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Correlation and path analysis studies for yield and yield component traits in Sesamum (*Sesamum indicum* L.)

Kartikey Sootrakar, SK Payasi, RP Joshi and P Perraju

Abstract
Forty-five crosses and ten parents of sesame genotypes were grown during Kharif 2019 at Instructional Farm, College of Agriculture, Rewa (M.P.) for the estimation of correlation and path coefficient analysis for seed yield and yield respective traits. Phenotypic and genotypic correlation analysis revealed that seed yield per plant expressed a positive significant association with days to 50% flowering, number of primary branches per plant, days to flower initiation, days to maturity, 1000 seed weight, capsule length, oil content and number of secondary branches per plant. Path coefficient analysis revealed that the seed yield per plant expressed a positive direct effect with number of capsules per plant followed by days to maturity, number of seeds per capsule, oil content, number of primary branches per plant, harvest index, 1000-seed weight and plant height.

Keywords: Correlation, path analysis, direct effect, indirect effect

Introduction
Sesame (*Sesamum indicum* L.) is one of the most important oilseed crops grown either as a pure or complex crop in the country since ancient times. India is the enormous sesame seed producer in the world and also the largest exporter of sesame seed in the world accounting for a share of 23%. Sesame seeds have high nutritious, medicinal value, high oil (38-54%) and protein content (18-25%), sesame seeds are peptic, rejuvenating, anti-aging and rich in vitamins E, minerals like copper, magnesium, zinc calcium, phosphorus, iron (white seeds) and potassium. Sesame oil is of superior property nearly matching olive oil (Kapoor, 1990) [7]. The oil is used as the source of biodiesel with superior environmental performance (Ahmed *et al.*, 2009) [1] and also serves as a useful ingredient in the manufacture of soaps, perfumery, cosmetics, pharmaceuticals, insecticides, paints and varnishes (Bedigian, 2003) [3]. Meanwhile, in the case of sesame similar to other crops yield is a complex character and the less productivity could be attributed to the interaction with different yield related, growth and morphological traits. Despite the rapid increase in the area under the crop, productivity has deteriorated over the years.
The Association of characters derived by the correlation coefficient, forms the basis for selecting the desirable plant, aiding in the evaluation of relative effect of various component characters on seed yield. A positive correlation between desired characters assists the breeder in selection. However, a negative correlation renders the recovery of recombinants in both characters at phenotypic and genotypic correlation coefficients were estimated in all possible combinations of characters at phenotypic and genotypic levels taking all the genotypes separately.
But the techniques of path analysis appears to help elucidate the pattern of the association through direct and indirect effect. The perception of the relationship between yield and its components is crucial for the selection process and this relationship can be explained through correlation and path coefficient analyses. Keeping in view on the significance of varietal improvement in sesame, the objective of the study is to determine the correlation and path analysis for yield components towards seed yield in sesame.

Materials and Methods
Ten parents *viz*., TKG 21, TKG 22, TKG 55, TKG 306, TKG 308, JTS 08, TKG 501, TKG 506, TKG 518 and JT 12 were crossed in a diallel fashion without reciprocals during Kharif 2018 at Instructional Farm, College of Agriculture, Rewa (M.P.) and the parents along with forty-five F1 hybrids were evaluated during rabi 2019.

Each plot consisted of two rows of 2m in length spaced at 35 cm between rows and 10 cm between plants. Normal recommended cultural practices and plant protection measures were followed. Three competitive plants from each replication were selected randomly in parents and hybrids several observations were recorded on days to flower initiation, days to 50% flowering, days to maturity, number of primary branches, number of secondary branches, number of capsules per plant, capsule length, plant height, number of seeds per capsules, 1000 seed weight, oil content, biological yield per plant, harvest index and seed yield per plant. The correlation coefficient among the characters in all possible combinations at the phenotypic, genotypic and environmental level were calculated by the formula is given by Miller *et al*. (1958) [10] and path coefficient analysis as suggested by Wright (1921, 1934) [16, 17] and elaborated by Dewey and Lu (1959) [4].

