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Assessment of Selection Criteria in Sesame by using Correlation and Path Coefficient Analysis under High Moisture and Acidic Stress Soil Condition

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Abstract

Background/Objectives: To evaluate and identify the selection criteria of high yielding genotypes of sesame in high moisture and acidic soil conditions in north east India. **Methods/Statistical Analysis:** Hundred diverse accessions of Sesamum indicum L. were investigated in Kharif 2014 at CSIR-NEIST Jorhat. Relationships were determined between single plant seed yield (g) and leaf nodes per plant, number of pods per plant, number of pods per main stem, breadth of pod, number of seeds per pod, 1000-seed weight and number of seeds per plant. Simple phenotypic correlation coefficients among all observed components were first calculated by the SPSS statistical program (version 10) and later separated into direct and indirect effects through path coefficient analyses as suggested by Singh and Chaudhary13. Path coefficients were estimated by following Dewey and Lu5. **Findings:** Analysis of variance revealed significant difference among genotypes for all the characters studied. Seed yield per plant showed significant and positive association with number of pods/plant, days to maturity and number of seeds/pod. Path coefficient analyses showed number of pods/plant had maximum direct effect on seed yield followed by breadth of pods, days to maturity and number of pods on main stem. It could be concluded that the number of pods per plant, days to maturity and number of pods on main stem are promising good selection criteria for single plant seed yield improvement in sesame. **Application/Improvements:** This analysis proposed that sesame breeding for higher yield could be based on these characters as selection criteria.

Keywords: Character Association, Correlation, Path Coefficient, Sesame, Single Plant Seed Yield

1. Introduction

Yield potential of any variety depends on the combined effect of genotypes and environmental interaction. Among different oil seed crops, sesame is most sensitive to water logged and acidic soil condition. We attempted to grow the plant in high moisture condition of north east Indian condition with acidic soil. The north east India is known for highest rainfall in the world. The pH of soil is 4.8, soil texture was sandy loam soil and available nitrogen was 255 kg/ha, phosphorus (46.76) and potassium (104 kg/ha).

Sesame plant is an important seed crop whose oil is commercially and nutritionally desirable because of its high stability and quality compared to other vegetable oil. Sesame meal is notable for its high protein content which is rich in methionine and tryptophan, amino acids that are rarely found in other sources of vegetable protein such as Soya. Thus, sesame meal or flour is added to recipes to give better nutritional balance to health food products [1,6,7]. It can grow on only minimum soil moisture with very scanty rain fall and can be grown with mixed crops[2].

Determination of seed and oil yield components and suitable character combination that affect yield to a maximum extent is important in formulating an effective breeding programme. An analysis of association between various plant characters helps in identifying the most important characters. Correlation studies provide reliable information on nature, extent and direction of selection[8,3]. However, it may not give satisfactory result because its

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analytical resolution is limited to identification of mutual associations among parameters. In crop breeding, path analysis has been widely used to identify traits that have significant effect on yield for potential use in selection this technique is useful in determining the direct influence of one variable on another and also separates the correlations coefficient into direct effect (path coefficient and indirect effects)[4,10].

The correlation between yield components and the partitioning of the correlation coefficient into its components of direct and indirect effect have been extensively studied in sesame.

The knowledge of nature and magnitude of genetic variability is of immense value for planning efficient breeding programme to improve the yield potential of the genotypes. Information on the association of plant characters with seed yield is of great importance to breeder in selecting desirable genotypes. Hence, the present investigation was carried out to gather information on character association and path co-efficient analysis in 100 diverse germplasm collections of sesame for thirteen characters under acidic soil condition of north east India.

2. Material and Methods

One hundred accessions of morphologically distinct sesame were collected from Rajasthan, Madhya Pradesh, Gujarat and Maharastra out of hundred, seventy were received from project coordinator, all India coordinated project on Sesame and Niger. This investigation was conducted in field trial at Research farm of CSIR-North East institute of science and technology Jorhat Asaam India during Kharif 2014. The soil of experimental field was sandy loam in texture. The fertility status of the soil was classified as medium in available nitrogen (261 kg /ha), Phosphorus (46.76 kg/ ha) and low in available potassium (104 kg /ha). The seeds of each accession were planted in a 3 meter row with line to line and plant to plant distance was 45 and 25 cm respectively. The trials were planted in complete randomized block design with three replications. All cultural practices were followed to raise a good crop.

The following were observed and measured on five randomly tagged plants. Plant height at maturity, leaf nodes per plant, number of primary branches, leaf area, days to maturity, length of fruiting nodes, number of pods per main stem, number of pods per plant were measured before harvesting while length of pod, breadth of pod, number of seeds per pod, 1000-seed weight, seed yield per plant were determined at after harvesting.

Simple phenotypic correlation coefficients among all observed components were first calculated by the SPSS statistical program (version 10) and later separated into direct and indirect effects through path coefficient analyses as suggested by[13]. Path coefficients were estimated by following[5].

