



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(3): 585-589

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Received: 01-03-2019

Accepted: 04-04-2019

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## Correlation and path coefficient analysis of yield contributing and fiber quality traits in Desi cotton (*Gossypium arboreum* L.)

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**Abstract**

In the present investigation, correlation and path coefficient analysis was carried out for fifteen different yield contributing and fiber quality traits in desi cotton (*G. arboreum* L.) using 39 genetically diverse desi cotton genotypes along with three checks. Correlation studies revealed significant and positive genotypic and phenotypic correlation of number of bolls per plant, number of sympodia per plant, lint index, boll weight, plant height, ginning percent, seed index and harvest index with seed cotton yield per plant. The path analysis studies revealed that, the traits viz., number of bolls per plant, boll weight, plant height, number of sympodia per plant, harvest index, days to 50 percent flowering, lint index, uniformity ratio and micronaire exerted direct positive effect on seed cotton yield. Therefore, these characters should be given due emphasis for making selection for high yielding genotypes in desi cotton.

**Keywords:** Correlation, path coefficient analysis

**Introduction**

Cotton (*Gossypium spp.*) is an important fiber and cash crop of the country which provides lint as raw material to the textile industry. The early estimates of USDA indicate that India has displaced China and has become the leading producer of cotton, while still maintaining the largest area under cotton and is the second largest exporter of cotton next to the United States. India also sustained the position of being the second largest consumer of cotton and consumed 24.5 million bales in 2015-16. China's cotton production was reduced to 20.60% due to drastic reduction in area under cotton to 22.72% in 2015-16. Australia (1910 kg/ha), Brazil (1536 kg/ha) and China (1524 kg/ha) are the world leaders in cotton productivity (USDA Estimate: 2015-16).

In plant breeding, correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. Direction and magnitude of correlation between yield and yield contributing characters must be considered for selecting the superior genotypes from diverse genetic population, but correlation does not provide information about direct and indirect effects of independent variables on dependent one, for this path coefficient analysis is essential. Path analysis splits correlation coefficient into the measures of direct and indirect effects, which reveals whether the association of these characters with yield is due to their direct effects on yield or is consequence of their indirect effects via other component characters. Thus, it measures cause of association between two variables and effect situation. The results of this study might be capable in the selection criteria in further studies in order to increase the selection efficiency in cotton.

**Materials and Methods**

The experiment was carried out during *kharif* 2016 at Cotton Research Station, Mehboob Baugh Farm, Vasant Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental material consists of forty-two diverse elite genotypes of *desi* cotton (*Gossypium arboreum* L.) including three checks viz., AKA-7, PA-08 and JLA-794. The experimental material was sown on 29<sup>th</sup> June, 2016 by dibbling 2-3 seeds per hill. Recommended agronomical and plant protection practices were followed regularly. Fertilizer dose of 50:25:25 kg NPK/ha was applied to the crop, out of which 25:25:25 kg NPK/ha was given at the time of sowing and remaining 25 kg N/ha was applied 45 days after sowing.

Observations were recorded on ten yield and yield contributing characters *viz.*, days to 50 percent flowering, days to 50 percent boll bursting, plant height, number of sympodia per plant, number of bolls per plant, boll weight, seed index, lint index, harvest index and seed cotton yield per plant, five fiber quality characters *viz.*, ginning percent, upper half mean length, fiber strength, micronaire and uniformity ratio. The data were collected and analyzed for correlation and path coefficient analysis. Genotypic and phenotypic correlation coefficients were estimated by the method proposed by Singh and Chaudhari (1977) [12]. Path coefficient analysis was done according to procedure suggested by Dewey and Lu (1959) [4].

## Results and Discussion

### Genotypic and phenotypic correlation coefficient

The characters at both genotypic and phenotypic level showed that number of bolls per plant, number of sympodia per plant, lint index, boll weight, plant height, ginning percent, seed index and harvest index was significantly and positively correlated with seed cotton yield per plant. There was weak positive correlation of micronaire, days to 50 percent flowering, days to 50 percent boll bursting, upper half mean length and uniformity ratio with seed cotton yield per plant. Whereas, trait fiber strength showed negative correlation with seed cotton yield per plant at both genotypic and phenotypic level (Table 1).

