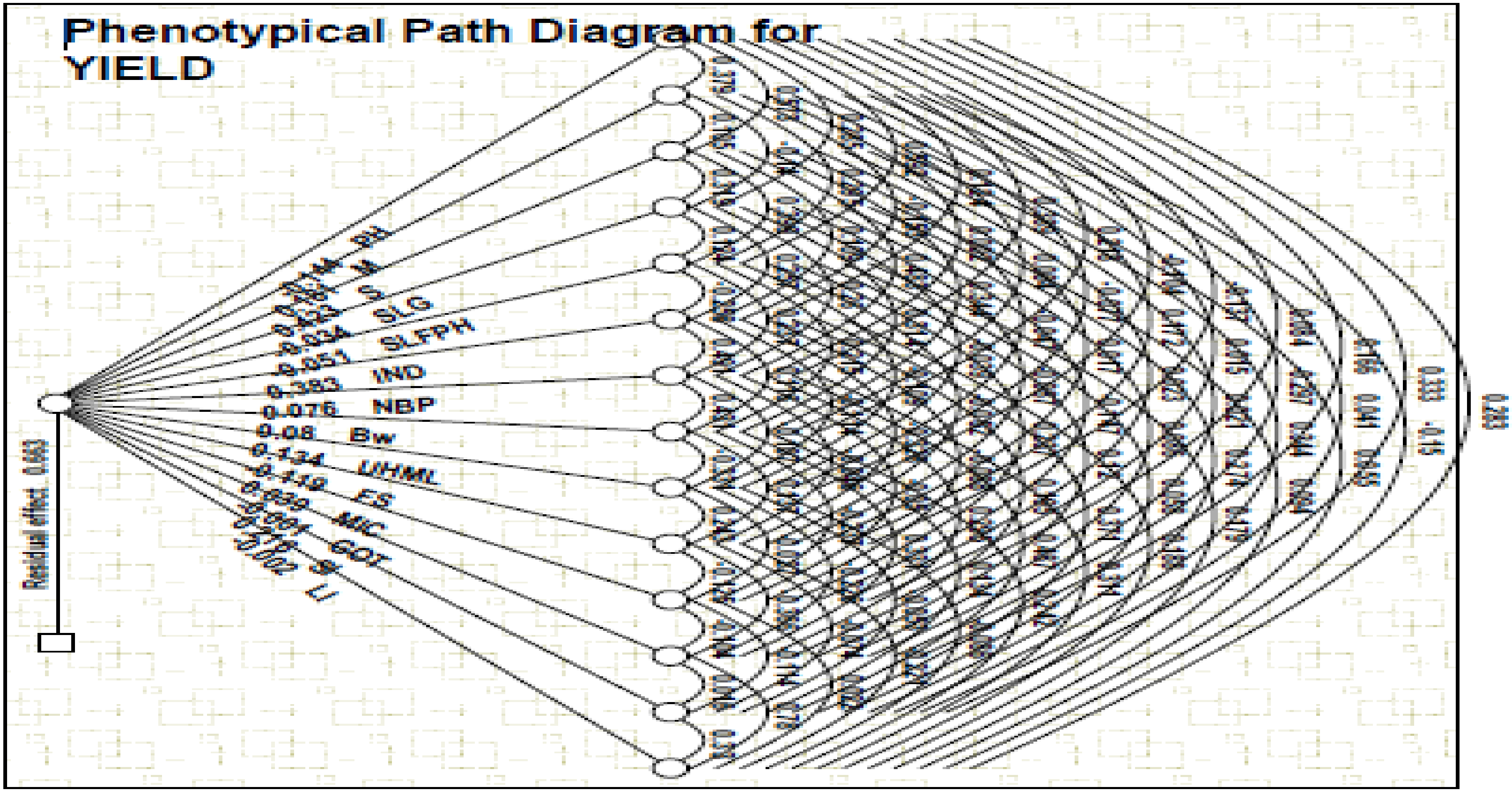
Table.2 Phenotypic path analysis for 15 yield, yield attributing and fibre quality traits in advanced lines of cotton (*Gossypium hirsutum* L.)

