

**Abstract of Theses Accepted for the Award of Post-Graduate Degrees in
the University of Agricultural Sciences, Dharwad**

DOCTOR OF PHILOSOPHY

GENETICS AND PLANT BREEDING

Stability, Combining Ability and Heterosis Studies in Male Sterile Based Three Way Hybrids in Cotton

RAVEENDRA R. SODDI

2001

MAJOR ADVISOR : Dr. B. M. KHADI

The experimental material consisted of four CGMS *G. hirsutum*, eight *G. hirsutum* diversified lines, eight *G. barbadense* lines, five restorer lines and three checks. The synthesized three way, single crosses along with checks were evaluated over three locations during kharif 1997-98.

The intrahirsutum hybrid as a female parent based three-way hybrid experiment data obtained from locationwise and over three locations indicated that, mean values for different groups of hybrids did not differ for all characters except for yield and its components. The average over location yield of check groups was highest than all other groups followed by *G. hirsutum* lines, intrahirsutum three-way hybrids (HHH), fertile single crosses and interspecific three way hybrids (HHB). When mean values of top five entries in each group was considered for comparison, only HHH type of three way hybrids out yielded the commercial checks and corresponding single crosses. Three-way hybrids with HBH and HBB as parental combinations had higher mean halo length than other groups.

The DMSA-1 x CPD-446 female was the best general combiner with higher gca effect in as many as five traits, lint index, bolls per plant, yield per plant and seed

cotton yield followed by DMSA-1 x L-605 for plant height and number of monopodia. The female line DMSA-3 x HLS-32179 expressed higher gca effect for lint index and boll weight whereas DMSA-1 x DRC-167 for ginning out turn and lint index.

Comparative per cent range of heterosis between three way hybrids and fertile single crosses as groups indicated that, only intraspecific three way hybrids group (HHH) showed higher range of heterosis over two checks (DHH-11 and DHB-105) and best single cross at all locations followed by fertile single crosses group.

Based on scoring of different hybrids for stability parameters, (DMSA-4 x CPD-431) x DR-1 and (DMSA-1 x HLS-32179) x DR-2 were found much more stable than DHH-11, DHB-105, Sahana and best single cross. Whereas, (DMSA-1 x CPD-446) x DR-2, (DMSA-1 x ICMF-20) x DR-2 and (DMSA-3 x CPD-446) x DR-4 were more stable than commercial check, DHB-105 Sahana and best single cross, (DMSA-1 x DR-4). All these stable hybrids were interestingly of HHH type but none of the HHB, HBH and HBB types did show stable performance over checks and single cross hybrids.

AGRICULTURAL EXTENSION

**Identification of Indigenous Technologies Followed and their Rationale as Perceived by Farmers
in Northern Transition Zone of Karnataka**

ARUN M. BALAMATTI

2001

MAJOR ADVISOR : Dr.B. SUNDARASWAMY

The study was conducted to document farmers' innovations and practices in Northern Transition Zone of Karnataka. Fifty per cent of the fieldwork was done between September 1997 and March 1998 and the rest of the work was completed between September 2000 and February 2001. Ninety farmers in 47 villages of 12 taluks across three districts were contacted based on the suggestions of extension personnel and snowball approach. Hence,

selection of respondents was both on random and purposive basis.

Hundreds of ITKs were documented through field investigation. However, 29 ITKs in agriculture and horticulture including two innovative agricultural implements, that are unique and have not been documented elsewhere, were identified for the study. Important ITKs were identified

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in rainfed rice cultivation, sugarcane cultivation and in pest, disease and nutrient management with the use of botanicals and animal products. Technologies or beliefs of Vedic origin like, *Agnihotra* and *Vaastu* were found to be used in agriculture. Similarly, a multipurpose sprinkler system was developed by a farmer. The technologies were found useful by the farmers not only in monetary terms but also that they could be practised by using locally available low-cost inputs and hence they were considered sustainable and in line with their socio-cultural ethos.

Scientific rationality could be reasoned out for a

few technologies mainly through available literature. The rationality of ITKs in rice and sugarcane farming, use of botanicals in pest and disease management, etc could be justified either from scientists or with the help of literature. For example, blind tillage in paddy field three days after sowing was in line with scientific observation that many weeds germinate in three days while paddy germinates after a week. However, the rationality of certain ITKs like use of parthenium, bengalgram and coconut milk as sources of micro-nutrient, rationality of *Vaastu* etc could not be reasoned out.

