Physiological Studies on Seed Dormancy in Teak (*Tectona grandis*)

M. GANAPATHI 2000 MAJOR ADVISOR : Dr. S.J. PATIL

Field experiment was conducted to investigate the influence of different growth regulators, chemicals and physical methods during 1999-2000 to know their effects on dormancy, germination and seedling growth parameters in teak (*Tectona grandis*). The treatment details of first experiment consisted of sixteen chemicals at three concentrations and with three soaking duratiions along with water treatment and control. The second experiment consisted of five different physical methods to overcome the dormancy.

The growth regulators, chemicals and physical treatments were found to exhibit significant influence on seed dormancy, germination and seedling parameters in teak seeds. Soaking of teak seed in different concentrations of ethrel (10, 25 and 50 ppm) and GA_3 (100, 200 and 300 ppm) recorded significantly higher germination percentage and seedling parameters (shoot length, root length, seedling dry weight, number of leave, seedling vigour index and root volume) over other treatments. The germination per cent and seedling parameters were found to increase with increase in concentrations of ethrel and GA_3. Among the different concentrations of ethrel and GA_3, the germination and seedling parameters were found to be the highest at 50 ppm of ethrel followed by 300 ppm of GA_3 and 0.5 per cent KNO_3.

Pretreating the teak seeds with ethrel at 50 ppm increased germination percentage but the seedling parameters were low. However, the treatment with KNO_3 at 0.5 per cent and GA_3 at 300 ppm recorded significantly higher seedling parameters *viz*., shoot length, root length, seedling vigour index, seedling dry weight, plant height and root volume over other treatments and control. The interaction effect between chemicals and soaking periods varied significantly in 72 hrs of soaking. Ethrel at 50 ppm induced higher germination percentage and was followed by GA_3 300 ppm and KNO_3 at 1.5%. However, the ethrel at 50 ppm induced lower values with respect of seedling parameters.

Among the different physical treatments studied, cowdung slurry induced significantly higher germination and seedling paremters and it was followed by alternate soaking and drying method and mechanical scarification as compared to control.

FORESTRY

Silvi - Genetical Studies in *Sapindus trifoliantus* Linn.

A.K. KIRAN KUMAR 2000 MAJOR ADVISOR : K.V. DEVAR

Tree improvement is effective only when it consists of the combination of all silvicultural and tree-breeding skills of the forester to grow the most valuable forest products as quickly as possible and as inexpensively as possible. Phenotypic variability for various characters was assessed for 40 candidate tree of *Sapindus trifoliatus* Linn. located in different climatic zones. Association of growth traits of candidate trees with locality conditions was determined and analysed.

Among morphometric characters highest co-efficient of variation was found for clear bole (48.50%) and fruit yield per tree (31.84%) and among germination parameters, it was found to be highest for germination value (66.08%). Partitioning of the variability into genotypic and phenotypic components in all the attributes indicated the prevalence of moderate to high GCV and the differences among GCV and PCV were found to be narrow suggesting the negligible role of the environment among the observed variations. Broad sense heritability was highest for clear bole (0.917) coupled with high genetic gain.

The correlation study indicated that the fruit yield increased as crown diameter enlarged and clear bole decreased. High germination was found in big fruits, which had large seeds. Whereas fruit yield, fruit weight and percent germination decreased as altitude increased. Trees from higher moisture regimes had higher fruit weight, seed weight and per cent germination, but less fruit yield. However, chemical properties under the trees showed a positive effect on various growth, yield and germination parameters, among which nitrogen and phosphorus had a greater effect on growth and fruit quality.

The present study indicated that the genotypes selected from the moist deciduous and coastal zones as best geographic sources and should be given more emphasis for further selection in soapnut.

