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Path analysis of different yield attributes on seed yield in sesame (*Sesamum indicum* L.)

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ABSTRACT

A core collection of 100 sesame (*Sesamum indicum* L.) genotypes (half of them were eastablished varieties and other half were germplasm lines) studied to the association of yield and attributes in rabi summer and Kharif seasons (with two dates of sowing in each season) at AICRP on sesame and niger, research farm, Jabalpur. Study of path analysis revealed that an early, dwarf genotype with bold seeded and high oil content would be suitable for *rabi* summer cultivation. A late tall genotype with more number of branches and capsules yield higher in *kharif* cultivation. An average genotype of height and earliness with more number of capsules with higher yield but with moderate seed size and oil content can only be suitable for cultivation in both the seasons.

Key words : Sesame, Path analysis, Rabi summer, Kharif.

INTRODUCTION

Sesame being the oldest and quality oilseed crop it is necessary to study its inheritance and genetics for any crop improvement to fulfill the oilseed production of the country. Sesame is a crop, grown around the year in the country, So it is needful to identify the most suitable genotype for different crop growing season. Path coefficient is standardized partial regression coefficient. In a biological system, the relationships may exist in a very complex form and the correlation coefficients are, only the indications of simple associations between variables. The magnitude of association between two variables is always proved to affect the simultaneous variability in other related characters. It is therefore, essential to study the relationships among the variables in a comprehensive way.

MATERIALS AND METHODS

The study of 6584 germplasm accessions showed the presence of wide range of variability in yield and other yield attributes. On the basis of above study, one hundred genotypes differing in morphological attributes, were chosen for detailed analysis, which was carried out in 2001 in two seasons (*rabi* summer and *kharif*) at two dates of sowing each (total four environments). These were observed for eight characters viz. days to 50% flowering, days to maturity, plan height (cm), number of branches per plant, number of capsules per plant, seed yield per plant (g), 1000-seed weight (g) and percent oil content.

The path coefficients analysis suggested by Wright (1921) is a powerful tool, which enables partitioning of the given relationship in its further components, which helps in understanding the underlying causes of a given effect. Following this method, a combined correlation (genotypic, phenotypic and environmental) between a component and seed yield can be partitioned into the direct effect of this character on dependent character and its indirect effects which it exerts through other components with which it is related. There are three main aspects of path analysis, which are used to understand the cause correlation and to identify the characters responsible for brining improvement of traits.

I. If the correlation coefficients between causal factors and the effect is almost equal to its direct effect then, correlation explains the true relationship and direct selection through this trait will be effective.
II. If the correlation coefficient is positive but the direct effect is negative or negligible, the indirect effects appear to be the cause of correlation. In such situation, the indirect causal factors are to be considered simultaneously.
III. Correlation coefficient may be negative but the direct effect is positive and high. Under these circumstances, a restricted simultaneous selection model is to be followed, i.e. restriction is to be imposed to nullify the undesirable indirect effects in order to make use of direct effects.

RESULTS AND DISCUSSION

To measure the direct as well as indirect association of one variable (cause) through another as the end product

(effect), path coefficient were calculated at combined levels for the entire yield attributing traits. The observed correlation coefficients of seed yield per plant with its components were partitioned into direct and indirect effects. In the present investigation seed yield per plant have been used as dependable variable with other traits in all the environments separately basis. Since, the values of genotypic path are more reliable in predicting the correct idea about the direct and indirect effects of component traits, only this has been discussed. The results of path coefficient analysis have been given in Table 1.

During first environment an over all observation of

Table 1 : Path coefficient showing direct and indirect effects of yield and its component

Environment 1(Season 1, date of sowing1)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of capsules per plant	1000 seed weight (g)	Oil content	Combined correlation with Seed yield
Days to 50% flowering	-0.0570	0.0494	0.0047	0.0207	-0.0402	0.0058	0.0123	-0.0043
Days to maturity	-0.0316	0.0891	0.0073	0.0241	-0.0462	0.0017	0.0048	0.0491
Plant height (cm)	-0.0077	0.0186	0.0347	-0.0170	0.0110	-0.0026	0.0025	0.0396
No. of branches per plant	0.0081	-0.0147	0.0040	-0.1463	0.1411	-0.0020	0.0017	-0.0081
No. of capsules per plant	0.0084	-0.0151	0.0014	-0.0758	0.2723	0.0061	-0.0009	0.1964
1000 seed weight (g)	-0.0028	0.0013	-0.0008	0.0025	0.0139	0.1190	-0.0011	0.1319
Oil content	0.0208	-0.0126	-0.0026	0.0073	0.0071	0.0040	-0.0338	-0.0098