VETERINARY SCIENCE

Histology and Histochemistry of the Endocrine Organs of the Indian Donkey (*Equus asinus*)

ASHOK PAWAR

2001

MAJOR ADVISOR :Dr. V. RAMKRISHNA

The present study on the histology and histochemistry of the endocrine organs viz. pineal, Pituitary, thyroid, parathyroid and adrenal gland in the young and adult Indian donkey to know the cytoarchitecture and histochemical characteristics of the cells with their location and functional status. The gross morphological studies revealed the location and position of various endocrine organs in the Indian donkey.

Histologically, the pineal gland consisted of pinealocytes, melanocytes and glial cells in the parenchyma. The presence of two types of pinealocytes indicate the functional status of the gland. The pituitary gland consisted of adenohypophysis and neurohypophysis. The adenohypophysis consisted of acidophils, basophil and chromophobes. Neurohypophysis consisted of pituitocytes and neuroglial cells. Herring bodies were noticed in the near blood vessels. Thyroid gland mainly consisted of small, medium and large follicles with blood vessels and parafollicular cells. The presence of small follicles were more in number and lined by cuboidal epithelium in young

donkey. Large follicles lined by flat epithelium with less or no colloid indicated the activity of the gland. Parathyroid gland consisted, oxyphil, two types of chief cells and parafollicular cells. The adrenal gland was consisted of outer cortex, middle ganglionic and medulla. Epinephrine and norepinephrine cells were noticed in the medulla.

Histochemically the pinealocytes of the pineal, basophils and neurosecretory substances (Herring bodies) of pituitary, colloid of the thyroid, chief cells and oxyphil cells of parathyroid and zona arcuata and zona reticularis of adrenal gland showed PAS positive reaction.

Pinealocytes of pineal, basophils of pituitary, follicular epithelium and colloid of follicles, chief cells of parathyroid and ganglionic cells of the adrenal gland were alcian blue (pH 2.5) positive.

No significant difference in the histology and histochemistry between young and adult Indian donkey endocrine glands except pineal and thyroid gland.

Hormonal Approaches to Augment Fertility and Fecundity in Sheep

MANIK KISHANRAO TANDLE

2001

MAJOR ADVISOR : Dr.SURESH S. HONNAPPAGOL

The cyclic ewes were supplemented with progesterone, GnRH and hCG during luteal phase of the cycle following breeding to improve fertility. The pregnant ewes had significantly higher progesterone on day 23 in relation to day 0 and the respective levels were 3.01 ± 0.33 and $0.31 \pm$

0.05 ng/ml. GnRH treated ewes had a lambing percentage of 83.33 followed by 66.67 in hCG ; 50.00 in late luteal progesterone and 16.67 in early luteal progesterone supplementation and the cost of therapy ranged between Rs. 7.80 to 46.90 per ewe. The supplementation of graded doses

of eCG on day 9 combined with PGF₂ a on day fixed doses of hCG at estrus were employed to improve fertility and fecundity in sheep. The estradiol 17-beta on day of natural estrus ranged between 3.78 ± 0.58 to 6.42 ± 1.26 as against 7.57 ± 1.93 to 10.14 ± 2.36 pg/ml at superovulatory estrus. While, respective progesterone levels were 0.27 ± 0.02 to 0.31 ± 0.07 and 0.30 ± 0.06 to 0.43 ± 0.04 ng/ml. The pregnant ewes registered

significantly higher progesterone on day 23 in relation to day of estrus and the respective levels were 2.26 ± 0.23 and 0.34 ± 0.04 ng/ml. The lambing percentage was only 33.33 in the control ewes as against a range of 57.14 to 85.71% in the eCG, PGF₂ a and hCG combined therapies. The cost of these treatments ranged between Rs. 94.60 to 184.20 per ewe.

MASTER OF SCIENCE

GENETICS AND PLANT BREEDING

Estimation of Genetic Diversity In Germplasm Collections of Rabi Sorghum (*Sorghum bicolor* (L.) Moench)

MOHAMMED RIZWAN HARIS

2001

MAJOR ADVISOR : Dr. N. Y. NAYAKAR

Sorghum is an important staple food for more than 300 million people of Africa and Asia and also as feed for cattle and poultry of the world. The rabi sorghum matures in clear weather as such quality of both grain and fodder is better than that of kharif. But genetic improvement of rabi sorghum is given importance in recent years. Exploitation of existing genetic variability is a pre requisite for any crop improvement. In different parts of Karnataka many local rabi land races are grown, which are well adapted to specific areas. Present study was undertaken for evaluation of 180 rabi sorghum germplasm lines collected from Bijapur and Gulbarga districts, NRCS, Hyderabad. These collections and four checks A-1, M 35-1, DSV-4 and DSV-5 were grown in augmented design with two replications during rabi 1999 at MRS, Dharwad to assess genetic diversity, variability, correlations for twenty quantitative characters.

