Indian Journal of Ecology (2022) 49(4): 1325-1328
DOI: https://doi.org/10.55362/IJE/2022/3666

Manuscript Number: 3666
NAAS Rating: 5.79

Trait Association Analysis for Yield and Attributing Traits in Sesame (*Sesamum indicum* L.)

Paras, R.K. Sheoran, Subhash Chander, Suman Devi* and Raju Ram Choudhary
Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar-125 004, India
**E-mail: sumanchaudhary304@gmail.com*

***Abstract*:** Correlations and path coefficient were studied in 60 genotypes of sesame (*Sesamum indicum* L.) in Randomized Complete Block Design (RCBD) in *Kharif* season, 2017 at Chaudhary Charan Singh Haryana Agricultural University, Hisar to evaluate the association of seed yield and yield attributing traits and to determine the direct and indirect effects of yield-related traits on seed yield.Seed yield per plant had significantly positive correlation with plant height, number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seeds weight capsule length while, with significantly negative correlation with days to 50% flowering and days to maturity.Path coefficient analysis revealed that number of capsules per plant had the highest direct and positive effect on seed yield per plant, thus indicates the selection based on these traits could be more effective to maximize the seed yield in sesame breeding programmes.

***Keywords*:** Sesame, Correlation coefficient, Path coefficient, RCBD, Replication

Sesame (*Sesamum indicum* L.) is one of the most important oilseeds crops due to its high degree of stability to oxidation and rancidity (Yadava et al 2012) .The sesame seeds contains good quality proteins, carbohydrates, fibers, phenolic compounds and also possess considerable quantity of mineral nutrients, amino acids and different vitamins (Chang et al 2002, Ojiako et al 2010). The crop is highly drought tolerant and cultivated in tropical and subtropical regions of Asia, Africa and South America. However, it is well suited to tropical climates with moderate rainfall and humidity (Chakraborthy et al 2008). India ranks first in world with 1.95 Million ha area and 0.87 Million tonnes production. The average yield of sesame in India is 413 kg/ha, low as compared with other countries in the world is 535 kg / ha (Singh et al 2022). In Indian subcontinent the crop is mainly cultivated on discarded land with poor fertility. Genotypes grown in India produce inferior yield in terms of both quality and quantity due to lack of efficient crop improvement programmes (Tadele 2019). Yield improvement depends on the use of improved genotypes. In present scenario, more aggressive breeding efforts are required to harness the untapped potential of this crop for further yield enhancement (Furat and Uzun 2010). Seed yield is one of the most complex characters that results due to the actions and interactions of various attributes or traits which are highly correlated, thus these traits have potential to influence seed yield either directly or indirectly (Rauf et al 2004). Thus, by keeping the above facts in view present investigation was carried out to understand the genetic association between yield and its component traits. It helps to determine direct and indirect effects of different yield and its attributing traits on seed yield of sesame.

MATERIAL AND METHODS

Field experiment was conducted at, Chaudhary Charan Singh Haryana Agricultural University, Hisar, during the *kharif*) 2017, under normal conditions with proper irrigation. The experimental plant material consists of sixty genotypes of sesame (*Sesamum indicum* L.) from the Oilseeds Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar (Table 2). All the genotypes were evaluated in Randomized Complete Block Design (RBD) with three replications. Each genotype was sown in rows of 3-meter length with spacing of 30 x 15 cm (row-to-row and plant-to-plant). All the agronomic packages and practices such as seed treatment, fertilizer application, timely irrigation, weeding and pesticides application were followed to raise healthy crop.

Morphological data: The observations on morphological traits such as days to flowering (50%) and days to maturity were recorded on the plot basis whereas remaining characters were recorded from five randomly selected plants from each genotype in each replication. Mean values over replications were used for statistical data analysis.

Statistical analysis: Correlation coefficients analysis among all possible character combinations at phenotypic and genotypic level was done by using formulae developed by Johnson et al. (1955). Path coefficient analysis was worked out as per the formula suggested by Wright (1921) and further adopted by Dewey and Lu (1959). Genotypic correlation coefficients of eleven morphological characters with seed yield per plant were used to estimate the path coefficients for the direct and indirect effects of various independent characters on yield. Statistical analysis of Correlation and Path coefficient data between yield and its attributing traits was done by Statistical Package for Social Sciences (SPSS) Version 11.0.