The genotypic and phenotypic correlations of number of bolls per plant, number of sympodia per plant, lint index, boll weight, plant height, ginning percent, seed index and harvest index were positive and significant with seed cotton yield per plant indicating the increase in seed cotton yield is mainly because of increase in one or more of the above characters. Similar results were reported by Hazem *et al.* (2005) [8], Desalegn *et al.* (2009) [3] and Ahsan *et al.*, (2014) [2]. Negative and non-significant correlation was observed between fiber

strength and seed cotton yield. This result is in conformity with the result obtained by Shakeel *et al.*, (2016) [11].

Plant height had positive and significant correlation with number of sympodia per plant, number of bolls per plant, lint index, ginning percent, upper half mean length, boll weight, seed index, uniformity ratio and fiber strength. Number of sympodia per plant showed positive and significant correlation with number of bolls per plant, lint index, ginning percent, boll weight and seed index. Number of bolls per plant exhibited positive and significant correlation with plant height, lint index, ginning percent, boll weight and seed index. The significant and positive correlation of boll weight with lint index, ginning percent, plant height, number of sympodia, number of bolls and micronaire was obtained. Seed index and lint index showed positive and significant correlation with each other and with number of bolls per plant, number of sympodia per plant, plant height, ginning percent and upper half mean length. The present investigation is in agreement with the results reported by Rasheed *et al.*, (2009) [10], Rao *et al.*, (2013) [9] and Erande *et al.*, (2014) [6]. Ginning percent exhibited positive and significant correlation with lint index, number of sympodia per plant, number of bolls per plant, plant height, boll weight and harvest index. Among the fiber quality parameters upper half mean length and fiber strength showed positive and significant correlation with each other and with uniformity ratio. Whereas, both the traits exhibited negative and significant correlation with micronaire value. Uniformity ratio exhibited positive and significant correlation with upper half mean length, fiber strength and plant height. Whereas, it showed negative and significant correlation with micronaire and boll weight. All the fiber quality traits studied, showed positive weak correlation with seed cotton yield per plant except fiber strength, which showed negative correlation with seed cotton yield per plant. Emine *et al.*, (2010) [5], Rao *et al.*, (2013) [9], Adeel *et al.*, (2014) [1] and Yaqoob *et al.*, (2016) [16] also obtained similar results.

**Table 1:** Genotypic and phenotypic correlation between yield and its components in cotton

Sr. No.	Characters		Days to 50% flowering	Days to 50% boll bursting	Plant height	Number of sympodia per plant	Number of bolls per plant	Boll weight	Seed index	Lint index
			1	2	3	4	5	6	7	8
1	Days to 50% flowering	G	1	0.9871**	0.0366	0.1663	0.1246	0.2453*	0.1456	0.1884
		P	1	0.9077**	0.0332	0.1500	0.0884	0.2234*	0.1378	0.1697
2	Days to 50% boll bursting	G		1	0.0151	0.1199	0.0867	0.2318*	0.1082	0.1805
		P		1	0.0127	0.1166	0.0939	0.2171*	0.1022	0.1807
3	Plant height	G			1	0.7976**	0.8036**	0.3133**	0.3402**	0.6392**
		P			1	0.7340**	0.6915**	0.3025**	0.2948**	0.6266**
4	No. of sympodia per plant	G				1	1.0129**	0.4644*	0.3268*	0.7111**
		P				1	0.7659**	0.4249**	0.2641*	0.6406**
5	No. of bolls per plant	G					1	0.5092**	0.4794*	0.7487**
		P					1	0.4423**	0.3024**	0.6330**
6	Boll weight	G						1	0.2005*	0.5463**
		P						1	0.1818*	0.5253**
7	Seed index	G							1	0.6030**
		P							1	0.5077**
8	Lint index	G								1
		P								

