Sindh Univ. Res. Jour. (Sci. Ser.) Vol. 48 (2) 241-244 (2016)

SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

Screening of sesame (*Sesamum indicum* L.) genotypes for yielding ability as per degree of association among yield contributing morphological features

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Received 17th December 2014 and Revised 2nd September 2015

Abstract: A field trial was conducted during 2013 to evaluate 09 sesame genotypes (Pr -122, Pr- 126, Pr-135, Pr-147, Pr-68, Pr-24, Pr-167, Pr-70, Sehwan-II) for estimating yield and its associated characters keeping the 10th S-17 as check variety. Three replications under Randomized Complete Block Design were done. The seed yield plant^{-1} was highly significantly correlated in a positive manner with days taken by the genotypes to bear flowers (r=0.645**), number of branches produced by individual plant (r=0.353**); number of capsules on plant basis (r=0.368**), yield harvested from each plot (r=0.362**) and negative but non-significantly correlated between seed yield plant^{-1} and plant stature (r= -0.094NS) and seed index (r= -0.077NS). Regression analysis suggested that 41.6% variation in seed yield plant^{-1} was caused by days to flowering, 13.50% by capsules plant^{-1}, 13.1% by yield plot^{-1}, 12.5% by branches plant^{-1}, 0.90% by plant height, 0.6% by seed index and 0.1% by days to maturity.

Keywords: Sesame, Correlation, Yielding Ability, Morpho-yield traits, Minor oilseed crops.

1. INTRODUCTION

The botanical name of sesame is *Sesamum indicum* L, it is an annual diploid (2n = 26) plant belonging to Pedaliaceae family. There are 16 genus and 60 species in the Pedaliaceae family (Khajehpour, 2010). Sesame is probably one of the oldest oilseeds under cultivation. It is widely grown in different parts of the world and generally cultivated on small holdings by resource-poor farmers in the tropics (Olowe, 2007). Almost all the wild species of the genus *Sesamum* are considered to be native to Africa, but first domestication of these were recorded in the Indian Sub-continent. Sesame seeds have a high nutritive value and seeds are used in baking products and for oil extraction. It is considered as a drought tolerant crop (Asghar *et al.,* 2003). The crop is the queen of vegetable oils and the oil has high degree of stability and resistance to rancidity (Arif *et al.,* 2006; Armstrong, 2012). In Pakistan, during 2011-12, the land under the utilization of growing sesame crop particularly in the provinces of Punjab, Sindh, Khyber Pakhtoon Khua and Balochistan was 63.6, 6.4, 0.1 and 7.5 thousand hectares with production of 23.8, 2.9, 0.1 and 4.3 thousand tons; while the average yield was 374, 457, 510 and 573 kg ha-1, respectively. This indicates that Punjab province is the main sesame producer in Pakistan. (GoP, 2013).

Evolution and development of high yielding varieties is primary aspect of the crop production technologies. The breeding programs are generally initiated with the objective to develop varieties with improved qualitative and quantitative characteristics (Mehta and Arias, 2001). However, selection is a significant tool implied to achieve crop improvement, selection of a particular trait relies upon the tendency to which correlation is found between yield conferring traits and yield of seeds. Correlation is a statistical technique that showed whether and how strongly pairs of variables are related. The important breeding parameters includes the use of genotypic and phenotypic correlations for estimating the extent of association of different yield contributing morphological features of a plant with grain yield (Ali *et al.,* 2002). Therefore, prior to initiate selection in a breeding program focused on crop improvement, it is essential to make oneself aware with knowledge of relative significance of various characters influencing the trait of prime interest as per higher economic value, moreover to confirm whether the correlation is surely in a desired direction (Falconer and Mackay, 1996).

2. MATERIALS AND METHODS

The experimental area of Oilseeds Section, A. R. I, Tandojam was the unit where this research study was under taken during the year 2013. Purpose was to evaluate and estimate yield on the basis of fluctuation in the value of the associated traits among selected sesame genotypes. The details of experiment are given under:

Genotypes:

1.	**Pr-122**	**2.**	**Pr-126**
3.	**Pr-135**	**4.**	**Pr-147**
5.	**Pr-68**	**6.**	**Pr-24**
7.	**Pr-167**	**8.**	**Pr-70**
9.	**Sehwan-II**		**10.S-17 (Check Variety)**