RESULTS AND DISCUSSION

The seed yield in sesame as well as in most of the crops is a complex character, which results from the multiplicative interaction of several other characters that are termed as yield components. The genetic makeup of seed yield in sesame is based on the overall net effect produced by various yield components directly or indirectly by interacting with one another. Therefore, selection for seed yield *per se* alone would not matter much as such unless accompanied by the selection for various component characters responsible for conditioning it. Thus, identification of important component characters and information about their association with yield and also with each other is useful for developing efficient breeding strategies for developing high yielding varieties. The magnitudes of genotypic correlation coefficients were higher than corresponding phenotypic correlation coefficients indicating the presence of genetic association among various characters (Table 2).

Correlation analysis : Seed yield per plant had significant and positive correlation with plant height , number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule and 1000 seeds weight at both genotypic and phenotypic level. It shown significant and positive correlation with capsule length at genotypic level. Hence, such characters should be given priority during selection for increasing seed yield in sesame. It was found to have significant and negative correlation with days to 50% flowering and days to maturity at both genotypic and phenotypic level. These results implies that selection based onplant height, number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seeds weight and capsule length could be more efficient in contributing towards more seed yield of sesame because the selection practiced for improving such traits individually or simultaneously is likely to bring improvement in others due to correlated response. The characters contributes more or less towards seed yield because of seed yield is a complex character, which results from the interaction of several other characters that are termed as yield components as we discussed. Similar findings have also been reported earlier for one or more characters by earlier researchers (Shekhawat et al 2013, Hika et al 2014, Mahmoud et al 2015, Saxena and Bisen 2016).

Path coefficient analysis: The evaluation of path coefficient in which diagonal values are have direct effects and off-diagonal indirect effects of yield attributing character on seed yield. The highest positive direct effect and significant association with seed yield per plant was exhibited by number of capsules per plant followed by days to 50%

Table 1. Sixty genotypes of sesame (*Sesamum indicum* L.) used in the present investigation

S. No.	Genotypes	S. No.	Genotypes	S. No.	Genotypes	S. No.	Genotypes
1	NIC-7834	16	SI-2139	31	PCU-39	46	RJS-44
2	NIC-7925	17	SI-1865-B	32	PCU-129	47	Julander
3	NIC-8025	18	SI-3281	33	PCU-136	48	MIS-8526
4	NIC-8165	19	SI-119-2-84	34	EC-3034190	49	TC-154
5	NIC-8254	20	IS-85	35	EC-31045	50	TC-173
6	NIC-8339	21	IS-113	36	EC-310427	51	TC-176
7	NIC-8394	22	IS-120-A	37	ES-71-A	52	TC-177-A
8	NIC-8414	23	IS-136	38	ES-120-1-84-A	53	TC-182
9	NIC-16104	24	IS-154	39	KMR-13	54	TC-190
10	NIC-16214	25	IS-207	40	KMR-60	55	TC-191
11	NIC-16347-1	26	IS-8480-A	41	SP-41	56	TC-206
12	NIC-17257	27	IC-1634-3	42	S-0253-A	57	TC-208
13	NIC-17311	28	IS-750-1-84	43	S-0268-C	58	TC-318
14	SI-44	29	IC-14160-1	44	SO-516-A	59	HT-1
15	SI-212	30	PCU-34	45	GSM-21	60	HT-2

Table 2. Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among morphological characters in sesame