Influence of Site Factors on Growth of Teak Stands in the Western Ghats of Karnataka

SHIVA KUMAR L APARANJI 2000 MAJOR ADVISOR : Dr. A.M. CHANDRASEKHARAIAH

Teak (*Irectona grandis* Linn. f.) is one of the most well known and popular timber species of high quality that is grown under varied environmental conditions. To elucidate the effect of rainfall, temperature and a few soil factors, a study was conducted on similar-aged teak plantations (19-20 years old) spread over six bioclimatic zones established by the KFD. Temperature rainfall, all edaphic factors studied and associated vegetation showed a major influence on its growth and yield as indicated by analysis of variance

Performance of teak for various growth and yield measurements were found to be better in the bioclimatic zone IV which was characterized by higher temperature (>23 °C) and medium rainfall (1500-2000 mm). Contrast analysis showed that about 61 per cent more growth under zones of higher temperature (II, IV and VI) when compared to lower temperature range (I, III and V) suggesting positive response of teak to higher temperature regime. Similarly higher performance of teak was noticed in medium rainfall zones compared to zones of higher (2000-5000 mm) or lower rainfall (1200-1500 mm).

Correlation studies indicated to be negative between bulk density and particle density with growth and yield of teak and positive association with porosity. Most of the chemical properties including soil nutrients have positive effect on the performance of teak. However, pH was found to be negatively correlated with growth parameters. Major soil nutrients *viz*., available nitrogen, phosphorous and potassium have resulted positive correlation with growth and yield of Teak.

Teak stands with higher invasive species show restricted growth than those plantations.

Genetic Variation for Phenology in a Clonal Seed Orchard of Teak (*Tectona grandis* Linn.f.)

RAJEŚH P. GUNAGA 2000 MAJOR ADVISOR : Dr. R. VASUDEVA

To elucidate clonal variations for phenology and its association with low fruit production among teak Clonal Seed Orchard (CSOs), a study was conducted in a 19 year old CSO for a period of 13 months at Manchikere, yellapura forest division. Inter-clonal differences among 24 teak clones for all phenological initiation events were significant suggesting a strong genetic basis. Strong provenance effect on phenology was also observed. Clones from central and southern provenances were early in initiating flower buds, flowers and peak flowering than those from northern. An overlap index to calculate the flowering synchrony among clones was developed for the first time. Clones of different provenances showed asynchronous flowering while there was a higher synchrony among clones within a provenance. Hence, simple geographical continuity of clonal origin could be considered as a thumb rule while selecting clones for CSO. Partial flowering synchrony among clones can potentially violate panmixis and hence all the assumptions of establishing a CSO. Matured non-flowering remetes within a teak clone can also reduce fruit production of CSO. This trait was genetically controlled and clones derived from other ortets tend to have higher per cent of non-flowering remetes.

In general, time of initiation for all phenophases showed higher broad sense heritability, suggesting that these initiation events were controlled by genetic factors. However, durations of all phenophases were environmentally regulated. The highest genetic gain was (27.78%) obtained for time of leaf flush initiation.

Clones that initiated leaf flushing early and possessed longer peak-flowering duration tend to produce higher number of fruits per inflorescence. Hence these two traits should be considered while selecting trees of CSO in order to increase the fruit yield. However, clones that coincide flowering with peak rainy days tend to show lower fruit set and hence should be avoided.

Reproductive Biology and Conservation of *Semecarpus kathalekanensis* : A Threatened Swamp Species of Central Western Ghats

H.B. RAGHU 2000 MAJOR ADVISOR : Dr. R. VASUDEVA

A few details of the reproductive biology of *Semecarpus kathalekanensis* (Dasappa and Swaminath) a recently described, threated tree species occurring in the fresh-water swampy habitats of the Central Western Ghats were worked out. Only 42 breeding individuals were found in three fragmented habitats suggesting that the species be critically endangered. *S. kathalekanensis* is a dioecious tree, occasionally monoecious individuals were also found. However, female flowers possessed rudimentary anthers, indicating it to be a cryptically dioecious.

Not all matured individuals of *S. kathalekanensis* participated in flowering every year. Of the total 20 female individuals, 20 per cent did not flower in both the years ; among 19 male individuals, only 21.05 per cent flowered in only one season. Such variations may potentially alter the genetic structure of the cohorts arising in different seasons. A significant asynchrony in flowering was noticed among the male and female trees, restricting the random gamete exchange. Since, the species possess recalcitrant seeds, it is difficult to store the seeds. An artificial pollen germination medium was standardized which can be used in the cryo-preservation of the pollen grains.

GBH of the mother tree was positively associated with fruit size and seed germination suggesting that older female trees tend to have higher reproductive success. Populations of *S. kathalekanensis* possessed restricted age classes. The early demographical studies indicated that the species shows a "type-II" survivorship curve.