\* and \*\* indicates significance at 5% and 1% level respectively

**Table 1:** Conti....

Sr. No.	Characters		Harvest index	Ginning percent	UHML	Fiber strength	Micronaire	Uniformity ratio	Seed cotton yield per plant
			9	10	11	12	13	14	15
1	Days to 50% flowering	G	0.1539	0.1425	-0.0254	0.1597	-0.0066	-0.0465	0.1662
		P	0.1151	0.1234	-0.0243	0.1618	-0.0161	-0.0278	0.1430
2	Days to 50% boll bursting	G	0.2040	0.1750	-0.1117	0.0022	0.0439	-0.1316	0.1410

		P	0.1916	0.1696	-0.1075	0.0129	0.0704	-0.1205	0.1390
3	Plant height	G	0.0558	0.6170**	0.3294**	0.2529*	-0.1340	0.2636*	0.6982**
		P	0.0521	0.5959**	0.3240**	0.2421*	-0.1258	0.2547*	0.6717**
4	No. of sympodia per plant	G	0.1820	0.6957**	0.1254	0.0204	0.1015	0.0422	0.9079**
		P	0.1441	0.6237**	0.1037	0.0208	0.0871	0.0426	0.8017**
5	No. of bolls per plant	G	0.3708**	0.6811**	0.1855	0.0117	0.0727	0.1500	0.9813**
		P	0.3939**	0.5828**	0.1567	0.0265	0.0945	0.1041	0.9272**
6	Boll weight	G	0.5097**	0.5429**	-0.1481	-0.1386	0.2301*	-0.2280*	0.7313**
		P	0.4657**	0.5224**	-0.1498	-0.1547	0.2172*	-0.2312*	0.6949**
7	Seed index	G	0.2837	0.0442	0.2988*	0.2608	-0.1700	0.2461	0.4217*
		P	0.1583	0.0420	0.2369*	0.1947	-0.1505	0.2058	0.3184**
8	Lint index	G	0.3681*	0.8266**	0.2168	0.0282	0.0216	0.1568	0.7573**
		P	0.3204**	0.8261**	0.2119	0.0251	0.0295	0.1451	0.7118**
9	Harvest index	G	1	0.3249**	0.0488	-0.1501	0.0730	0.0336	0.4590*
		P	1	0.2863**	0.0390	-0.1170	0.1128	0.0435	0.4737**
10	Ginning percent	G		1	0.0433	-0.1298	0.1884	-0.0025	0.7098**
		P		1	0.0366	-0.1280	0.1676	-0.0105	0.6639**
11	Upper half mean length	G			1	0.7632**	-0.7990**	0.9890**	0.0774
		P			1	0.7509**	-0.6968**	0.9578**	0.0720
12	Fiber strength	G				1	-0.6899**	0.7622**	-0.0544
		P				1	-0.5762**	0.7344**	-0.0434
13	Micronaire	G					1	-0.8375**	0.1713
		P					1	-0.6916**	0.1580
14	Uniformity ratio	G						1	0.0133
		P						1	0.0065
15	Seed cotton yield per plant	G							1
		P							1

\* and \*\* indicates significance at 5% and 1% level respectively

### Path coefficient analysis

The genotypic path analysis studies revealed that days to 50 percent flowering (5.805), lint index (5.802), seed index (3.388), uniformity ratio (1.761), harvest index (1.309), plant height (1.794), number of bolls per plant (1.001), number of sympodia per plant (0.766), boll weight (0.235) and micronaire (0.285) exerted direct positive effect on seed cotton yield. Whereas, days to 50 percent boll bursting, ginning percent, upper half mean length and fiber strength exerted negative direct effect on seed cotton yield per plant (Table 2 and Fig. 1).

Positive and significant correlation of plant height with seed cotton yield per plant was mainly due to its positive direct effect on seed cotton yield and positive indirect effect through

number of bolls per plant, number of sympodia per plant, boll weight, ginning percent, lint index and seed index. Ginning percent exhibited negative direct effect on seed cotton yield per plant. The fiber quality traits viz., uniformity ratio and micronaire value exhibited positive direct effect on seed cotton yield per plant, while upper half mean length and fiber strength showed negative direct effects (Table 2).