Result and Discussion

A positive correlation between desirable characters is helpful to the plant breeder because it helps in the simultaneous advancement of both the characters. In the present investigation, the phenotypic and genotypic correlation of seed yield per plant exhibited a significant positive correlation with days to 50% flowering, number of primary branches per plant, days to flower initiation, days to maturity, 1000 seed weight, capsule length, oil content and number of secondary branches per plant presented in Table No. 2. The present findings are in agreement with those of Sivaprasad and Yadavalli (2013) [13] for capsule length; Thirumalarao *et al*. (2013) [15] for plant height; Baraki *et al*. (2015) [2] for days to maturity. While, a significant negative correlation was exhibited with number of capsules per plant, biological yield per plant, harvest index, plant height and number of seeds per capsule.

The path coefficient analysis of different characters revealed that the highest positive direct effect on seed yield per plant expressed positive significance with number of capsules per plant, days to maturity, number of seeds per capsules, oil content, number of primary branches per plant, harvest index, 1000 seed weight presented in Table No. 1. These results are in conformity with the finding of Parameshwarappa *et al*. (2009) [12] for number of capsules and plant height; Yol *et al*. (2010) [18] for plant height and 1000 seed weight; Goudappagoudra *et al*. (2011) [5]. The path analysis of the present investigation revealed that substantial negative direct effect on seed yield per plant was exerted by days to flower initiation, number of secondary branches per plant, capsule length, days to 50% flowering and biological yield per plant. Similar results have been obtained by Gangadhara *et al*. (2012) [6] for days to flower initiation, number of secondary branches per plant, capsule length, days to 50% flowering and biological yield per plant.

Table 1: Genotypic path table showing direct and indirect effect of various traits on sesame yield

Characters	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X1	-1.2260	-0.7132	-0.1458	-0.4602	0.5504	-0.3407	0.2425	0.0367	0.4576	0.3511	-0.4900	0.2496	0.1482
X2	-0.5372	-0.9234	-0.1513	-0.6394	0.3189	-0.1982	0.3044	0.2404	0.6854	0.4529	-0.2314	0.4369	0.0481
X3	0.1846	0.2543	1.5519	1.2479	-0.4303	-0.8127	-0.4200	-0.5307	-1.4917	-0.8777	0.2403	-0.0267	-0.6792
X4	0.1833	0.3382	0.3927	0.4884	-0.1588	-0.0842	-0.0195	-0.0242	-0.2571	0.1325	0.1419	0.0833	-0.0202
X5	0.5212	0.4010	0.3219	0.3776	-1.1611	-0.3244	-0.5517	-0.3409	-0.6081	-0.1222	-0.0234	-0.0735	-0.2089
X6	0.6735	0.5202	-1.2693	-0.4182	0.6773	2.4240	1.9480	0.8399	0.7998	-0.1716	0.1796	0.2005	-0.4309
X7	0.2245	0.3742	0.3072	0.0454	-0.5394	-0.9121	-1.1350	-0.3174	-0.1858	-0.2017	0.1209	-0.5268	0.4576
X8	-0.0027	-0.0236	-0.0311	-0.0045	0.0267	0.0315	0.0254	0.0908	-0.0162	0.0055	0.0056	0.0102	-0.0149
X9	-0.2254	-0.4483	-0.5805	-0.3179	0.3163	0.1992	0.0989	-0.1075	0.6039	0.2777	-0.3531	0.0178	0.2910
X10	-0.0919	-0.1574	-0.1815	0.0871	0.0338	-0.0227	0.0570	0.0196	0.1476	0.3209	0.0134	0.1312	0.1486
X11	0.2322	0.1456	0.0900	0.1688	0.0117	0.0430	-0.0619	0.0361	-0.3396	0.0243	0.5810	0.1075	0.1679
X12	0.0280	0.0651	0.0024	-0.0235	-0.0087	-0.0114	-0.0639	-0.0155	-0.0041	-0.0563	-0.0255	-0.1376	-0.0683
X13	-0.0491	-0.0212	-0.1778	-0.0168	0.0731	-0.0722	-0.1638	-0.0667	0.1958	0.1882	0.1175	0.2016	0.4064
Partial R^2	0.1043	0.1741	0.1997	0.2611	0.3367	-0.1960	-0.2955	-0.0127	-0.0075	0.1039	0.1609	-0.0928	0.0998