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R.C.B.D was used, replications were 03, and genotypes included 09 pipe line varieties and one commercial check variety in sub-plots sized 1.8m × 5m, keeping row to row distance of 45 cm. In each plot, 4 rows were maintained. After 25 days of sowing, when plant germinated and reached the height of 15-20 cm spacing was maintained. The plants in excess were rogued out by thinning to ensure single plant hill^{-1}. During the entire crop season, the recommended agronomic practices applied. Fertilizer application, supply of irrigation water and pest control operations were followed evenly for all the accessions. Precisely, the crop was grown under uniform conditions to reduce the effect of environment that may have led to variability. The picking of the plants was carried out during the month of September in the tagged plants on single plant basis. The traits studied are listed below:

Parameters studied:

1. Days to seventy five percent flowering
2. Days to ninety percent maturity
3. Stem length (cm)
4. Number of branches per plant
5. Number of capsules per plant
6. Yield in grams per plant^{-}
7. Yield on plot basis in grams
8. 1000 seed weight in grams

Statistical analysis:

The analysis of variance (ANOVA) for the collected data was done by following the method given by Steel and Torrie (1980). For the estimation of correlations the method given by Snedecor and Cochran (1980) was applied.

3. RESULTS

In order to evaluate and estimates correlation among yield and its associated characters for various sesame genotypes, the experiment was held during the year 2013 at the experimental farm, Oilseeds Section, Agriculture Research Institute, Tandojam. The specific genotypes used in this study and the traits studied are described as above. The analysis of variance for yield and its components are present in table 1 and 2. The correlation coefficients (r) regarding seed yields and its contributing components and analysis on regression analysis coefficients (r^2) are described in table 3.

Analysis of variance (ANOVA):

The sesame genotypes varied significantly at 1% level of significance for days taken by the genotypes to complete seventy five percent flowering, days taken by the genotypes to reach ninety percent physical maturity, stem length, branches per plant, capsules per plant, individual plant yield and yield on plot basis while non-significant for seed index. The ANOVA **(Table 1 and 2)** also suggested that the data for all the traits studied were useful and can be further analyzed to estimate genotypic variance Vg, phenotypic variance Vp, heritability estimates (h^2), heritability (%) and genetic advance (GA).

Table 1. Mean squares derived from ANOVA of sesame genotypes for days to flowering, days to maturity, plant height and number of branches plant^{-1}

Source	D.F.	Days to flowering	Days to maturity	Plant height	No of branches plant^{-1}
Replications	2	0.633	2.233	137.532	3.184
Genotypes	9	50.096**	108.800**	428.601**	2.549**
Error	18	1.337	0.789	13.825	0.649
Total	29				

Table 2. Mean squares derived from ANOVA of sesame genotypes for number of capsules plant^{-1}, seed index, yield plant^{-1} and seed yield plot^{-1}

Source	D.F.	Number of capsules plant^{-1}	Seed index	Yield plant^{-1}	Yield plot^{-1}
Replications	2	82.105	0.195	0.151	910.000
Genotypes	9	902.700**	0.011 NS	1.752**	25140.741**
Error	18	61.230	0.010	0.382	150.741
Total	29				

Correlation (r) and regression (r^2) analysis:

The correlation and regression analysis indicated that correlation between days to 75% flowering and yield of seeds on plant basis was not only positive but also significant at P<0.01(r=0.645**) and coefficient of determination (r^2= 0.416) suggested that 41.6 percent change in the yield of seeds of individual plant was due to days to 75% flowering. The regression co-efficient revealed that when one unit of days to 75% flowering will increase 0.143 gm yield increases **(Table-3).** The days to 90% maturity was non-significantly associated with yield of seeds produced by plants on individual basis (r=0.036^{NS}); while the coefficient of determination (r^2= 0.001) indicated 0.10 percent contribution of days to 90% maturity in the variation of yield of seeds on plant basis. Similarly, the height of plants as mentioned above as stem length was negative but non-significantly associated with the same trait (r= -0.094^{NS}). While calculating coefficient of determination which stood as r^2= 0.009, it could be expected that 0.09% variation in yield of seeds on individual plant basis can be because of one unit change in height of plant 0.004 gram grain yield decreases. In case of the trait number of branches per plant, it was positive and highly significantly correlated with yield of seeds on plant basis at P<0.01 (r=0,353**), coefficient of determination which stood as r^2 = 0.125depicted that 12.5% change in yield of seeds is because of the first trait. The ultimate yield of seeds when was related to the number of capsules borne by the plant, it was found that both the traits were highly significantly correlated with each other in a positive manner, *i.e* r = 0.368**. The coefficient of determination in this case was $r^2 = 0.135$ which meant that 13.5% variation due to pods plant^{-1}, one unit variation in the former trait can bring 0.019 grams change in the seed yield per plant. Because of seed index, only the 0.60 percent variation could be observed in the yield of seeds produced by each plant as both the traits were negatively but non-significantly associated. The related values of "r" and "r^2" were -0.077$^{(NS)}$ and 0.0066, respectively. In case of relation between yield per plot and yield per plant, both were significant and positive. Calculations depicted "r" value as 0.362** and "r^2" as 0.131, hence inferred that 0.0037 grams increase in yield of seeds can be because of seed yield plot^{-1}.