Thus path coefficient analysis undertaken in the present investigation revealed importance of number of sympodia per plant, number of bolls per plant, boll weight, plant height and lint index in breeding for higher seed cotton yield per plant. Similar findings were reported by Rasheed *et al.* (2009) [10], Thiyagu *et al.* (2010) [13], Tulasi *et al.* (2012) [14], Vinodhana *et al.* (2013) [15] and Gulhane and Wadikar (2017) [7].

**Table 2:** Path coefficient analysis for yield and yield contributing characters

Sr. No.	Characters	Days to 50% flowering	Days to 50% boll bursting	Plant height	Number of sympodia per plant	Number of bolls per plant	Boll weight	Seed index	Lint index	Harvest index	Ginning percent	UHML	Fiber strength	Micronaire	Uniformity ratio
1	Days to 50% flowering	5.8048	5.7302	0.2122	0.9656	0.7231	1.4240	0.8453	1.0936	0.8935	0.8270	-0.1475	0.9270	-0.0383	-0.2698
2	Days to 50% boll bursting	-5.5184	-5.5903	-0.0845	-0.6701	-0.4849	-1.2956	0.6051	1.0088	-1.1404	-0.9782	0.6246	-0.0124	-0.2454	0.7357
3	Plant height	0.0656	0.0271	1.7940	1.4309	1.4417	0.5620	0.6103	1.1467	0.1001	1.1070	0.5909	0.4536	-0.2404	0.4729
4	No. of sympodia per plant	0.1275	0.0918	0.6111	0.7662	0.7761	0.3558	0.2504	0.5449	0.1394	0.5331	0.0961	0.0156	0.0777	0.0324
5	No. of bolls per plant	0.1248	0.0869	0.8049	1.0144	1.0016	0.5099	0.4801	0.7498	0.3714	0.6821	0.1858	0.0117	0.0728	0.1502
6	Boll weight	0.0578	0.0547	0.0739	0.1095	0.1201	0.2358	0.0473	0.1288	0.1202	0.1280	0.0349	0.0327	0.0543	0.0538
7	Seed index	0.4934	0.3668	1.1525	1.1072	1.6242	0.6794	3.3881	2.0430	0.9610	0.1499	1.0124	0.8837	0.5759	0.8339
8	Lint index	1.0931	1.0470	3.7082	4.1258	4.3436	3.1697	3.4984	5.8017	2.1355	4.7956	1.2579	0.1633	0.1252	0.9095
9	Harvest index	0.2016	0.2672	0.0731	0.2383	0.4857	0.6676	0.3716	0.4821	1.3099	0.4255	0.0639	-0.1966	0.0956	0.0440
10	Ginning percent	-0.7328	-0.90	-3.1737	-3.5784	-3.5030	-2.7923	0.2275	4.2514	-1.6709	-5.1433	-0.2226	0.6674	-0.9688	0.0127
11	Upper half mean length	0.0450	0.1977	-0.5828	-0.2219	-0.3282	0.2620	0.5287	0.3836	-0.0863	-0.0766	-1.7694	-1.3503	1.4137	-1.7499
12	Fiber strength	-0.1605	-0.0022	-0.2542	-0.0205	-0.0117	0.1393	0.2622	0.0283	0.1509	0.1304	-0.7671	-1.0051	0.6934	-0.7661
13	Micronaire	-0.0019	0.0125	-0.0381	0.0289	0.0207	0.0655	0.0484	0.0061	0.0208	0.0536	-0.2273	-0.1963	0.2845	-0.2383
14	Uniformity ratio	-0.0818	-0.2317	0.4641	0.0744	0.2641	-0.4015	0.4333	0.2760	0.0592	-0.0043	1.7412	1.342	-1.4746	1.7606

ratio															
15	Seed cotton yield per plant	0.1662	0.1410	0.6982	0.9079	0.9813	0.7313	0.4217	0.7573	0.459	0.7098	0.0774	-0.0544	0.1713	0.0133
	Partial R <sup>2</sup>	0.9645	-0.7882	1.2526	0.6957	-0.9829	-0.1724	1.4288	4.3937	0.6012	-3.6506	-0.1370	0.0547	0.0487	0.0234

