Cotton, one of the most economically important crops worldwide, is used to produce most important renewable natural textile fibre, it is also the second best source of plant proteins and fifth best oil producing plant, the by products, also play an important role in the economics of agricultural and industrial development.

Cotton is important often cross-pollinated crop, where the achievement of commercial exploitation of heterosis is comparable to even that of maize. To improve the remunerative value of hybrid seed production and commercial cultivation of hybrid it is necessary to develop productive CGMS based hybrids.

**Approaches of improving performance of hybrids**

Present study aims at comparing the outcome of approaches of developing new hybrids, namely deriving new A and R lines and developing A x R crosses based on them. The second approach involves crossing potential B lines with these R lines and assessing the B x R crosses as a pre-requisite and developing their A x R version later. As the base material for first objective new potential A lines and R lines were developed. The new R lines are based on sterile cytoplasm as this approach of developing R lines helps in improving the fertility restoration system of the R lines. Similarly new A lines were developed with improved potential and genetic diversity. The new A x R lines were involved in line x tester (4 x 8) combinations. Parallely attempt was made to develop new potential hirsutum varietal lines (maintainer lines) and
they were crossed to the same set of R lines to develop B x R (4 x 8) cross combinations. The two groups of crosses were compared along with commercial check at four different environments representing Dharwad and Ranebennur locations during two years (2003-04 and 2004-05).

Different productivity and plant type traits were studied in them. As a group the set of B x R crosses were found to be better than A x R crosses. Some of the A x R crosses were among the top 16 crosses identified in the study. It is important to note that, the new A x R crosses derived through genetic manipulation were comparable to the best national check (Bunny) and some of them (H3497 x RH179-7, H3497 x RH95 and H3503 x RH179-7) were numerically superior to commercial check (Bunny). However, the best B x R crosses viz., H3086 x RH173-5, H3038 x RH179-7, H3038 x RH158, H3070 x RH173-5 and H3086 x RH179-7 were distinctly superior over check. Among these best crosses of the study, the combining ability status was utilized in drawing inference about the handling of the crosses in future.

Comparative per cent range of pooled heterosis between A x R and B x R crosses as groups indicated that, B x R hybrids group showed higher range of heterosis over mid parent and check (Bunny) similar trend observed in different environments. The magnitude of positive heterosis in B x R group of crosses was more than A x R group of crosses.

Pooled heterosis of A x R hybrids over different environments data indicated that most of the crosses exhibited significant heterosis over their respective mid parent for seed cotton yield and lint yield, whereas crosses, H3497 x RH179-7, H3497 x RH95, H3503 x RH179-7, H3497 x RH158,
H3503 x RH95, H3503 x RH157-1 and H3503 x RH122 recorded positive heterosis for seed cotton yield over check. However they were on par with check (Bunny). Pooled data of heterosis of B x R crosses over different environments indicated that, hybrid H3086 x RH173-5 found more heterotic than check (Bunny) for seed cotton yield, lint yield, GOT (%) and plant height.

The parental lines used in the study H3503, H3086 and RH158 were the best general combiners for seed cotton yield (highest positive gca effect) among A, B and R lines respectively. Similarly H3503, H3070 and RH158 for GOT (%) and H3497, H3038 and RH158 were found to be best combiners for boll weight among A, B and R lines respectively. Specific combining effects were determined for different characters and the crosses with highest sca effect were identified for each character.

Among the CGMS lines, based on weighted gca pooled score H3497 and H3503 and maintainor lines H3086 and H3038 were the best general combiners based on different characters. Among the group of restorer lines (testers) RH158, RH173-5 and RH179-7 were found to be good combiners against both new CGMS lines and varietal maintainor lines.

Three methods of determining pooled score including simple pooled gca score, per cent gca and weighted per cent gca methods were compared and based on weighted per cent gca method some differences in relative ranking of pooled gca status was observed.

Relative magnitude of GCA and SCA variances indicated that in A x R crosses additive variance was important for seed cotton yield, while among
B x R crosses dominance variance is more important. For other characters in general, dominance variance was more important than additive variance.

Based on per se performance of most productive as well as most unproductive crosses, path of productivity was determined. Among the group of characters studied, seed cotton yield, lint yield, average boll weight, number of bolls per plant, number of seeds per boll, plant height and days to 50 per cent flowering were commonly contributing to increase in seed cotton yield for both A x R and B x R group of crosses. In A x R group of crosses seed index and in B x R group of crosses number of monopodia, sympodia, GOT (%), seed index and lint index revealed negative association for seed cotton yield.

**Stability parameters**

Based on evaluation of stability parameters, the A x R hybrids namely H3497 x RH179-7, H3497 x RH95 and H3503 x RH179-7 were found more stable on account of high yield, regression (bi) value being closer to unity and least mean square deviation (S^2 di) values. Among the B x R cross combinations hybrids H3038 x RH179-7, H3038 x RH158, H3070 x RH173-5 and H3086 x RH179-7 were more productive and more stable than check hybrid Bunny.

**In vitro studies on pollen germination and vigour**

Pollen medium for cotton was standardized in order to study the differences of the genotypes for pollen germination and vigour. To increase the pollen germination and tube growth different agarose concentrations were tried. Among them the composition namely basic medium + 1% agarose gave
highest pollen germination. Parental lines namely maintainer and restorers were compared for different pollen growth parameters. Genotypic differences were observed with respect to pollen germination, tube growth, tubes per pollen and vigour index.

**Molecular characterization of genotypes**

The superior hybrids of A x R and B x R groups were utilized for RAPD analysis with the help of 24 random primers. Primers OPG-10, OPG-20 and OPF-06 were able to distinguish the hybrid H3086 x RH173-5 from its parents. Similarly primers OPG-04 and OPG-07 could discriminate the hybrid H3497 x RH179-7 from its parents.