Table 3. Correlation and regression analysis for seed yield plant^{-1} vs various traits of sesame genotypes

Traits	Correlation (r)	Coefficient of determination (r^2)	Regression coefficient (b)
Number of days to flowering	0.645**	0.416	0.143
Number of days to maturity	0.036	0.001	0.002
Plant height	-0.094	0.009	0.004
Number of branches plant^{-1}	0.353**	0.125	0.607
Number of pods plant^{-1}	0.368**	0.135	0.019
Seed index (1000 seed weight)	-0.077	0.006	1.676
Seed yield plot^{-1}	0.362**	0.131	0.0037

4. DISCUSSION

The available germplasm/varietal material collected from different sources was screened time to time to investigate the genotypic and phenotypic variances and possible genetic gains. In this study, 09 genotypes (Pr -122, Pr- 126, Pr-135, Pr-147, Pr-68, Pr-24, Pr-167, Pr-70, Sehwan-II) were evaluated for yield and yield associated characters keeping S-17 as check variety. The results revealed that the seed yield plant^{-1} was positively and significantly correlated with days to 75% flowering (r=0.645**), branches plant^{-1} (r=0.353**); capsules plant^{-1} (r=0.368**), yield plot^{-1} (r=0.362**) and negative, non-significant (P>0.05) correlation with seed yield plant^{-1} was recorded for plant height (r= -0.094^{NS}) and seed index (r= -0.077^{NS}). The above findings are in concurrence with those of Hassan and Abdella (2004) who reported that seed yield and the branches per plant showed a significant and positive correlation and the other characters indicated a positive but non-significant correlation with seed yield. Parimala and Mathur (2006) reported that the multiple correlation coefficient between seed yield and all seven characters in equation were very high (R=0.9754). Another important study conducted by Zeina *et al.* (2006) painted crystal clear picture of correlation of yield of sesame seeds on individual plant basis with other morphological traits. According to them the first fruiting node and height were negative but significantly associated, however, capsules carried by a plant, its height, nodes present on the main stem and weight of seeds present in each capsule were significant and associated with the yield of seeds on plant basis in positive manner. Similarly, Mehta and Arias, (2001) analyzed character inter dependence and reported via writings the strong and positive association between yield of sesame seeds produced by individual plant with its number of branches and number of capsules.

Regression analysis suggested that 41.6% variation in seed yield plant^{-1} was caused by days to 75% flowering, 13.50% by capsules plant^{-1}, 13.1% by yield plot^{-1}, 12.5% by branches plant^{-1}, 0.90% by plant height, 0.6% by seed index and 0.1% by days to maturity. The findings of many past workers agreed the results of present research. Adebisi (2004) pointed out 1000-seed weight as the most contributor to the regression equation, accounting for 36% of variation in field emergence and 17% in seed yield. Regression analysis done by Parimala and Mathur (2006) showed r = 0.9687 for the trait number of capsules developed by a plant. Furthermore, they declared this trait to be of utmost importance as the same could contribute to 93.84% of the seed yield. Similarly, Onginjo and Ayiecho (2009) reported that seed yield per plant registered the highest coefficient of determination (63.8%). In a similar study, Alake *et al.,* (2010) showed that 86.4% of the total variations in seed yield could be explained by variations in capsule weight per plant, seed weight, and capsule number per plant, implying that capsule weight per plant could be used as primary selection criterion for improving seed yield in sesame genotypes. Haruna *et al.,* (2011) reported that the highest percent contribution to seed yield was made by and via seed yield per plant (34.4042 and 21.2104%) when the data is combined. Seed yield plant^{-1} should therefore, be considered as the most important trait in the determination of seed yield per unit area and selection of parents.

5. CONCLUSIONS

The seed yield plant^{-1} was positively and significantly correlated with days to 75% flowering (r=0.645**), branches plant^{-1} (r=0.353**); capsules plant^{-1} (r=0.368**) and yield plot^{-1} (r=0.362**). Negative and non-significant (P>0.05) correlation with seed yield plant^{-1} was recorded for plant height (r= -0.094^{NS}) and seed index (r= -0.077^{NS}). Some 41.6%

variation in seed yield plant^{-1} was caused by days to 75% flowering, 13.50% by capsules plant^{-1}, 13.1% by yield plot^{-1}, 12.5% by branches plant^{-1}, 0.90% by plant height, 0.6% by seed index and 0.1% by days to 90% maturity.

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