R SQUARE = 0.8745, RESIDUAL EFFECT = 0.3543

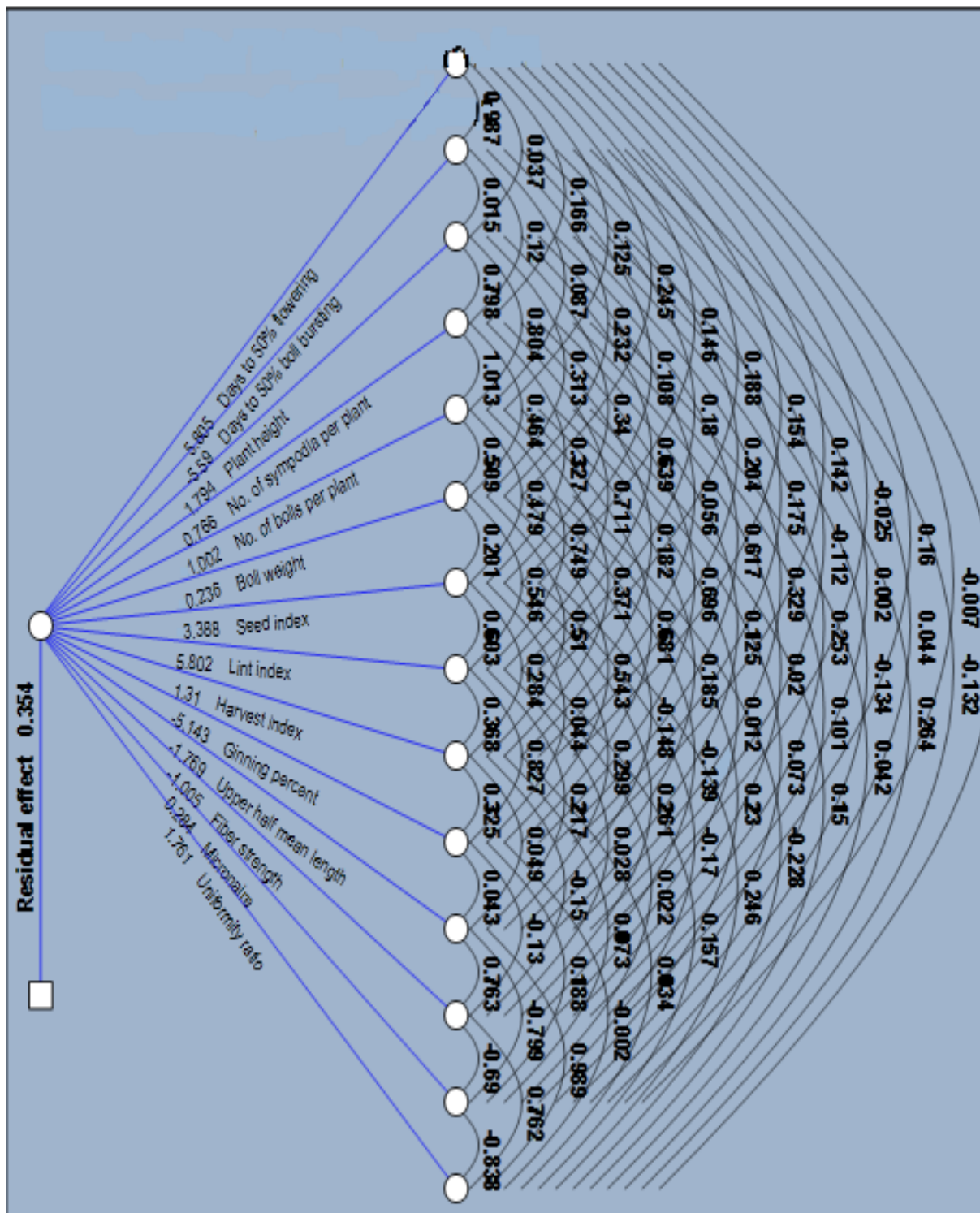


Fig 1: Genotypic Path Diagram for Seed Cotton Yield Per Plant

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