Characters	DF	DM	PH	PBP	SBP	NCP	NSC	CL	CW	1000 SW	OC	SYP
DF		0.967**	-0.168*	0.133	-0.209**	-0.265**	-0.022	-0.006	0.023	-0.066	-0.056	-0.158*
DM	0.977**		-0.186*	0.105	-0.219**	-0.253**	-0.011	0.023	-0.019	-0.043	-0.088	-0.167*
PH	-0.299**	-0.312**		-0.097	0.011	0.128	0.242**	-0.047	-0.073	0.182*	0.032	0.219**
PBP	0.158*	0.127	-0.169*		0.347**	0.200**	0.014	0.041	0.118	0.087	0.140	0.210**
SBP	-0.221**	-0.230**	0.023	0.451**		0.379**	-0.074	0.100	0.034	0.161*	0.154*	0.273**
NCP	-0.286**	-0.273**	0.226**	0.250**	0.405**		0.129	0.120	-0.125	0.280**	0.074	0.819**
NSC	-0.013	-0.011	0.395**	0.013	-0.070	0.180*		0.215**	0.073	0.117	-0.102	0.446**
CL	-0.035	-0.003	0.103	0.030	0.154*	0.197**	0.300**		-0.104	0.219**	-0.139	0.144
CW	0.006	-0.040	-0.253**	0.235**	0.049	-0.170*	0.138	-0.282**		-0.087	0.148*	-0.029
1000 SW	-0.091	-0.055	0.354**	0.183*	0.185*	0.428**	0.196**	0.421**	-0.179*		0.054	0.452**
OC	-0.124	-0.150*	0.191*	0.210**	0.205**	0.058	-0.132	-0.231**	0.296**	0.077		0.062
SYP	-0.178*	-0.187*	0.381**	0.283**	0.298**	0.863**	0.512**	0.233**	-0.041	0.634**	0.122	

* Significant at 5 % ** Significant at 1 %
DF = Days to flowering (50%), DM = Days to maturity, PH= Plant height, PBP = Primary branches per plant, SBP = Secondary branches per plant, NCP = No. of capsules per plant, NSC = No. of seeds per capsule, CL = Capsule length, CW = Capsule width, 1000SW = 1000 Seeds weight, OC = Oil content, SYP = Seed yield per plant

Table 3. Path coefficient analysis for morphological characters in sesame

Traits	DF	DM	PH	PBP	SBP	NCP	NSC	CL	CW	1000 SW	OC	PC with SYP
DF	0.365	-0.313	-0.001	0.004	0.004	-0.195	-0.007	0.000	0.001	-0.015	0.000	-0.158*
DM	0.353	-0.324	-0.001	0.003	0.005	-0.186	-0.004	-0.001	-0.001	-0.010	-0.001	-0.167*
PH	-0.061	0.060	0.006	-0.003	0.000	0.094	0.081	0.002	-0.003	0.042	0.000	0.219**
PBP	0.048	-0.034	-0.001	0.028	-0.007	0.148	0.005	-0.002	0.004	0.020	0.001	0.210**
SBP	-0.076	0.071	0.000	0.010	-0.021	0.280	-0.025	-0.005	0.001	0.037	0.001	0.273**
NCP	-0.097	0.082	0.001	0.006	-0.008	0.737	0.043	-0.006	-0.004	0.064	0.001	0.819**
NSC	-0.008	0.003	0.001	0.000	0.002	0.095	0.334	-0.011	0.003	0.027	-0.001	0.446**
CL	-0.002	-0.007	0.000	0.001	-0.002	0.088	0.072	-0.050	-0.004	0.050	-0.001	0.144
CW	0.008	0.006	0.000	0.003	-0.001	-0.092	0.024	0.005	0.035	-0.020	0.001	-0.029
1000 SW	-0.024	0.014	0.001	0.002	-0.003	0.207	0.039	-0.011	-0.003	0.229	0.000	0.452**
OC	-0.020	0.028	0.000	0.004	-0.003	0.054	-0.034	0.007	0.005	0.012	0.008	0.062

See Table 2 for details

flowering, number of seeds per capsule and 1000-seed weight, capsule width, primary branches per plant (Table 3). The oil content and plant height also exhibited positive direct effect on the grain yield but association was low. However, days to maturity, capsule length and number of secondary branches per plant showed negative direct effect on seed yield per plant. These results are in accordance with the earlier finding (Gangadhara et al 2012, Shekhawat et al 2013, Meena et al 2016, Saxena and Bisen 2016).