	PH	NM	NS	SLG	SLFPH	IND	NBP	BW	UHML	FS	MIC	GOT	SI	LI	SCY
PH	**-0.1438**	-0.0546	-0.0824	-0.0411	-0.0851	-0.0178	-0.0560	-0.0314	0.0149	0.0198	-0.0120	-0.0239	- 0.0479	-0.0407	**0.2988***
NM	0.0687	**0.1810**	0.0191	-0.0253	0.0535	-0.0276	0.0004	0.0007	-0.0139	0.0312	0.0027	-0.0537	0.0075	-0.0272	**0.0819**
NS	0.2423	0.0446	**0.4228**	0.1349	0.1685	0.0459	0.2044	0.1455	-0.0200	0.0072	0.0095	0.0090	0.1454	0.0232	**0.5010****
SLG	-0.0096	0.0047	-0.0107	**-0.0336**	-0.0042	-0.0086	-0.0087	-0.0106	0.0013	0.0029	0.0049	-0.0029	-0.0092	-0.0032	**0.2303**
SLFPH	-0.0300	-0.0150	-0.0202	-0.0063	**-0.0507**	0.0131	-0.0120	-0.0109	0.0055	0.0026	-0.0120	-0.0061	-0.0029	-0.0091	**0.0314**
IND	0.0474	-0.0585	0.0417	0.0985	-0.0988	**0.0383**	0.1881	0.0444	-0.0438	-0.1258	-0.0339	0.0748	0.1424	0.0722	**0.5350****
NBP	0.0296	0.0002	0.0368	0.0198	0.0181	0.0374	**0.0762**	0.0328	-0.0081	-0.0035	-0.0038	0.0225	0.0371	0.0237	**0.5201****
BW	0.0174	0.0003	0.0274	-0.0250	0.0172	0.0092	0.0343	**0.0797**	-0.0264	0.0109	-0.0189	0.0264	0.0107	0.0193	**0.2085**
UHML	-0.0139	-0.0103	-0.0063	-0.0053	-0.0146	-0.0153	-0.0143	-0.044	**0.1338**	0.0325	-0.0037	-0.0302	-0.0071	-0.0115	**0.0022**
FS	0.0164	-0.0205	-0.0020	0.0103	0.0062	0.0391	0.0055	-0.0163	-0.0289	**-0.1192**	0.0149	0.0436	0.0088	0.0263	**-0.1616**
MIC	0.0033	0.0006	0.0009	-0.0058	0.0093	-0.0035	-0.0020	-0.0093	-0.0010	-0.0049	**0.0392**	-0.0041	-0.0044	0.0009	**-0.0377**
GOT	-0.0001	0.0002	0.0000	0.0000	-0.0001	-0.0001	-0.0002	-0.0002	0.0001	0.0002	0.0000	**-0.0005**	0.0000	-0.0004	**0.0567**
SI	0.0719	0.0089	0.0742	0.0592	0.0125	0.0802	0.1051	0.0289	-0.0115	-0.0159	-0.0245	0.0035	**0.2159**	0.0712	**0.4953****
LI	-0.0006	0.0003	-0.0001	-0.0002	-0.0004	-0.0004	-0.0007	-0.0005	0.0002	0.0005	0.0000	-0.0017	-0.0007	**-0.0022**	**0.1423**

Residual effect = 0.663 * Significant at 5% (p = 0.05) ** Significant at 1% (p = 0.01)

PH- Plant height (cm), NM- Number of monopodia, NS- Number of sympodia, SLG- Sympodial length at ground level (cm), SLFPH- Sympodial length at 50% plant height (cm), INL- Inter nodal length (cm), NBP- Number of bolls per plant, BW- Boll weight (g), UHML- Upper half mean length (mm), FS- Fibre strength, MIC- Micronaire (µg/inch), GOT-Ginning outturn (%), SI-Seed index (g), LI-Lint index (g), SCY-Seed cotton yield (kg/ha)

Figure.1 Phenotypic path diagram for yield, yield attributing and fibre quality traits



Sympodial length at ground level exhibited significant positive correlation with inter-nodal length (0.251), number of bolls per plant (0.260), boll weight (0.314) and seed index (0.274). Sympodial length at fifty per cent plant height exhibited significant positive correlation with inter-nodal length (0.258). Number of bolls exhibited significant and positive correlation with boll weight (0.431), ginning outturn (0.295), seed index (0.487) and lint index (0.311). These results confirmed the findings of Abbas *et al.*, (2015), Angadi *et al.*, (2016) and Irfan *et al.*, (2018). Boll weight exhibited significant positive correlation with Ginning outturn (0.331). Similar findings were reported by Srinivas *et al.*, (2014). UHML has shown significant negative correlation with ginning outturn (-0.226) as reported by Angadi *et al.*, (2016). Fibre strength has shown significant negative correlation with ginning outturn (-0.366) as reported by Srinivas *et al.*, (2014). Ginning outturn exhibited significant positive association with lint index (0.780). Similar reports were given by Preetha and Raveendran (2007). Significant positive association of seed index was found with lint index (0.330). Trait like intermodal length shown significant negative association with fibre strength. Negative correlation between yield and quality traits make the selection procedure difficult where both the parameters have to be developed simultaneously. Meredith and Bridge (1971) found that linkage was primary cause for negative correlation between yield and fibre quality traits and recommended intermating to break this association. It is essential to resort to the path analysis to know the exact forces that are involving in the strengthening of the total correlation. The number of sympodia per plant (0.422) had highest direct effect on seed cotton yield. Similar results were reported by Neelima *et al.*, (2005), Leela pratap *et al.*, (2007), Padmavati (2008) and srinivasalu (2009). Therefore, selection on number of sympodia will be useful in increasing the seed cotton yield. Whereas traits like plant height, sympodial length at ground level, sympodial length at fifty per cent plant height, fibre strength, ginning outturn and lint index showed negative direct effect on seed cotton yield. Number of monopodia per plant, number of sympodia, inter-nodal distance, number of bolls per plant, boll weight, UHML, micronaire, seed index exhibited low levels of direct effect on seed cotton yield. Therefore, a restricted selection model of direct selection for such traits is suggested for obtaining yield improvement. The results discussed above indicate that correlation, direct and indirect effect estimates vary for different traits with variation in genetic material based on yield component traits and fibre properties. Hence, correlations and direct and indirect effect estimation would provide useful information for planning a successful breeding programme if the genetic material is grouped for yield and fibre quality characters and also it is essential for selection of suitable breeding methodologies for simultaneous improvement of both yield and quality parameters.