Three distinct biological features complicate the conservation of *S. kathalekanensis*. First, its high habitat specificity (only to a few fresh-water swamps), second, consistently small population size (less than fifty in any population) and finally its dioecious nature. In order to restore the population above critical level, re-introduction to type localities, perhaps for the first time, were attempted and species was successfully established in newer localities.

Phenology, Regeneration and Propagation Studies in *Ougeinia dalbergioides* Benth.

T.S. HAREESH 2000 MAJOR ADVISOR : Dr. A.M. CHANDRASEKHARAIAH

Ougeinia dalbergioides is an important deciduous tree possessing good timber and medicinal value. The flowering in this species was reported to be erratic with poor natural regenration. In this context, an attempt was made to assess present regenration status in Uttara Kannada district, to explore the problems of poor regeneration related to its phenology and to standardize vegetative propagation technique to conserve the germplasm. One hundred matured individuals were monitored for phenology for 13 months and 32 quadrats of 40 m x 40 m were laid to assess the regeneration.

O. dalbergioides behaves like a late successional species of a dry deciduous forest with respect to vegetative phenology. Fruiting in *Ougeinia* is highly opportunistic, only few flowered individuals produce fruits. The reproductive success was very less (<1.0%) due to immature fruit predation and seed abortion. Among the weather parameters, rainfall was positively and significantly associated with leaf expansion initiation. The rainfall and relative humidity prevailed during July-Augst significantly influenced reproductive phenophases.

The forest in Bhagawathi range showed species composition typical of a dry deciduous forest type where *O. dalbergioides* was one of the dominant species showing a clumped spatial dispersion. *O. dalbergioides* occupied 8th position among regeneration individuals constituting 2.89 per cent to the total regenerating individuals. Advance regeneration of *O. dalbergioides* was virtually absent as indicated by the population structure. Among the various biotic factors, grazing was the prime factor affecting the regeneration of this species. Regeneration was negatively associated with electrical conductivity of the soil. The

species showed good root suckering capacity and all the regenerating individuals seem to be the resultant of the root suckers. The stem cuttings collected during April and treated with Seradix-3% showed a good rooting percentage (35.85) and hence, this treatment may be considred a standard.

Influence of Site Factors on Growth and Productivity of *Bambusa bambos* L. Voss

J.H. INDRESHA 2000 MAJOR ADVISOR : K.V. DEVAR

Evaluation of site factors and their influence in different Forest Ranges is generally aimed at identifying optimum conditions of climatic, topographic and various edaphic factors required to increase the growth and biomass production of *Bambusa bambos*. Five Forest Ranges of Sirsi Forest Division were evaluated for various growth and yield parameters to assess the composition and strucutre of bamboo associated forests, the influence of locality conditions and associated species on the growth and yield of *Bambusa bambos*. The Sirsi Forest Division was characterised by predominance of moist deciduous forest types, where some semi-evergreen (Janamane) and dry deciduous (Banavasi) forest types were also present. The number of species was highest in Janamane (26 species) and least was recorded from Siddapur (20 species). The Sirsi Forest Division characterised by the preponderance of contiguous and random distribution where only *Bambusa bambos* had regular distribution. Siddapur showed the maximum density of *Bambusa bambos* (128 clumps/ha) where as the density of associated vegetation was highest in Janamane (288 stems/ha). The species richness and evenness were highest in Janamane and lowest in Siddapur.

The growth parameters were positively and non-significantly associated with rainfall. The altitude had a positive effect on growth and yield the effect of slope was negative on growth and yield. Nitrogen and phosphorous were associated positively with all the traits. The same trend was followed by other soil properties *viz*., pH, electrical conductivity, potassium, calcium, magnesium and organic carbon. All the growth parameters of *Bambusa bambos* were negatively correlated with number of species, their density and total basal area.

GENTICS AND PLANT BREEDING

Heterosis in Relation to Parental Divergence in Onion (*Allium cepa* L.)