Residual effect = 0.4049

Where, X1- days to flower initiation, X2- days to 50% flowering, X3- days to maturity, X4-Number of primary branches per plant, X5- Number of secondary branches per plant, X6- Number of capsules per plant, X7- Capsule length, X8- plant height, X9- Number of seeds per capsules, X10- 1000 seed weight, X11- Oil content, Xt12- biological yield per plant, X13- Harvest index X14- seed yield per plant

Table 2: Phenotypic and genotypic correlation coefficient between seed yield and its components in sesame

Characteristics		Days to flower initiation	Days to 50% flowering	Days to maturity	Number of primary branches per plant	Number of secondary branches per plant	Number of capsules per plant	Capsule length (cm)	Plant height (cm)	Number of seeds per capsules	1000 seed weight (g)	Oil content %	Biological yield per plant (g)	Harvest index (%)	Seed yield per plant (g)
X1	P	1.000	0.630**	0.535**	0.09	-0.157*	0.389*	0.372*	0.274**	0.258	0.499**	0.130	0.145	0.289**	0.177*
	G	1.000	0.582**	0.164*	0.804**	-0.325**	0.279**	0.804**	0.280**	0.178*	0.460**	0.042	0.185*	0.496**	0.246**
X2	P		1.000	0.364**	0.003	-0.099	-0.109	0.125	0.159*	0.253	0.235**	-0.107	0.322**	0.166*	0.576*
	G		1.000	0.119	0.692**	0.277**	-0.173*	0.475**	0.347**	0.164*	0.061	-0.585**	0.409**	0.289**	0.674**
X3	P			1.000	0.02	-0.111	-0.008	0.044	0.142	0.189	0.221**	0.112	0.215**	0.184*	0.156*
	G			1.000	0.375**	-0.345**	0.524**	-0.04	0.294**	0.330**	0.178*	0.062	0.03	0.463**	0.277**
X4	P				1.000	-0.105	0.105	-0.033	0.007	0.143	0.064	0.031	0.248**	0.239**	0.226*
	G				1.000	-0.449**	0.215**	0.271**	-0.05	0.524**	-0.071	-0.107	0.113	0.482**	0.324**
X5	P					1.000	0.095	-0.041	0.084	-0.160	0.044	-0.021	0.340**	0.05	0.038
	G					1.000	0.278**	-0.330**	0.342**	-0.526**	0.105	0.074	0.464**	0.164*	-0.012
X6	P						1.000	-0.021	0.11	-0.086*	0.085	-0.13	0.046	0.042	-0.015
	G						1.000	-0.198*	-0.260**	0.961**	0.271**	0.02	0.083	0.403**	0.139
X7	P							1.000	0.148	-0.024	-0.078	0.079	-0.064	0.085	0.143*

	G							1.000	0.030	-0.742**	0.566**	0.291**	0.063	-0.178*	0.260**
X8	P								1.000	-0.07	-0.053	0.192*	0.053	0.006	-0.055
	G								1.000	-0.373**	-0.490**	0.155*	0.171*	0.180*	-0.081
X9	P									1.000	-0.024	0.133	0.092	-0.171*	-0.164*
	G									1.000	-0.286**	0.251**	-0.017	-0.041	-0.290**
X10	P										1.000	0.114	-0.084	-0.007	0.156*
	G										1.000	0.400**	-0.473**	0.438**	0.535**
X11	P											1.000	-0.017*	-0.05	0.067
	G											1.000	-0.204**	-0.052	0.129
X12	P												1.000	-0.097*	-0.034
	G												1.000	-0.121	-0.189*
X13	P													1.000	-0.049*
	G													1.000	-0.085

Conclusion

The phenotypic and genotypic correlation of seed yield per plant exhibited significant positive correlation with biological yield per plant, 1000 seed weight, harvest index, oil content, number of primary branches per plant, capsule length, days to maturity and number of seeds per capsules whereas, significant negative correlation was exhibited with plant height, day to 50% flowering, days to flower initiation, number of capsules per plant and number of secondary branches per plant. This suggests that while selecting for improvement in seed yield these characters should be kept in mind provided the characters also show high variability.

The path coefficient analysis of different characters revealed that highest positive direct effect on seed yield per plant expressed positive significant with number of capsules per plant, days to maturity, number of seeds per capsules, oil content, number of primary branches per plant, harvest index, 1000 seed weight. Therefore, these traits may be considered as the principal traits while selecting for grain yield and selection indices may be formed by considering all these characters for improvement of grain yield.

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