Residual = 0.9233

Path coefficient showing direct and indirect effects of yield and its component

Environment 2(Season 1, date of sowing2)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of capsules per plant	1000 seed weight (g)	Oil content	Combined correlation with Seed yield
Days to 50% flowering	0.0386	0.0348	0.0009	-0.0001	0.0004	0.0056	0.0122	0.0924
Days to Maturity	0.0322	0.0417	-0.0003	-0.0002	-0.0002	0.0037	0.0107	0.0876
Plant height (cm)	-0.0011	0.0004	-0.0291	-0.0004	-0.0009	-0.0039	0.0040	-0.0310
No. of branches per plant	0.0013	0.0026	-0.0037	-0.0032	-0.0034	-0.0021	0.0017	-0.0069
No. of capsules per plant	-0.0019	0.0011	-0.0026	-0.0012	-0.0093	-0.0087	-0.0012	-0.0239
1000 seed weight (g)	-0.0029	-0.0021	-0.0015	-0.0001	-0.0011	-0.0751	-0.0071	-0.0898
Oil content	-0.0056	-0.0053	0.0014	0.0001	-0.0001	-0.0063	-0.0846	-0.1004

Residual = 0.9764

Table 1 contd.……..

Path coefficient showing direct and indirect effects of yield and its component
Environment 3(Season 1, date of sowing1)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of capsules per plant	1000 seed weight (g)	Oil content	Combined correlation with Seed yield
Days to 50% flowering	-0.0401	-0.0295	0.0504	0.0016	0.0464	-0.0139	0.0034	0.0206
Days to maturity	-0.0306	-0.0386	0.0571	0.0024	0.0526	-0.0039	0.0038	0.0428
Plant height (cm)	-0.0065	-0.0092	0.2385	0.0042	0.1353	0.0002	0.0074	0.3679
No. of branches per plant	-0.0022	-0.0029	0.0310	0.0324	0.0515	0.0017	0.0035	0.1149
No. of capsules per plant	-0.0065	-0.0068	0.1075	0.0056	0.3003	0.0050	0.0102	0.4152
1000 seed weight (g)	0.0060	0.0016	0.0006	0.0006	0.0160	0.0931	-0.0006	0.1172
Oil content	0.0047	0.0050	-0.0597	-0.0036	-0.1035	0.0020	-0.0295	-0.1849

Residual = 0.7699

Path coefficient showing direct and indirect effects of yield and its component
Environment 4(Season 2, date of sowing2)

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of capsules per plant	1000 seed weight (g)	Oil content	Combined correlation with Seed yield
Days to 50% flowering	-0.0406	0.0622	0.0005	0.0251	0.1252	0.0001	0.0001	0.1924
Days to Maturity	-0.0381	0.0880	0.0007	0.0226	0.1267	0.0004	0.0001	0.2003
Plant height (cm)	0.0024	-0.0073	-0.0083	-0.0060	-0.0136	0.0000	0.0000	-0.0328
No. of branches per plant	-0.0122	0.0236	0.0006	0.0842	0.4054	-0.0002	0.0001	0.5016
No. of capsules per plant	-0.0076	0.0166	0.0002	0.0506	0.6721	0.0000	0.0002	0.7322
1000 seed weight (g)	0.0004	-0.0021	0.0000	0.0010	0.0012	-0.0162	0.0000	-0.0158
Oil content	0.0055	-0.0124	-0.0005	-0.0161	-0.1894	-0.0007	-0.0006	-0.2161

Residual = 0.4552

above results of path coefficient analysis of seed yield and its components plant height. number of capsules per plant, 1000-seed weight and days to maturity played an important role in determining the seed yield per plant.

In the first environment, path coefficient analysis of different traits contributing towards seed yield revealed the highest positive correlation of number of capsules due to very high magnitude its direct effect. Further its indirect effects via days to 50% flowering, 1000-seed weight and plant height. Similarly, 1000-seed weight, days to maturity and plant height had high positive direct effect on seed yield. Number of branches per plant, days to 50% flowering and % oil content exhibited negative direct effect on seed yield.