In conclusion, seed cotton yield being a complex polygenic character, direct selection based on these traits would not yield fruitful results without giving importance to its genetic background. Correlation analysis helps in examining the possibilities of improving yield through indirect selection of highly correlated component traits. Seed cotton yield had significant positive correlation with plant height, number of sympodia per plant, inter nodal length, number of bolls per plant and seed index indicating the increase in seed cotton yield is due to increase in one or more of the above traits. Therefore, selection on these traits will be useful in increasing the seed cotton yield. Path analysis revealed high positive direct effect of number of sympodia on seed cotton yield. Selection based on this trait would be effective in improving the seed cotton yield.

References

Abbas, H. G., Mahmood, A. and Ali, Q., 2015, Genetic variability and correlation analysis for various yield traits of cotton (*Gossypium hirsutum* L.). *J. Agric. Res.*, 53(4): 481-490.

Abdullah, M., Numan, M., Shafique, M. S., Shakoor, A., Rehman, S. and Ahmad, M. I., 2016, Genetic variability and interrelationship of various agronomic traits using correlation and path analysis in cotton (*Gossypium hirsutum* L.). *Acad. J. Agric. Res*., 4(6): 315-318.

Ahsan, M. A., Majidano, M. S., Bhutto, H., Soomro, A. W., Panhwar, F. H., Channa, A. R. and Sial, K. B., 2015, Genetic variability, coefficient of variance, heritability and genetic advance of some *Gossypium hirsutum* L. accessions. *J. Agric. Sci*., 7(2): 147-151.

Angadi, C., Manjula, S. M., Patil, S. S., Madhura, C., Basavaradder, A. B. and Santosh, H. B., 2016, Correlation and path coefficient analysis of yield component and fibre quality traits of upland cotton (*Gossypium hirsutum* L.). *Int. J. Agric. Sci. Res*., 6(1): 171-176.

Ashok Kumar, K. and Ravikesavan, R., 2010, Genetic studies of correlation and path coefficient analysis for seed oil, yield and fibre quality traits in cotton (*G. hirsutum* L.). *Aust. J. Basic and Appl. Sci.*, 4(11): 5496-5499.

Dewey, D. R. and Lu, K. H., 1959, A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, 51(9): 515-518.

Erande, C. S., Kalpande, H. V., Deosarkar, D. B., Chavan, S. K., Patil, V, S., Deshmukh, J. D., Chinchane, V. N., Anil Kumar, Utpal Dey and Puttawar, M. R., 2014, Genetic variability, correlation and path analysis among different traits in desi cotton (*Gossypium arboreum* L.). *Afr. J. Agric. Res.*, 9(29): 2278-2286.

Farooq, J., Anwar, M., Riaz, M., Farooq, A., Mahmood, A., Shahid, M. T. H., Rafiq, M. S. and Ilahi, F., 2014, Correlation and path coefficient analysis of earliness, fibre quality and yield contributing traits in cotton (*Gossypium hirsutum* L.). *The J. Animal & Plant Sci*., 24(3): 781-790.

Irfan, A. R., Yujun, S., Jinying, L. and Deguang. Y., 2018, Genetic variability, association analysis and path analysis in advance breeding material of *Gossypium hirsutum* L. *Int. J. Biosci.*, 12(1): 294-299.

Leela pratap, k., Chenga Redddy, V., Rama Kumar, P.V. and Srinivasa Rao, V., 2007, Correlation and path coefficient analyses for yield component traits in cotton (*Gossypium hirsutum* L.). *The Andhra Agric. J.*, 54 (1 & 2): 31-35.