CONCLUSION

Seed yield per plant showed a significant and positive correlation with plant height, number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seeds weight at both genotypic and phenotypic level. Genotypic correlation coefficients were higher in magnitude than phenotypic correlation coefficients for all the traits under study. This indicates the presence of inherent association among various characters. Path coefficient analysis for different characters revealed that number of capsules per plant, days to 50% flowering and number of seeds per capsules had the highest direct and positive effect on seed yield per plant and inferred that there is true relationship between respective traits and grain yield. Consequently, these traits should be considered as important selection criteria in sesame breeding programmes for getting higher seed yield.

REFERENCES

Chang LW, Yen WJ, Huang SC and Duh PD 2002. Antioxidant activity of sesame coat. *Food Chemistry* **78**(3): 347-354.

Chakraborthy GS, Sharma G and Kaushik KN 2008. *Sesamum indicum*: A Review. *Journal of Herbal Medicine and Toxicology* **2**(2): 15-19.

Dewey DR and Lu KH 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal* **51**: 515-518.

Fazal A, Mustafa HSB, Hasan EU, Anwar M, Tahir MHN and Sadaqat HA 2015. Interrelationship and path coefficient analysis among yield and yield related traits in sesame (*Sesamum indicum* L.). *Nature and Science* **13**(5): 27-32.

Furat S and Uzun B 2010 The use of agro-morphological characters for the assessment of genetic diversity in sesame (*Sesamum indicum* L). *Plant Omics Journal* **3:** 85-91.

Johnson HW, Robinson HF and Comstock RE 1955. Estimates of genetic and environmental variability in soybean*. Agronomy Journal* **47**: 314-318.

Hika G, Geleta N and Jaleta Z 2014. Correlation and divergence analysis for phenotypic traits in sesame (*Sesamum indicum* L.) genotypes. *Science, Technology and Arts Research Journal* **3**(4): 1-9.

Lidansky T 1988. *Statistical Methods in the Biology and in the Agriculture.*

Mahmoud MWSH, Elezz AA and Hassan THA 2015. Genetic variability, heritability and correlation coefficients of yield and its component in sesame. *Egypt Journal of Plant Breeding* **19**(4): 1101-1116.

Meena R, Solanki ZS and Choudhary BR 2016. Studies on genetic variability, character association and path coefficient analysis in sesame (*Sesamum indicum* L.). *Journal of Plant Genetic Resources* **21**(2): 90-92.

Ojiako OA, Igwe CU, Agha NC, Ogbuji CA and Onwuliri VA 2010. Protein and amino acid compositions of *Sphenostylis stenocarpa, Sesamum indicum, Monodora myristica* and *Afzelia Africana* seeds from Nigeria. *Pakistan Journal of Nutrition* **9**(4): 368-372.

Rauf S, Khan MT, Sadaqat HA and Khan AI 2004 Correlation and path coefficient analysis of yield components in cotton (*Gossypium hirsutum* L.). *International Journal Agriculture Biology* **6**: 686-688.

Shekhawat RS, Rajput SS, Meena SK and Singh B 2013. Variation and character association in seed yield and related traits in sesame (*Sesamum indicum* L.). *Indian Research Journal of Genetics and Biotechnology* **5**(3): 186-193.

Saxena K and Bisen R 2016. Genetic variability, correlation and path analysis studies for yield and yield component traits in sesamum (*Sesamum* i*ndicum* L.). *International Journal of Agriculture Sciences* **8**(61): 3487-3489.

Singh V, Singh R and Indu T 2022. Effect of plant geometry and sulphur on growth and yield of sesame (*Sesamum indicum* L.). *The Pharma Innovation Journal* **11**(4): 310-312

Tadele Z 2019. Orphan crops: their importance and the urgency of improvement. *Planta* **250**(3): 1-18.

Wright S 1921. Correlation and causation. *Journal of Agricultural Research* **20**: 557-585.

Yadava DK, Vasudev S, Singh N, Mohapatra T and Prabhu KV 2012. Breeding major oil crops: Present status and future research needs. *Technological Innovations in Major World Oil Crops* **1**: 17-51.

Received 26 March, 2022; Accepted 22 June, 2022