B. VINUTHA 2000 MAJOR ADVISOR : Dr. S. GANGAPRASAD

Onion, Allium cepa var. cepa. L. is one of the important bulb crops cultivated extensively in India and it is considred as second most important vegetable after tomatoes in the world. Extent of heterosis was examined in relation to genetic divergence in onion (*Allium cepa* L.). The material consisted of fifteen F_1 hybrids derived by crossing Ten parents. Mahalanobis' D^2 was used to estimate genetic distance. The progenies were grouped into six clusters. Cluster-I, possessed six parents and nine hybrids followed by cluster-II with one parent and two hybrids and cluster-IV with three hybrids. The cluster-VI included one parent and one hybrid. Cluster-III and V were solitary clusters with single parent in each. Fresh bulb weight contributed maximum towards divegence followed by split bulbs, marketable bulbs, storage loss in weight, loss due to sprouting, plant height and loss due to rotting. Selection of parents for hybridization based on fresh bulb weight, marketable bulbs and split bulbs would lead to the selection of genetically divergent material. Heterosis was calculated over mid parent, better parent and standard check. Heterosis was observed for most of the characters except for number of leaves and neck thickness. Heterosis for yield to the extent of upto 28.36 per cent as measured over standard check, was observed. The parents were grouped into 3 clusters. The range, mean and standard deviation of

intra-and inter-cluster divergence were used to define four divergence classes. The frequency of heterotic crosses for most of the characters were found to be higher in crosses between the parents with intermediate divergence followed by highly divergent genotypes. The parents Agri found rose, Nasik red and Arka bindu are suggested to use as one of the parent to generate high yielding, better storage life and good quality hybrids.

Combining Induced and Recombinational Variability for Improving Productivity in Blackgram (*Vigna mungo* L. Heppter)

K. ROOPALAKSHMI 2000 MAJOR ADVISOR : Dr. S.T. KAJJIDONI

An investigation was carried out to compare the variability generated through hybridization and combination of hybridization and mutation to improve yield and its component traits. Two locally adopted cultivars such as TAU-1 and Manikya were crossed with two donor lines viz., 169 for number of pods per plant and 216 for 100 seed weight. The seeds of the four single cross hybrids were treated with 20kr gamma rays and the segregating populations of four irradiated and four unirradiated single crosses, two three way crosses and one double cross were studied for seven quantitative traits. The irradiated progenies of single cross hybrids exhibited higher mean performance for plant height, number of pods per plant, number of seeds per pod and seed yield. The other chracters such as number of clusters per plant and pod length exhibited high mean values in hybridized populations indicating the shift of mean towards desirable side due to hybridization. There was no change in mean performance for 100 seed weight in any of populations studied.

The estimates of PCV and GCV in different segregating populations indicated that variability generated through irradiation has supplemented the variability generated by hybridization for characters like number of clusters per plant and pod length. For other characters such as plant height, number of pods per plant, number of seeds per pod, 100 seed weight and seed yield per plant, hybridized populations involving more than two parents produced more variability. Most of the characters understudy exhibitied low to moderately high heritability along with lower estimates of genetic advance indicating role of environment, while 100 seed weight and number of clusters per plant recorded high hertability and genetic advance indicating the least influence of environment of these traits.

The nature and degree of association among different traits under study were changed in favourable direction in irradiated hybridized populations compared to hybridized populations. The seed yield exhibited significant and positive association with plant height, number of clusters and number of pods per plant in all the segregating populations, however in irradiated population in addition to these traits pod length also exhibited significant association. The segregating populations of crosses involving more than two parents produced large number of supeior progenies in respect of seed yield and its contributing traits compared to other populations.

Heterosis and Combining Ability Analysis for Morphological Characters and Biotic Stresses in Groundnut (*Arachis hypogaea* L.)

G. APPARAO 2000 MAJOR ADVISOR : Dr. K.G. PARAMESHWARAPPA

This investigation was carried out during kharif 1999 at the Research Farm of Oilseeds Scheme Main Research Station, UAS, Dharwad. 25 hybrids were obtained by crossing five adapted groundnut genotypes as lines with five testers possessing tolerance to foliar disease late leaf spot and *Spodoptera liture* in line x tester design. The hybrids were grown along with their parents in a ramdomized block design with two replications to workout heterosis and combining ability for the quantitative characters.

Subsequently, four F_2s of the selected crosses were

also grown in a separate trial to study various genetic parameters. The results revealed that ehe extent of heterosis was higher for number of mature pods. total number of pods, pod yield per plant, kernel yield per plant and number of primary branches. The crosses TAG-24 x ICGV-86699 and Dh-56 x M-III expressed heterobeltiosis for eight characters while the cross Dh-56 x JL-86350-20 exhibited considerable heterosis for foliar disease and pest coupled with pod yield.

