Correlationstudies and Path Analysis in Sesame (*Sesamum indicum L.*)

ABSTRACT

Sesame (*Sesamum indicum L.*), an ancient oilseed crop, is cultivated in central and northern India under rainfed conditions during the *kharif* season. Despite its high oil and protein content, sesame cultivation area and production remain low due to variousreasons. This study, conducted at CCS HAU, Hisar, aimed to improve sesame yield through plant breeding by examining correlation and path analysis. This trial was conducted usingAugmented RCBD and data was recorded on traits including plant height, primary branches, secondary branches, number of capsules per plant, and seed yield per plant. Genotypic correlations showed seed yield positively correlated with the number of capsules per plant (r = 0.854**), primary branches (r = 0.602**), and secondary branches (r = 0.283*), and slightly negatively with plant height (r = -0.064). Path analysis indicated the number of capsules per plant had the highest direct effect on yield (0.769) followed by primary branches. The study concludes that enhancing primary branches and capsules per plant while managing plant height can significantly boost sesame yield.

Keywords:Sesame, Correlation, Path analysis, Seed yield

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) is an ancient cropwith a rich history of over 3000 years of cultivation. It belongs to the Pedaliaceae family and has a diploid genome with 2n = 2x = 26 [1]. Sesame is widely cultivated for its high oil content, which is 50%. Sesame oil is known for its premium quality in cooking due to its high stability, minimal rancidity, and zero cholesterol content. It's also rich in antioxidants such as sesamolin, sesamin, and sesamol[2]. Sesame seeds also offer a substantial protein content, averaging 21.9%. This crop is predominantly cultivated in India, China, Sudan, and Myanmar, contributing to 60% of the world's production. Notably, India leads in sesame production, with 19.47 lakh hectares of cultivated area and a production of 8.66 lakh tons[3].

The seed yield in sesame is mostly influencedby traits such as primary and secondary branches, number of capsules etc.In plant breeding, selection is crucial for increasing seed yield. The selection efficiency is enhanced by giving more weight to traits positively associated with seed yield [4].

The study of correlation and path analysis ishelpful in this regard. Correlation analysis helps reveal the association among various traits, while path analysis goes a step further by dissecting each trait's direct and indirect contributions to dependent traits [5]. This information significantly impacts breeders' decisions regarding selection for increasing seed yield [6].

This study aims to achieve two main objectives: (i) determine the correlation between traits and seed yield, and (ii) identify the direct and indirect effects of traits on seed yield.

2. MATERIAL AND METHODS

This research is being conducted at the Oilseeds Section, Department of Genetics and Plant Breeding, CCS HAU (Chaudhary Charan Singh Haryana Agricultural University), in Hisar. For this, we selected 50 genotypes along with 2 checks. These accessions were planted during the Kharif season of 2023 in the oilseeds farm area. The evaluation of accessions is being conducted using an Augmented Randomized Complete Block Design. Each genotype is planted in paired rows of 5 m each. Data such as plant height, primary and secondary branches per plant, number of capsules per plant and seed yield per plant were recorded from three competitive plants, excluding border plants. Throughout the growing season, recommended agronomic practices like thinning, hoeing, weeding, irrigation, and fertilization are being done. The collected data is subjected firstly to ANOVA analysis [7] followed by correlation [6] and path analysis [5].

3. RESULTS AND DISCUSSION

The findings of the augmented ANOVA are presented in Table 1. According to the table, the genotypes showed significant differences for all traits under consideration, indicating substantial variation among them. No significant differences were observed among the blocks. We have two checks, and no significant differences were observed for these. However, significant differences were observed when comparing genotypes with checks.