3. Results and Discussion

Analysis of variance revealed that highly significant differences among the all the characters under study except leaf nods per plant (Table 1) indicating considerable amount of genetic variation present in the material. High magnitude of variation in the experimental material was reflected by high value of mean and range for almost all the characters.

Correlations among all pairs of variables are shown in (Table 2). Interrelationship between characters across the one hundred accessions revealed positive and significant correlation between single plant seed yield (g) and characters such number of seeds per pod, number of pods per plant, number of pods per main stem, and days to maturity. This suggests that any increase in such traits will lead to improved single plant seed yield[4,10,15] also reported that positive and significant correlation were observed for seed yield (g) with number capsules and 100-seed weight[3] also reported that seed yield per plant was positive significantly correlated with number of capsule per plant[10] found positive correlation between height to first capsule and plant height. 1000 seed weight showed positive and significant correlation with number of pods per plant and days to maturity which suggest that improvement in these yield components will bring about increase in seed size and number. However, negative and significant correlation was observed between most 1000-seed weight with number of seeds per pod which indicates that increase in number of seed may produce low 1000 grain weight. Therefore there may be needed to strike a balance between these two important attributes when breeding for high yield improvement in sesame.

The number of seeds /pod was positive and significantly correlated with length of fruiting nodes, length of pods, number of pods and days to maturity. Similar finding were reported by[11,14,15].

Path coefficient analysis has been widely used in crop breeding to determine the nature of relationship between

grain yield and its contributing components and to identify those component with significant effect on grain yield for potential use as a selection criteria[11,15].

A path coefficient is a standardized partial regression coefficient and measures the direct influence of a predictor variable on the response variable[9]. Results showed that the most important agronomic traits determining seed yield per plant in the path coefficient analysis were number of pods/plant, number of pods on main stem, days to maturity and breath of pods .These traits had a positive direct effect with seed yield (Table 3). These results are in agreement with those of [12,15].

In spite of the high positive direct effect among seed yield and the above mentioned traits number of primary branches and length of fruiting nodes had negative direct effects. According to our study it can be concluded that to increase seed yield and assessment of selection criteria in sesame. the characters like number of pods /plant days to maturity, number of pods on main stem and breath of pods should be increase so contrary to achieve potential yield of sesame in high moisture and acidic soil conditions.

Table 1. Analysis of variance of different characters in sesame

Characters	Mean Square
Plant height	1123.44**
Leaf nodes /plant	35.34
No. of primary Branches	167.78**
Days to maturity	1078.89**
Leaf area	450.03**
Length of fruiting nodes	230.56**
Number of pods /plant	1680.48**
No. of pods on Main stem	824.33**
Length of pods	630.49**
Breath of pods	120.12*
No of seeds/ pods	1950.45**
1000- grain weight	98.03**
Seed yield/plant	490.34**

** Significant at 1 % Level * Significant at 5 % level

Table 2. Correlation coefficients between thirteen characters in sesame

	Plant height	Leaf nodes / plant	No. of primary Branches	Days to maturity	Leaf area	Length of fruiting nodes	Number of pods /plant	No. of pods on Main stem	Length of pods	Breath of pods	No. of seeds/ pods	1000 grain weight	Seed Yield/ plant
Plant height	1.00												
Leaf nodes / plant	0.112	1.00											
No. of primary Branches	0224**	0.699**	1.00										
Days to maturity	0.123	0.581**	0.448**	1.00									
Leaf area	0.445**	-0.268**	-0.132	0.191	1.00								
Length of fruiting nodes	0.57	-0.155	-0.356**	0.009	0.006	1.00							
Number of pods /plant	0.345**	-0.234	0.277	-0.323	0.111	0.212**	1.00						
No. of pods on Main stem	-0.117	0.091	-0.300**	-0.18	0.49	0.478**	0.367**	1.00					
Length of pods	0.075	-0.081	-0.156	-0.138	0.165	0.189*	0.539**	0.344**	1.00				
Breath of pods	0.163	0.565**	0.502**	0.467**	0.445**	0.123	0.003	0.008	0.456**	1.00			
No of seeds/ pods	0.234	0.008	0.345	0.456**	0.123	0.675**	-0.450**	0.102	0.457**	0.230	1.00		
1000- grain weight	0.006	0.105	0.046	0.349*	0.3458	-0.127	-0.498**	0.145	-0.172	-0.193	-0.238*	1.00	
Seed yield/ plant	0.137	-0.013	0.231	0.452**	0.187	0.003	0.650**	0.437**	0.329*	0.108	0.453**	0.278	1.00

** Significant at 1 % Level, * Significant at 5 % level

Table 3. Direct (diagonal) and indirect effects of characters towards seed yield/plant at genotypic level in Sesame