Combining ability studies indicated that both additive and non-additive gene actions existed in the inheritance of most of characters with predominant non-additive genetic effects except for late leaf spot, days to 50 per cent flowering and number of immature pods. The parent Dh-40 was a good general combiner for eight characters and Dh-56 for late leaf spot and *Spodoptera* tolerance. The crosses TAG-24 x ICGV-86699 and Dh-40 x Dh-73 expressed significant sca effects for eight characters. Higher magnitude of variability was noticed for most the characters while high heritability and genetic advance values were observed in case of kernel yield per plant, shelling per cent, 100-kernel weight, late leaf spot score. Late leaf spot incidence, *Spodoptera litura* damage and plant height were negatively associated with pod yield while its association with total number of pods and kernel yield was positive.

Genetic Studies on Inter and Intra Plant Type Crosses Involving Compact and Robust Cotton

DANAPPA S. KATNALLI 2000 MAJOR ADVISOR : Dr. S.S. PATIL

Cotton is one of the important commercial crops of our country. Existing robust cotton genotypes are productive but have inaccessibility for plant protection. Compact cotton genotypes have advantages of plant protection efficiency, short duration and suitability for machine picking. Present study was undertaken for evaluation of inter and intra plant type crosses involving compact and robust cotton genotypes. Interplant type (robust x compact) crosses were developed through line x tester mating design and intraplant type (robust x robust) crosses were developed through 7 x 7 dialleal mating design.

Most of the inter and intraplant type crosses expressed significant heterosis over mid and better parents for all the characters studied. GCA variance was found to be significant and higher in magnitude than significant SCA variance for all the characters. There were potential intera and intraplant type crosses involving both parents with high *gca* effects for yield and yield component characters in desirable direction. These crosses also expressed significant *sca* effects for all the characters. The robust parents RAH-221, RAH-101 and SP-46 and compact parent Anjali were identified as best general combiners based on pooled *gca* score method.

Among intrahirsutum crosses, the mean value observed for different quantitative characters indicate that in intracompact cross, seed cotton yield was lower as compared to intrarobust and interplant type crosses. The comparison of interplant type crosses and intrarobust and interplant type crosses. The comparison of interplant type crosses and intrarobust crosses revealed that, even though interplant type crosses showed reduction in plant stature, they were more productive and heterotic for seed cotton yield.

The trend was different when a similar comparison was made on interspecific crosses. It was observed that, the crosses of robust *hersutum* x *barbadense* are more productive than those of compact *hirsutum* x *barbadense*.

Heterosis and its Relation to Parental Genetic Divergence in Sorghum (*Sorghum bicolor* L. Moench)

SHANKAR RAO V. PAWAR 2000 MAJOR ADVISOR : Dr. N.Y. NAYAKAR

The material for the present study comprised of 16 parents, 16 hybrids and five checks of rabi sorghum. All these were evaluated during rabi 1999-2000 at Main Research Station, University of Agricultural Sciences, Dharwad.

Mahalanobis's D^2 analysis was carried out involving i) parents and hybrids ii) parents alone, to estimate genetic adversity. Attempts were made to estimate heterosis for 16 quantitative characters and to find out the relation between divergence of parents and extent of heterosis.

Analysis of variance revealed the presence of considerable genetic variability among the genotypes for all the quantitative characters under study

On the basis of Mahalanobis D^2 analysis 32 genotypes (16 parents + 16 hybrids) were grouped in to four clusters and hybrids were grouped in first three clusters along with parental lines. Intracluster divergence suggested that the genotypes in cluster I had the highest diversity among them as compared to those in other clusters. Studies on intercluster distance showed that parental entries in cluster IV (SVD 9729) and cluster III (116 B, SVD 9662) were diverse from most of other genotypes. Similarly, 16 parental lines were grouped in four clusters. Here also above said parents were grouped in divergent clusters IV and II, respectively. This indicates the consistancy of diversity of these parents.

Based on heterosis and *per se* performance, the hybrids M31-2A x SVD 9739 and 116 A x SVD 9662 were found to be the best cross combinations for grain yield and its component characters.