There was considerable range of variation in the germplasm lines for all the 20 characters studied. The character viz., flag leaf area at 50 per cent flowering and maturity, panicle weight without seeds, number of grains per panicle, grain yield and fodder yield exhibited high GCV, PCV

and high heritability coupled high genetic advance.

Correlation studies indicated that harvest index, number of grains per panicle, panicle weight, number of secondaries per panicle, breadth and flag leaf area at maturity are the important components of grain yield. Among the characters studied, panicle weight and the highest direct positive effect on grain yield. Harvest index and fodder yield were next in the order.

Using D² analysis of Mahalanobis (1936), 180 germplasm lines were grouped into four divergent clusters. Cluster I was the biggest with 153 genotypes followed by cluster II with 18 and cluster III with eight genotypes. On the other hand cluster IV had only one genotype (IS 3435). Inter cluster D² values ranged from 657.54 between cluster I and III to 1847.08 between III and IV. Inter cluster distance was maximum in cluster I (342.68) and the least in cluster II (178.56). Based on the overall ranking for each cluster across mean values of 20 quantitative traits, cluster II ranked first followed by clusters I, IV and III. It is suggested that the best genotypes in cluster II and I can be used for future breeding programme.

Genetic Analysis of Seed and Oil Related Traits in Cotton (*Gossypium* spp.)

NAGAPPA B. HARIJAN

2001

MAJOR ADVISOR : Dr. B. M. KHADI

Cotton seed is an inexpensive but valuable source of oil, cake, linters and hulls. All of these have several industrial and other applications. A comprehensive study was

undertaken to investigate genetic variability in cultivated as well as some wild species of cotton for seed and oil related traits. Further, heterosis and combining ability was also assessed

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In *intra*hirsutum and interspecific (*G. hirsutum* x *G. barbadense*) hybrids for above said traits. Cytoplasmic differences for seed and oil related traits were also studied using alloplasmic isogenic lines and isohybrids. Some diploid hybrid combinations along with parents were also evaluated. Character association studies in tetraploid and their respective hybrids and alloplasmic isohybrids were conducted to know the correlation for seed, oil and fibre properties. Significant variability for GOT, seed index, oil percentage, kernel percentage, seed coat percentage, seed and fuzz percentage were observed in all the genetic stocks with few exceptions. Highest oil percentage observed in *G. klotzianum* followed by *G. anomalum* in wild species. Among the cultivated species *G. hirsutum* exhibited higher oil percentage followed by *G. barbadense*. Heterosis was in positive direction for GOT in *intra* hirsutum hybrids, while it was in negative direction for interspecific (*G. hirsutum* x *G. barbadense*) hybrids. Similar observations were also noticed for oil percentage in which

Interspecific hybrids expressed inconsistent results. The preponderance of SCA variance over GCA variance for most of the seed and oil related traits was observed. Adverse effect of *G. herknessii* cytoplasm was evident with respect to GOT, oil percentage, kernel percentage and fibre length. High oil content genotypes though exhibited higher oil percentage did not possess higher oil yield (kg/ha) due to their lower seed yield. Oil percentage found more in *G. arboreum* than *G. herbaceum*. Reciprocal effect were found in diploid cultivated interspecific hybrids for GOT, seed index, oil percentage and bundle strength. There was lack of significant correlation between oil percentage and other fibre properties in almost all genetic stocks. However, kernel percentage expressed significant positive correlation with oil percentage. Estimation of genetic variability, heritability and expected genetic advance were more for GOT, seed index and oil percentage, while it was moderate for kernel percentage.

Breeding Investigations in Segregating Populations of Greengram (*Vigna radiata* (L.) Wilczek)

P. HASANSAHIB

2001

MAJOR ADVISOR : Dr.S.A. PATIL

Two separate experiments were conducted during kharif 2000 to evaluate segregating populations generated for combining powdery mildew resistance and seed yield (Expt. 1) and to evaluate segregating populations derived from hybridization and irradiation (Expt. 2) in greengram.