Meredith, W. R. and Bridge, R. R., 1971, Break up of linkage blocks in cotton, *Gossypium hirsutum* L. *Crop Sci.*, 11: 695-697.

Memon, S., Baloch, A. W., Gandahi, N., Yasir, T. A., Sarki, S. M., Wasaya, A., Mallano, I. A., Ali, M., Rind, M. A., Baloch, A. M. and Khetran, A. S., 2017, Evaluation of genetic divergence, character associations and path analysis in upland cotton genotypes. *Indian J. Pure Appl. Biol.*, 6(4): 1516-1521.

Neelima, S., Chenga Reddy, V. and Narisi reddy, A., 2005, Association and path analysis in American cotton (*Gossypium hirsutum* L.). *J. Indian Soc. Cotton Improv.*, 30(1): 53-58.

Padmavathi, A., 2008, Characterization of cotton germplasm (*Gossypium hirsutum* L.). *M.Sc. (Agri.) Thesis*, Acharya N.G.

Ranga Agricultural Univ., Rajendranagar, Hyderabad.

Padmavathi, A., Ahamed, M. and Kumar, P., 2015, Association analysis of yield and fibre quality characters in upland cotton. *J. Cotton Res. Dev*., 29(2): 224-228.

Patel, S. M., Patel, N. A., Parmar, M. B., Patel, M. P. and Patel, J. A., 2013, Studies on variability parameters, correlation and path coefficient analysis in *Bt* cotton hybrids (H × H). *Crop Res. HISAR*, 46(1-3): 212-216.

Pradeep, S., Satish, Y. and Srinivasa Rao, V., 2014, Character association and path coefficient analysis for yield and yield component traits in upland cotton (*Gossypium hirsutum* L.). *J. Res. ANGRAU*, 42(3 & 4): 32-35.

Preetha, S. and Raveendran, T. S., 2007, Genetic variability and association analysis in three different morphological groups of cotton (*Gossypium hirsutum* L.). *Asian J. Plant Sci*., 6: 122-128.

Poehlman, M. J. and Sleper, D. A., 1995, Breeding Field Crops: Iowa State University, Press, Ames.

Reddy, K. B., Reddy, V. C., Ahmed, M. L., Naidu, T. C. M. and Srinivasa, V., 2015, Correlation and path coefficient analysis in upland cotton (*Gossypium hirsutum* L.). *Int. J. Pure App. Biosci.*, 3(3): 70-80.

Shazia, S., Saifullah, A., Kandhro, M. M., Salahuddin, L. and Laghari, S., 2010, Correlation and path coefficient analysis of yield components of upland cotton (*Gossypium hirsutum* L.). *World Appl. Sci. J.*, 8 *(Special Issue of Biotech. & Genetic Engg.)*: 71-75.

Singh, P. and Narayanan, S. S., 1993, Biometrial techniques in plant breeding. *Kalyani Publishers*, New Delhi.

Srinivasulu, P., 2009, Genetic divergence in upland cotton (*Gossypium hirsutum* L.). *M.Sc. (Agri.) thesis*, Acharya N.G. Ranga Agricultural Univ., Rajendranagar, Hyderabad.

Srinivas, B., Bhadru, D., Brahmeswara Rao, M. V. and Gopinath, M., 2014, Genetic studies in yield and fibre quality traits in American cotton (*Gossypium hirsutum* L.). *Agric. Sci. Dig.*, 34(4): 285–288.

Thiyagu, K., Nadarajan, N., Rajarathinam, S., Sudhakar, D. and Rajendran, K., 2010, Association and path analysis for seed cotton yield improvement in interspecific crosses of cotton (*Gossypium spp*). *Electron. J. Plant Breed.*, 1(4): 1001-1005.

USDA's Foreign Agricultural Service, 2018, Cotton: World Markets and Trade. Available online: *https://apps.fas.usda.gov/psdonline/circulars/cotton.pdf.* [Accessed on: 10/05/2018]

Vinodhana, N., Gunasekharan, M. and Vindhiyavarman, P., 2013, Genetic studies of variability, correlation and path coefficient analysis in cotton genotypes. *Int. J. Pure. Appl. Biosci.*, 1(5): 6-10.

How to cite this article:

Shruti, H. C. Sowmya, J. M. Nidagundi, R. Lokesha, B. Arunkumar and Shankar M. Murthy. 2020. Correlation and Path Coefficient Analysis for Seed Cotton Yield, Yield Attributing and Fibre Quality Traits in Cotton (*Gossypium hirsutum* L.). *Int.J.Curr.Microbiol.App.Sci.* 9(02): 200-207. doi: https://doi.org/10.20546/ijcmas.2020.902.025