The parents (M 31 - 2 A, 9-13 ; M 31-2A, SVD 9729 ; M 31 - 2A, SVD 9739 ; M 31 - 2 A, SVD 9753 ; 104 A BRJ 198 ; 104 A, BRJ 204 ; 104 A, R 647) which had moderate genetic divergence between them produced higher frequency of heterotic crosses than parents with extreme genetic divergence.

The above inferences drawn were evidenced from the high level of heterosis and *per se* performance of hybrids *viz.*, M 31-2A x SVD 9739 and 116 A x SVD 9662 which are the combinations of parental lines of moderate genetic divergence.

Genotypic Response to Drought Stress in Groundnut (*Arachis hypogae* L.)

SUVARNA 2000 MAJOR ADVISOR : Dr. P.V. KENCHANAGOUDAR

The experiment was conducted to evaluate 20 groundnut genotypes for drought tolerance their physiological response and to assess genetic variability, association under normal (full irrigation), mid-season (MSD), and end-season drought (ESD) conditions, in a strip plot design during post rainy season of 1999-2000 at International Crops Research Institute for the Semi-arid Tropics (ICRISAT), Patancheru, Hyderabad.

Analysis of variance showed significant differences for all physiological and yield contributing characters studied except relative leaf water content (RWC) and light interception (LI) at 90 DAS among the genotypes and for number of immature pods (NIMP) among drought treatments. Significant Genotype x Drought interaction existed for crop growth rate (CGR), harvest index (HI), RWC and LI at harvest.

Rate of pod addition (RPA), CGR, HI and pod yield were identified as potential characters for improvement of genotypes under both the drought conditions and LI, number of mature pods (NMP), shelling percentage under MSD and NIMP, hundread kerenel weight, RWC, specific leaf nitrogen (SLN), partiioning of drymatter (PDM) under ESD.

Under MSD, yield was negetively associated with RWC at 90 DAS, specific leaf area (SLA) at harvest and RPA. Under ESD yield was positively associated with SLN at harvest, rate of kernel and pod development, pod growth rate, hundred kernel weight and sound mature kernel percentage.

Based on *per se* performance for yield the genotypes ICGV 86031, 93261, 93269, 93277 and 92120, R 9214, R 9251 and KRG 1 under both the stress conditions and ICGV 92113 and S 206 only under MSD were identified as high yielding with low reduction in yield. These genotypes should be tested again under drought conditions in different locations to identify stable types.

Studies on Recombinational, Induced and Recombinational Variability, Mating Schemes and Selection Methods for Improving Productivity in Blackgram (*Vigna mungo* L. Hepper.)

SHOBHA U. IMMADI 2000 MAJOR ADVISOR : Dr. S.T. KAJJIDONI

An investigation was carried out in blackgram (*Vigna mungo* L. Hepper.) To compare the variability generated through hybridization and combination of hybridization and irradiation and further advancement rhrough different methods of selection *viz*. bulk, individual plant selection (IPS) and single pod descent method (SPD) to improve seed yield and its component traits Two locally adopted cultivars such as TAU-1 and Manikya were crossed with two donor lines *viz*.. 169 for number of pods per plant and 216 for hundred seed wieght

The estimates of PCV and GCV in different segregating populations indicated that variability generated through irradiation has supplemented the variability generated by hybridization for characters like plant height, number of cluters per plant, pod length, number of seeds per pod and hundred seed weight. For other characters such as number of pods per plant and seed yield per plant hybridized populations involving more than two parents produced more variability. Most of characters under study exhibited moderate to high heritability and genetic advance indicating the importance of additive genetic components for the inheritance of those characters.

The nature and degree of association among different traits under study were changed in favourable direction in irradiated hybridized populations compared to hybridized populations. The seed yield exhibited significant and positive association with plant height, number of clusters pre plant and number of pods per plant in all the segregating populations. The segregating populations of crosses involving more than two parents exhibited higher intergeneration collection and heritability (regression method) estimates and also produced large number of superior progenies in respect of seed yield and its contributing traits compared to other populations.

A comparison of the three selection methods indicated that SPD method of advancement was superior to bulk and IPS methods in all the seven segregating populations for all the genetic paremeters studied.

