CHAPTER VI

SUMMARY AND CONCLUSIONS

The present investigation was carried out to elucidate the information on genetic variability, correlation coefficients and path analysis for pod yield and its components and to assess the drought tolerance in the advanced breeding lines of groundnut. A total of 90 lines comprising 72 advanced breeding lines of ten different crosses and 18 parents were evaluated in a Randomized Block Design with three replications under four different conditions viz; well watered condition, Stress-I condition (drought imposed at peg formation stage, 55-60 DAS), Stress-II condition (drought imposed at pod development stage, 75-80 DAS) and Stress-III condition (drought imposed at peg formation & pod development stages, 55-60 DAS & 75-80 DAS) at the Main Oilseeds Research Station, J.A.U., Junagadh during Summer 2017.

The observations were recorded on five randomly selected plants in each entry and replication from each condition and their mean values were used for statistical analysis. The characters studied were specific leaf area (cm\(^2\)/g), SCMR-1, SCMR-2, days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of hanging pegs per plant, number of pods per plant, number of mature pods per plant, number of immature pods per plant, pod yield per plant (g) shelling out turn (%), 100-kernel weight (g), sound mature kernel (%), biological yield per plant (g), harvest index (%) and oil content (%).

The analysis of variance for individual condition showed significant differences among the genotypes for all the characters thereby suggesting presence of ample genetic variation in the advanced breeding lines used in the study.

Under all the conditions, specific leaf area, number of hanging pegs per plant, shelling out turn, 100-kernel weight, sound mature kernel, biological yield per plant and harvest index showed wide range of variation, while the range observed was of moderate magnitude for SCMR-1, SCMR-2, number of pods per plant and number of mature pods per plant. A narrow range of variation was observed for days to 50% flowering, days to maturity, plant height, number of branches per plant, number of immature pods per plant, pod yield per plant and oil content. The results on mean of different yield components under well watered and three imposed drought conditions
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revealed that the water stress during peg formation and pod development stages reduced specific leaf area, plant height, number of pods per plant, number of mature pods per plant, pod yield per plant, shelling out-turn, 100-kernel weight, sound mature kernel, biological yield per plant, harvest index and oil content.

The values of phenotypic coefficient of variation (PCV) were slightly higher than that of genotypic coefficient of variation (GCV) for all the traits studied indicating less effect of environment on the expression of characters studied.

Under all the conditions, estimates of GCV and PCV were high for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant and plant height except for plant height under Stress-III condition. Number of pods per plant also had high estimates of GCV and PCV under Stress-III condition. High magnitude of GCV indicated the presence of wide genetic variation for the characters under study to allow further improvement by selection of the individual traits. Moderate values of GCV and PCV were observed for number of pods per plant, 100-kernel weight, biological yield per plant and harvest index under well watered, Stress-I and Stress-II conditions. In addition, moderate GCV and PCV values were also observed for shelling out-turn in Stress-I condition and pod yield per plant and sound mature kernel under Stress-III condition. Under Stress-III condition, harvest index, plant height, 100-kernel weight, sound mature kernel, biological yield per plant, pod yield per plant and shelling out-turn exhibited moderate values of GCV and PCV. The estimates of GCV and PCV were found low for specific leaf area, SCMR-1, SCMR-2, days to 50% flowering, days to maturity, number of branches per plant and oil content under all the four conditions. Low values of GCV and PCV were also observed for pod yield per plant and sound mature kernel under well watered and Stress-I condition, while these values were low for shelling out turn under well watered and Stress-II condition.

High heritability estimates were observed for number of hanging pegs per plant, specific leaf area, number of immature pods per plant, sound mature kernel, 100-kernel weight, number of mature pods per plant, number of pods per plant, plant height, shelling out turn, harvest index, SCMR-1, SCMR-2, days to 50% flowering, biological yield per plant, days to maturity and pod yield per plant under well watered and imposed drought conditions. Heritability was moderate for oil content and low for number of branches per plant under all the conditions.
The expected genetic advance was high for specific leaf area, 100-kernel weight, number of hanging pegs per plant, shelling out turn and sound mature kernel under well watered and Stress-I conditions except for shelling out turn under well watered condition. Under Stress-II and Stress-III conditions, expected genetic advance was high for specific leaf area, number of hanging pegs per plant, shelling out turn, 100-kernel weight, sound mature kernels and harvest index. The expected genetic advance was moderate for biological yield per plant, number of pods per plant, number of mature pods per plant, plant height, SCMR-1, SCMR-2, days to 50% flowering, days to maturity, number of branches per plant, number of immature pods per plant, pod yield per plant and oil content under well watered condition and three imposed drought situations. The genetic advance was also found moderate for harvest index and shelling out turn in well watered condition and for shelling out turn under Stress-I condition.