During second environment, an overall observation in second environment of yield and its components of path

Table 1 contd.……..
Path coefficient showing direct and indirect effects of yield and its component
Pooled analysis

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of capsules per plant	1000 seed weight (g)	Oil content	Combined correlation with Seed yield
Days to 50% flowering	0.0408	0.0729	0.0000	-0.0003	0.0264	0.0001	0.0475	0.1875
Days to Maturity	0.0327	0.0908	0.0001	-0.0003	0.0286	0.0001	0.0371	0.1892
Plant height (cm)	-0.0006	-0.0021	-0.0035	0.0000	0.0019	0.0000	-0.0031	-0.0074
No. of branches per plant	0.0034	0.0075	0.0000	-0.0035	0.0694	0.0000	0.0166	0.0935
No. of capsules per plant	0.0054	0.0131	0.0000	-0.0012	0.1982	0.0000	0.0191	0.2345
1000 seed Weight (g)	-0.0007	-0.0018	0.0000	0.0000	0.0010	-0.0069	-0.0046	-0.0131
Oil content	-0.0145	-0.0252	-0.0001	0.0004	-0.0283	-0.0002	-0.1339	-0.2017

Residual = 0.9019

analysis (viz. days to 50% flowering and days to maturity) played an important role in determining the seed yield per plant.

In second environment, only earliness (i.e. days to 50% flowering and days to maturity) had the positive direct effect on seed yield and also positive indirect effect through 1000 seed weight and % oil content on seed yield.

The two environments were the sowing time i.e. sowing in *rabi* summer, early genotypes of bold seeded dwarf types with high oil content will be more suitable for cultivation in *rabi* summer.

In third environment an over all observation of above results of path coefficient analysis of yield and its components (viz number of capsules per plant, plant height, 1000-seed weight and number of branches per plant), played an important role determining the seed yield per plant.

In third environment number of capsules per plant, plant height, 1000-seed weight and plant height had the high direct effect on seed yield and also positive indirect effect through each other on seed yield. But days to 50% flowering, days to maturity and % oil content exhibited negative direct effect on seed yield.

During fourth environment an overall observation of above results of path coefficients analysis of yield and its components (viz. number of capsules per plant, number of branches per plant and days to maturity) played an important role in determining the seed yield per plant.

In fourth environment, similarly, number of capsules per plant, number of branches per plant and also days to maturity had a very high direct effect on seed yield and negative direct effect of days to 50% flowering, 1000-seed weight, plant height and % oil content.

These two environments (i.e. third and fourth) were two date of sowing in *kharif* season and it comes out of this study that a genotype of late flowering , tall with more number of branches and capsules will be suitable for *kharif* cultivation.

On the basis of the pooled analysis of all four environments these results of path coefficient analysis of seed yield and its components, suggests that number of capsules per plant, days to maturity and days to 50% flowering, played an important role in determining the seed yield.

Observation on the data of the pooled basis indicated highest positive direct effect of number of capsules per plant and days to maturity. Negative direct effect of % oil content, 1000 seed weight, plant height and number of branches observed on seed yield.

The change in the sign and magnitude of the direct and indirect effects of various characters effecting during all the environments separately and also on pooled basis indicated the significant effect of genotype x environmental interaction in the expression of yield and its components. Based on above results, it can be concluded that selection for more number of capsules per plant with a moderate seed size and plant height and late maturing types should be included in the selection

criteria for the improvement of seed yield with high oil content in sesame populations. It is very clear that there should be a separate and totally different selection criteria for both the seasons of crop cultivation.

The information related to characters contributing towards seed yield per plant has been discussed in the light of available literature. The positive direct effect of number of capsules per plant on seed yield was also reported by Khoragade *et al*. (1987), Ding *et al* (1987) and Godawat and Gupta (1986). Pathak and Dixit (1986) observed the highest direct effect of days to 50% flowering, plant height and 1000-seed weight on seed yield whereas in present investigation it was not found the same. The considerable G x E interaction in the expression of the traits was suggested also by Godawat and Gupta (1986) so that the magnitude of direct and indirect effect of various yield components on yield varied with environments, which is in agreement with this investigation. Positive direct of effect number of capsules per plant, number of branches per plant and plant height was on seed yield also observed by Krishnadas and Kadambavanasundaram (1986) and Uzo *et. al*. (1985).

Study of path analysis revealed that an early, dwarf genotype with bold seeded and high oil content would be suitable for *rabi* summer cultivation. A late tall genotype with more number of branches and capsules yield higher in *kharif* cultivation. An average genotype of height and earliness with more number of capsules with yield higher but with moderate seed size and oil content can only be suitable for cultivation in both the seasons.

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