Heterosis and Combining Ability Studies for Yield and Its Component Characters in Pigeonpea (*Cajan caja*n L. Millsp.)

SUNIL KUMAR BIRADAR 2000 MAJOR ADVISOR : P.S. DHARMARAJ

The study was undertaken to assess the magnitude of heterosis and combining ability in respect to yield and its component characters in pigeonpea. A 10 x 10 diallel set was developed by crossing 10 lines. 45 direct F_{1s} along with their parents were planted in randomised block design in kharif season of 1998-99 at Agricultural Research Station, Gulbarga.

Hybrids showed highly significant differences for all the characters except 100-seed weight. Significant *per se* performance and standard heterosis in desirable direction were recorded in several crosses. The crosses BSMR-780 x WRP-248, GS-1 x ICPL-94063, BWR-171xGS-1 expressed heterosis to the extent of 48.96, 32.77 and 21.24 per cent over check (ICP-8863) for yield respectively.

The estimated component of general and specific combining ability (GCA and SCA) variances showed the predominance of additive gene action for days to 80 per cent maturity, 100-seed weight and protein content and non additive gene action for remaining characters.

The parents BSMR-780 and ICPL-87119 were best general combiner for grain yield and other important yield attributing characters. The crosses BSMR-7 80 x WRP-240 and GS-1 x ICPL-94063 exhibited desirable Sca effects and high *per se* value for grain yield and these crosses can be recommended for further exploitation.

Combining Ability Studies and Evaluation of Three-way Cross Hybrids in Sunflower (*Helianthus annuus* L.)

C. NAGARAJA 2000 MAJOR ADVISOR : I. SHANKAR GOUD

The study was undertaken to elicit information on the combining ability, nature of gene action, heterosis and performance comparison of single and three-way cross hybbrids by using Line x Tester mating design. Forty five hybrids (30 three-way cross hybrids and 15 single cross hybrids) developed using nine CMS lines and five restorer lines. All the hybrids, parents and standard checks were planted in randomized block design during kharif 1999 at RRS, Raichur

The analysis of variance revealed significant differences for all the characters Significant *per se* performance and standard heterosis in desirabie direction recorded several crosses. Among 45 hybrids studied, four three-way cross hybrids had significant positive heterosis over the best check for seed yield. The maximum value of standard heterosis for seed yield was 34.60 per cent observed in CM-8 x R-4 followed by CM-9 x R-2 (27.80%) and CM-7 x R-3 (22.60%).

The combining ability studies indicated the higher ratio of SCA and GCA variances for all the characters studied indicating predominance of non-additive gene action. Among the female parents CM-9, CM-8 and CM-7 and among the male parents R-5, R-2 and R-1 are the good general combines for majority of the traits studied

The study of sca effects revealed that the performance of the hybrids for all the characters was higher when parents having low x high gca effects. The mean per se performance of top three three-way and single cross hybrids indicated that three-way cross hybrids gave 31.3 per cent increase in seed yield and 28.5 per cent increase in oil yield over single cross hybrids. All the genotypes showed susceptible reaction to Alternaria leaf blight while eight parents and 23 hybrids showed resistant reaction to rust diseases The specific combining ability showed that three three-way cross hybrids *viz*., CM-5 x R-2, CM-7 x R-3 and CM-9 x R-4 and three single cross hybrids *viz*., CM-1 x R-1, CM-1 x R-1 and CM-2 x R-5 proved to be the best specific combiners for majority of the characters.

Studies on Response to Selection for Seed Cotton Yield in Segregating Generations of Cotton (*Gossypium hirsutum* L.)

S.M. DOMNAL 2000 MAJOR ADVISOR : Dr. S.S. PATIL

The study was undertaken to test the efficiency of early generation selection in both compact and robust genotypes. For this purpose, three compact crosses *viz*., RACH-1, RACH-2 and RACH-3 were utilized. The robust crosses involved in the study were DHH-11, NHH-44, RAHH-1 and RAHH-133. Thus, selection response was studied in both compact and robust crosses. The comparison of response among compact and among robusts was done. Further, the response in compact crosses was compared with the response observed in robust crosses.

