The present investigation was carried out with a set of eight varieties of linseed and their twenty eight F1’S obtained through diallel crossing excluding reciprocals. The eight parents, their 28 F1’S and the 28 respective F2’S were grown in a randomized block design during rabi season of 2012 and studied for fifteen quantitative characters. The analysis of variance showed highly significant differences among the genotypes for all the characters studied except days to maturity in F1’S as well as F2’S. The highest values of phenotypic as well as genotypic variances were observed in number of capsules per plant for parents as well as crosses in F1’S, whereas in F2’S it was found to be maximum in linolenic acid percent in crosses, followed by number of capsules per plant. The genetic coefficient of variance was high in number of capsules per plant, Linolenic acid content and technical height in F1’S, whereas, in F2’S it was found to be maximum in steric acid followed by number of capsules per plant. The highest value of heritability was observed in linoleic acid content among parents whereas among crosses it was the highest in case of linolenic acid in F1’S. However, in F2’S it was found to be highest in oleic acid and linolenic acid respectively for parents and crosses. Genetic advance was observed to be the highest in number of capsules per plant for parents and linolenic acid for crosses in F1 as well as F2 generation. Genetic advance expressed as percentage of mean was highest in steric acid percent for parent and seed yield per plant for crosses in F1 while in F2 it was maximum in steric acid both for parents as well as crosses. Heterosis for seed yield per plant was found to be highest in JLS-9 X KL-221 over mid, better as well as over standard variety. Wherever, inbreeding depression in F2 for seed yield per plant was found to be highest in the cross JLS-9 X RLC-76. The combining ability studies indicated that both additive and non additive genetic components were involved in determining the expression of the characters included in the present study but non additive type of gene action predominated in all these characters. LMS-149-4 was found as good general combiner for seed yield per plant as well as oil content. However, the cross JLS-9 X KL-221 was the best specific combiner for seed yield per plant and Meera X KL-221 for oil content. The result of antioxidant assay revealed that LMS-153-3 was the best performer, whereas in F1s as well as F2s the cross LMS-149-4 X KL-221 performed best but none of the samples was found to perform better than standard Quercetin. The per se performance of the parents was an adequate measure of general combining ability and parents may be selected on the basis of per se performance in breeding for character improvement. Higher the inhibition percentage higher will be the antioxidant potential. The traits which perform better can be utilized to develop natural antioxidants. Methods which exploit non–additive gene action such as development of hybrids using male sterility or both additive and non-additive gene action such as reciprocal recurrent selection may be suggested for genetic improvement of the character.