The genetic advance expressed as percentage of mean was high for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant, plant height, number of pods per plant, 100-kernel weight and harvest index under well watered and imposed drought conditions. High genetic advance expressed as percentage of mean was also observed for biological yield per plant under all the conditions except in Stress-I condition; shelling out turn under Stress-I and Stress-III conditions and sound mature kernel and pod yield per plant under Stress-II and Stress-III conditions. The genetic advance expressed as percentage of mean was moderate for shelling out turn, sound mature kernel, specific leaf area, pod yield per plant, SCMR-1 and SCMR-2 under well watered condition; for biological yield per plant, sound mature kernel, specific leaf area and pod yield per plant under Stress-I condition; for shelling out turn, specific leaf area and SCMR-2 in Stress-II condition and for specific leaf area and SCMR-1 in case of Stress-III condition. Under well watered condition, the genetic advance expressed as percentage of mean was low for days to 50% flowering, number of branches per plant, oil content and days to maturity. The genetic advance expressed as percentage of mean was low for SCMR-1, SCMR-2, days to 50% flowering, oil content, number of branches per plant and days to maturity under all the imposed stress conditions.

High estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant, plant height, number of
pods per plant, 100-kernel weight and harvest index under well watered and all the imposed drought conditions. In addition, high estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for sound mature kernel, biological yield per plant and pod yield per plant under Stress-II and Stress-III conditions and shelling out turn under Stress-I and Stress-III conditions.

The values of genotypic correlation were higher than their corresponding phenotypic correlation in the present investigation. This indicated that though there was high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment. It has also indicated that there was an inherent relationship between the characters studied. In the present investigation, pod yield per plant exhibited significant and positive correlation with number of branches per plant, number of pods per plant, number of mature pods per plant, shelling out turn, 100-kernel weight, harvest index and oil content at both the genotypic and phenotypic levels whereas, its association was found significant and positive with biological yield per plant at phenotypic level under well watered condition.

Under Stress-I condition, pod yield per plant had significant and positive association with number of pods per plant, number of mature pods per plant, 100-kernel weight, sound mature kernel, harvest index and oil content. It had also significant and positive phenotypic correlation with biological yield per plant and genotypic correlation with specific leaf area, number of hanging pegs per plant and shelling out turn. Under Stress-II condition, pod yield per plant had significant and positive correlation with specific leaf area, number of pods per plant, number of mature pods per plant, 100-kernel weight, shelling out turn, sound mature kernel, biological yield per plant, harvest index and oil content. In case of Stress-III condition, pod yield per plant showed significant and positive correlation with number of branches per plant, number of pods per plant, number of mature pods per plant, shelling out turn, 100-kernel weight, sound mature kernel, harvest index and oil content whereas, its association was found significant and positive with biological yield per plant at phenotypic level only.

The path coefficient analysis revealed high and positive direct effect of number of mature pods per plant, harvest index, biological yield per plant and number of immature pods per plant toward pod yield per plant under well watered and Stress-I condition. Under Stress-II condition, high and positive direct effect was exerted by
number of pods per plant, biological yield per plant and harvest index while, under Stress-III condition, biological yield per plant, harvest index and number of mature pods per plant showed positive and direct effect on pod yield per plant. These characters may be considered as the most important yield contributing characters and due emphasis should be placed on these components while selecting for high yielding types in groundnut.

The results showed wide range in DTI values under all the three imposed drought conditions indicating considerable variation among lines/genotypes used in the study. The lines SB-71, SB-4, SB-27, TPG-41, SB-68, SB-28 and SB-55 under Stress-I (Drought imposed at peg formation stage, 55-60 DAS), SB-22, SB-26, SB-58, SB-71 and SB-27 under Stress-II condition (Drought imposed at pod development stage, 75-80 DAS) and SB-27, SB-4, SB-71, SB-22 and SB-28 under Stress-III condition (Drought imposed at peg formation & pod development stages, 55-60 & 75-80 DAS) displayed maximum DTI values and thus, were rated as drought tolerant. These drought tolerant genotypes showed high pod yield per plant under well watered and imposed drought conditions and had maximum DTI and minimum reduction in pod yield per plant due to stress condition. The results on mean of different yield components under well watered and three imposed drought conditions revealed that the water stress during peg formation and pod development stages reduced specific leaf area, plant height, number of pods per plant, number of mature pods per plant, pod yield per plant, shelling out-turn, 100-kernel weight, sound mature kernel, biological yield per plant, harvest index and oil content.

The salient findings of the present investigation are summarized as under:

1. The analysis of variance revealed highly significant differences among the mean squares due to genotypes for all the characters except for number of branches per plant, suggesting the sufficient variability in the material used.
2. Under all the conditions, wide range of variation was recorded for specific leaf area, number of hanging pegs per plant, shelling out turn, 100-kernel weight, sound mature kernel, biological yield per plant and harvest index.
3. The values of PCV were slightly higher than that of GCV for all the traits indicating less effect of environment on the expression of characters studied.
4. The estimates of GCV and PCV were high for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant and plant height under well watered and three imposed stress conditions.
except plant height under Stress-III condition. Number of pods per plant also had high estimates of GCV and PCV under Stress-III condition.