	Plant height	Leaf nodes /plant	No. of primary Branches	Days to maturity	Leaf area	Length of fruiting nodes	Number of pods /plant	No. of pods on Main stem	Length of pods	Length of pods	Breath of pods	1000-grain weight	Seed Yield / plant
Plant height	0.042	0.002	0.013	0.003	0.001	0.120	0.123	0.005	0.170	0.087	0.129	0.154	0.131
Leaf nodes / plant	0.211	0.009	0.016	0.137	0.004	0.027	0.178	0.008	0.176	0.134	0.156	0.287	0.113
No. of primary Branches	0.081	0.154	-0.123	0.005	0.000	0.004	0.156	0.178	0.005	0.267	0.156	0.165	0.214
Days to maturity	0/013	0.098	0.245	0.239	0.005	0.007	0.089	0.206	0.009	0.178	0.298	0.186	0.486
Leaf area	0.156	0.065	0.187	0.128	0.101	0.167	0.087	0.233	0.198	0.182	0.197	0.165	0.134
Length of fruiting nodes	0.170	0.045	0.004	0.058	0.001	-0.034	0.199	0.244	0.196	0.102	0.157	0.045	0216
Number of pods /plant	0.004	0.038	0.035	0.178	0.003	0.201	0.401	0.198	0.205	0.101	0.005	0.301	0.889
No. of pods on Main stem	0.045	0.000	0.006	0.036	0.003	0/208	0.005	0.329	0.287	0.109	0.009	0.187	0.469
Length of pods	0.125	0.002	0.009	0.046	0.006	0.023	0.127	0.178	0.028	0.005	0.004	0.145	0.241
Breath of pods	0.287	0.001	0.046	0.048	0.145	0.027	0.211	0.176	0.301	0.209	0.178	0.179	0.650
No of seeds/ pods	0.162	0.004	0.467	0.049	0.169	0.301	0.217	0.005	0.199	0.093	0.017	0.173	0.413
1000- grain weight	0.023	0.005	0.230	0.067	0.034	0.278	0.209	0.105	0.088	0.091	0.175	0.167	0.210

Residual 0.371 Bold figures are direct effect

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5. References

1. Arslen C, Uzun B, Ulger S, Cagirgan MI. Determination of oil content and fatty acid composition of sesame mutants suited for intensive management conditions. J Am Oil Chem Soc. 2007; 84: 917–20.
2. Ashri A. Sesame (Sesamum indicum L.). In: Singh RJ, editor. Genetics resources, chromosome engineering, and crop improvement. Oilseed Crops. Boca Raton. FL: USA: CRC Press; 2007; 4: 244–306.
3. Chowdhury S, Datta AK, Saha A, Sengupta S, Paul R, Maity S, Das A. Traits influencing yield in sesame (Sesamum indicum L.) and multilocational trials of yield parameters in some desirable plant types. Indian Journal of Science and Technology. 2007; 3(2): 163–6.
4. Sankar PD, Kumar CR. Character association and path coefficient analysis in sesame (Sesamum indicum L.). Agricultural Science Digest. 2003; 23:17–9.
5. Dewey DR, Lu KH. A correlation and path-coefficient analysis of components of crested wheatgrass seed production. Agron J. 1959; 51:515–8.
6. Yol1 E, Karaman E, Furat S, Uzun B. Assessment of selection criteria in sesame by using correlation coefficients, path and factor analyses. Australian Journal of Crop Science. 2010; 4(8):598–602.
7. Erbas M, Sekerci H, Gül S, Furat S, Yol E, Uzun B. Changes in total antioxidant capacity of sesame Sesamum by variety. Asian J Chem. 2009; 21:5549–55.
8. Gnanasekaran M, Jebaraj S, Muthuramu S. Correlation and path co-efficient analysis in sesame (Sesamum indicum L.). Plant archives. 2008; 8:167–9.
9. Li CC. Path Analysis: A primer. Pacific Grove, California, USA: Boxwood press; 1975. p. 346.
10. Parameshwaappa SG, Palakshappa MG, Salimath PM, Parameshwarappa KG. Studies of genetic variability and characters association in germplasm collection of sesame. Karnataka Journal of Agriculture Science. 2009; 22(2):252–4.
11. Pathak HC, Dixit SK. Genetic variability and inter relationship studies in black seeded sesame. Madras Agricultural Journal. 1992; 79:94–100.
12. Shi KB, Kang CW, Lee RE, Kim DH, Lee BH. Heritability's,

genetic correlation and path coefficient of some agronomic traits in different cultivar environment in Sesame. Sesame and Sunflower News Letter. 2001; 16:16–22.
13. Singh RK, Chaudhary BD. Biometrical Methods in Quantitative Genetic Analysis. Ludhiana, India: Kalyani Publishers; 1999. p. 304.
14. Thiyagu K, Kandasamy G, Manivannan N, Muralidharan V, Uma D. Correlation and path analysis for oil yield and its components in cultivated sesame (Sesamum indicum L.). Agricultural Science Digest. 2007; 27(1): 62–4.
15. Tomar HS, Srivastava GK, Tiwari OP, Tripati RS. Correlation and path co-efficient analysis of various components on seed yield of summer sesame. Journal of Oilseeds Research. 1999; 16:137–8.