Seed yield is a complex phenomenon,result of the combined effects of multiple traits. For the identification of yield-contributing traits, we look for correlation analysis. The correlation coefficients among major traits are shown in Table 2. For genotypic correlation, seed yield per plant has a high positive correlation with the number of capsules (r = 0.854**) and primary branches per plant (r = 0.602**), a moderate positive correlation with secondary branches per plant (r = 0.283*). However, seed yieldis negatively correlated with plant height (r = -0.064). The number of capsules per plant has a strong positive association with primary branches (r = 0.578**) and a moderate positive association with secondary branches (r = 0.407**), but a non-significant negative association with plant height (r = -0.002). Additionally, secondary branches are positively correlated with primary branches and plant height. For phenotypic correlation,a similar trend is observed. Consider these correlations when selecting sesame plants in segregating generations, giving more weight to medium plant height, an increased number of primary branches, and a higher capsule count, which are helpful in genetically improving seed yield. For correlation comparable results for one or more traits are reported in [8], [9], [10], [11], [12],[13].

Further confirming the usefulness of the correlation coefficient, we go for the path analysis. Path analysis is a technique used to dissect the correlation coefficient between direct and indirect effects. Selecting traits based on correlation value and direct effects is thoughtful as these presenta clearer picture. More accuracy is achieved if we give weightage to traits based on correlation and path analysis. The results of the path analysis are presented in Table 3. The maximum direct effect on seed yield per plant is exerted by the number of capsules per plant with a value of 0.769 followed by primary branches with a value of 0.190. Plant height and secondary branches negatively affect the seed yield per plant by exerting negative direct effects. The maximum positive indirect effect on seed yield was exerted by capsules through primary branches. Secondary branches also had a positive indirect effect through capsules per plant. However, secondary branches have a negative direct effect, indicating that they reduce seed yield. This may be because the capsules on secondary branches remain immature at the time of harvesting, causing the seeds in these

Table 1. Analysis of variance for traits in sesame

	Mean sum of squares					
Source	**df**	**Plant height**	**Primary branches**	**Secondary branches**	**Capsules /plant**	**Seed yield/plant**
Block (Ignoring Treatments)	4	51.33	0.22	0.11	20.15	7.11
Treatment (Eliminating Blocks)	51	155.77*	0.61*	7.45*	152.05**	33.85**
Treatment: Check	1	4.90	0.10	6.40	32.40	10.00
Treatment: test and test vs. Check	50	158.79*	0.62*	2.38	154.45**	34.32**
Residuals	4	19.90	0.10	1.15	5.15	1.75

*, ** significant at 5 and 1 per cent respectively

Table 2. Genotypic (upper diagonal) and phenotypic (below diagonal) correlation coefficients among traits of sesame

Characters	**Plant height**	**Primary branches**	**Secondary branches**	**Capsules /plant**	**Seed yield/plant**
Plant height		0.168	0.319*	-0.002	-0.064
Primary branches	0.311*		0.307*	0.578**	0.602**
Secondary branches	0.024	0.346*		0.407**	0.283*
Capsules /plant	-0.055	0.181	-0.113		0.854**
seed yield/plant	-0.041	0.144	0.174	0.841**	

*, ** significant at 5 and 1 per cent respectively

Table 3. Direct (diagonal) and indirect effects of traits on seed yield

Characters	**Plant height**	**Primary branches**	**Secondary branches**	**Capsules /plant**	**Seed yield/plant**
Plant height	**-0.074**	0.032	-0.021	-0.002	-0.064
Primary branches	-0.012	**0.190**	-0.020	0.445	0.602
Secondary branches	-0.023	0.058	**-0.066**	0.313	0.283
Capsules /plant	0.002	0.110	-0.027	**0.769**	0.854

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capsules to remain small.Plant height is negatively correlated and has a negative direct effect on seed yield per plant. This is because tall plant height is directly correlated with the more vegetative phase, which means less reproductive phase. A decreased reproductive phase leads to reduced seed yield. Therefore, it seems that medium plant height, number of branches, especially primary branches, and number of capsules are important traits for improving seed yield in sesame. A residual of 0.243 in path analysis suggests that these traits are sufficient to elucidate the correlation and path analysis. For path analysis, similar results were reported in [14], [15],[16],[17].

4. CONCLUSION

Correlation and path studies show that the number of capsules and primary branches plays a very prominent role in determining the sesame yield. During selection in segregation generation emphasis on these traits help in immediate increase in sesame seed yield.

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