5. Under all the conditions, high heritability estimates were observed for number of hanging pegs per plant, specific leaf area, number of immature pods per plant, sound mature kernel, 100-kernel weight, number of mature pods per plant, number of pods per plant, plant height, shelling out turn, harvest index, SCMR-1, SCMR-2, days to 50% flowering, biological yield per plant, days to maturity and pod yield per plant.

6. The expected genetic advance was high for specific leaf area, 100-kernel weight, number of hanging pegs per plant and sound mature kernel under well watered and Stress-I conditions, in addition to that shelling out turn under Stress-I condition. Under Stress-II and Stress-III conditions, expected genetic advance was high for specific leaf area, number of hanging pegs per plant, shelling out turn, 100-kernel weight, sound mature kernel and harvest index.

7. The genetic advance expressed as percentage of mean was high for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant, plant height, number of pods per plant, 100-kernel weight and harvest index under well watered and three imposed drought conditions. High genetic advance expressed as percentage of mean was also observed for biological yield per plant under all the conditions except in Stress-I condition; shelling out turn under Stress-I and Stress-III conditions and sound mature kernel and pod yield per plant under Stress-II and Stress-III conditions.

8. High estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for number of hanging pegs per plant, number of immature pods per plant, number of mature pods per plant, plant height, number of pods per plant, 100-kernel weight and harvest index under well watered and all the imposed drought conditions. In addition, high estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for sound mature kernel, biological yield per plant and pod yield per plant under Stress-II and Stress-III conditions and shelling out turn under Stress-I and Stress-III conditions.

9. The values of genotypic correlation were higher than their corresponding phenotypic correlation in majority of cases. This indicated that though there
was high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment.

10. Under well watered condition, pod yield per plant exhibited significant and positive correlation with number of branches per plant, number of pods per plant, number of mature pods per plant, shelling out turn, 100-kernel weight, harvest index and oil content at genotypic and phenotypic levels whereas, its association was found significant and positive with biological yield per plant at phenotypic level.

11. Under Stress-I condition, pod yield per plant had significant and positive correlation with number of pods per plant, number of mature pods per plant, 100-kernel weight, sound mature kernel, harvest index and oil content. It was also significantly and positively correlated with biological yield per plant at phenotypic level and with specific leaf area, number of hanging pegs per plant and shelling out turn at genotypic level.

12. Under Stress-II condition, pod yield per plant had significant and positive correlation with specific leaf area, number of pods per plant, number of mature pods per plant, 100-kernel weight, shelling out turn, sound mature kernel, biological yield per plant, harvest index and oil content.

13. In case of Stress-III condition, pod yield per plant showed significant and positive correlation with number of branches per plant, number of pods per plant, number of mature pods per plant, shelling out turn, 100-kernel weight, sound mature kernel, harvest index and oil content whereas, its association was found significant and positive with biological yield per plant at phenotypic level only.

14. SCMR and specific leaf area were negatively associated with each other hence, selection of genotypes with higher SCMR and lower specific leaf area may lead to selection of genotypes with higher yield.

15. Path coefficient analysis showed high and positive direct effect of number of mature pods per plant, harvest index, biological yield per plant and number of immature pods per plant on pod yield per plant under well watered and Stress-I conditions. Under Stress-II condition, high and positive direct effect was exerted by number of pods per plant, biological yield per plant and harvest index. Under Stress-III condition, biological yield per plant, harvest index and number of mature pods per plant showed positive high direct effect on pod
yield per plant. Hence, these characters may be considered as the most important yield contributing characters and emphasis should be placed on these components while selecting for high yielding types in groundnut.

16. The lines SB-71, SB-4, SB-27, TPG-41, SB-68, SB-28 and SB-55 under Stress-I (Drought imposed at peg formation stage, 55-60 DAS), SB-22, SB-26, SB-58, SB-71 and SB-27 under Stress-II condition (Drought imposed at pod development stage, 75-80 DAS) and SB-27, SB-4, SB-71, SB-22 and SB-28 under Stress-III condition (Drought imposed at peg formation & pod development stages, 55-60 & 75-80 DAS) displayed maximum DTI values and thus, were rated as drought tolerant. These drought tolerant genotypes showed high pod yield per plant under well watered and imposed drought conditions and had maximum DTI and minimum reduction in pod yield per plant due to stress condition.

17. On the basis of DTI, the lines SB-4, SB-27, SB-28 and SB-71 displayed high DTI and pod yield per plant under well watered and three imposed drought situations and thus, they were considered as drought tolerant. These genotypes may be used in breeding programme to developed drought tolerance types in groundnut.