In the cross RACH-2, selection response was estimated over diverse environments to quantify the association between those diverse environments which in turn, help to identify the genotypes suitable for diverse climatic conditions. Correlated response for different quantitative and quality traits was done in each cross irrespective of robust and compact type. Heterosis and inbreeding depression was estimated in segregating generations of both compact and robust crosses. Potential lines were identified in all the crosses utilised for the study. Finally, an attempt was made to find out the strength with which each character is associated to yield in both selected and unselected F_3 population of the cross RACH-2.

PLANT BIOTECHNOLOGY

Development and Characterization of Sporeless Mutants of Local *Bacillus thuringiensis* Isolates

S. MURUGENDRA 2000 MAJOR ADVISOR : Dr. M.S. KURUVINASHETTI

The focus of the present study was to isolate *Bacillus turingiensis* from soils of Western Ghat region in Uttar Kannada district of Karnataka, characterization of their insecticidal activity and development of sporeless mutants. Out of 32 *Bacillus* isolates, only elven had endospores and crystals. Two isolates M3 and M7 were toxic to diamond back moth (*Plutella xylostella*) and *Spodoptera litura* causing 98.2% and 97.4% mortality, respectively.

Isolates, M3 and M7 were subjected to MNNG matagenesis for developing sporeless mutants. Sporeless mutants, Mut M3 and Mut M7 were obtained from M3 and M7 strains, respectively. Both mutants and wild type isolates were characterized for intrinsic antibiotic resistance, insecticidal activity, protein and plasmied profile. All the isolates including mutants were sensitive to tetracycline, chloramphenicol and kanamycin. Both the mutants were resistant to streptomycin but sensitive to nalidixic acid. On the other hand wild type strains were resistant to nalidixic acid, but sensitive to streptomycin. SDS-PAGE protein profile indicated the presence of *Cry* protein bands of more than 130 kda and 65 kda in M3, M7 and Mut M3. But Mut M7 and 67 kda band. The genetic distance (%) based on protein profile was 50.00 per cent between Mut M3 and M7 and the maximum of 86.667 per cent between Mut M3 and M3. All the isolates had a single plasmied of about 15 kb. Toxicity of both wild type and mutant strain was tested against nematode. All of them were found to be toxic to nematode. However, PCR with nematode specific primer did not yield any amplification product.

Talc and starch based wettable powder (WP) formulations of mutants and wild type strains were tested against *Spodoptera litura*. Among talc and starch based formulations talc based formulation was found to be more effective and it was at par with the aqueous formulation of commercial preparation (Dipel 8L).

PLANT PATHOLOGY

Biology and Management of Stylosanthes Antracnose Caused by *Colletotrichum gloeosporioides* (PENZ) PENZ and SACC

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Colletotrichum gloeosporiodies was isolated from anthracnose infected stylosanthes leaf. The parhogencity was proved by spraying monoconidial culture which resulted in formation of cream to light grey centres and dark margnis and elliptical stem lesions similar in colour to leaf lesions. The conidia were cylindrical or oblong, hyaline single celled and measured 16.23 x 7.81 µm from infected tissue of Dharwad isolate. Richards's medium was the best synthetic medium to support maximum mycelial growth of the fungus. The fungus reached maximum growth on 14th day of incubation, sucrose, tyrosine and magnesium sulphate yielded maximum dry mycelial growth of the fungus among carbon, nitrogen and sulphur sources respectively. The temperature of 30 °C, alternate cycles of light and darkness and RH 95 per cent were found to be best for the fungal growth.

The pathogen was able to survive in unsterilised soil fo a period of two months. But, survival was for more than se en months on infected leaves fallen on ground. The pathogen *C. gloeosporioides* was found seed transmissible and survived in the seeds for upto one year and no host except stylosanthes was infected. Plants were more suscaptible from 30 to 45 days period for infection by the fungus. *In vitro* studies indicated that, 30 °C temperature, 100 per cent relative humidity and continuous light intensity period for 72 hours showed maximum antharacnose lesion development. Benomyl, bayleton and difenconazole were most effective systemic fungicides. Whereas, Dithane M-45, captan, clerodendron and *Trichoderma harzianum* were found to best non-systemic fungicides, plant extract and bioagent respectively in inhibiting the mycelial growth of the fungus. The addition of plant extract (*Clerodendron inerme*) and bioagent (*T. harzianum*) in the spraying schedule along with benomyl was found to effective in reducing the disease.