In Experiment 1, three F_2 populations obtained by crosses between three agronomic bases viz., Chinamung, Selection -4 and Hunasur Local and a powdery mildew resistant source TARM-18 were evaluated. The traits, clusters per plant, pods per plant, seeds per pod and seed yield showed high PCV and GCV while plant height, pod length and 100-seed weight showed low to moderate PCV and GCV. Heritability estimates were high for all the traits. Seed yield per plant exhibited positive correlation with all the six component traits studied. Pods per plant, clusters per plant had the highest correlation with seed yield. In path analysis, pods per plant showed the highest direct effect and clusters per plant the highest indirect effect via pods per plant and hence, pods per plant and clusters per plant can be considered as the most important yield components in greengram. Among

the three F_2 populations studied, F_2 of cross Hunasur local X TARM-18 showed highest mean values, favourable range and V_p and V_g for pod length, seeds per pod and seed yield, making this an ideal source population for further selection. C_2F_2 -254 and C_2F_2 -29 have emerged as promising segregants with 55.4 and 30.6 per cent increase in seed yield per plant over commercial check Chinamung.

In Experiment 2, F_2 and F_2M_2 population derived from the crosses involving two germplasm lines Colco LM-5 and M-446 with agronomic base Chinamung were evaluated. F_2M_2 s showed highest mean values for plant height, pods per plant and seed weight, favourable range for clusters per plant and pods per plant. Irradiation followed by hybridization enhanced variability for plant height, pods per plant, pod length, seeds per pod and seed yield. Change in the direction and strength of association of several characters due to irradiation followed by hybridization was observed. $I_1F_2M_2$ -33, $I_1F_2M_2$ -17, $I_2F_2M_2$ -47 are the promising segregants.

**Assessment of Variability for Fruit Quality Parameters in Local Collections of Byadgi Chilli
(*Capsicum annuum* L.) Variety**

K. VENKATESWARARAO

2000

MAJOR ADVISOR :Dr. S.A. PATIL

The investigation was carried out during kharif 1999 at the College of Agriculture, Dharwad and at ARS, Hanumanamatti. The study included the local collections of Byadgi chilli from whole of North Karnataka where the Byadgi chilli is extensively grown. A total of 900 collections were made, from which 90 lines were selected by systematic classification and removing the homologues. These selected 90 lines were grown in two environments during kharif 1999 viz., at Dharwad and Hanumanamatti in a replicated trial. Considerable variability for most of the characters was indicated by analysis of variance. GCV and PCV were moderate to low for most of the characters. Number of fruits per plant, fruit length, dry fruit weight, number of seeds per fruit, fruit surface area, fruit colour and total yield per plant had high heritability estimates. Genetic advance was moderate for number of fruits per plant, number of seeds per fruit, fruit surface area and total yield per plant. Dry fruit weight had significant negative

association with number of fruits, while for most of other characters it was positive and significant. Total yield per plant was positively significant with most of the fruit characters except fruit colour. Fruit colour and fruit wrinkles had significant positive association between them. Genotypic path of total yield showed that yield was influenced most by number of fruits per plant. Path for dry fruit weight indicated that it was mostly influenced by fruit diameter and number of seeds per fruit. Lot of variability was observed in these collections with respect to fruit parameters. The yields were also much higher than the local yields and also associated with good quality features. The grading of quality attributes yielded satisfactory results. The wrinkling nature was more associated with *Kaddi* types while fruit colour was more associated with *Dabbi* types. Thirteen genotypes each in *Kaddi* and *Dabbi* were selected for further studies including 32,43,41 in *Kaddi* 87, 81, 84 in *Dabbi* as the most promising collections.

**Genetic Variation for Response of Early Vigour Related Traits to Alginate Coating in Rainfed
Upland Rice (*Oryza sativa* L.)**

VIJAYKUMAR S. MELI

2000

MAJOR ADVISOR :Dr. V.V. SHENOY

An investigation was undertaken on ten rainfed upland rice (*Oryza sativa* L.) genotypes to study the variation for early vigour related traits, induction of alpha-amylases during seed germination; genotypic variation in early vigour related parameters in response to alginate seed coating and storability of the coated seeds.

Substantial genetic variation was noticed within the genotypes for electrical conductivity of seed leachates, the first and final counts of germination and rate of germination, time for 5cm root growth and shoot growth, root length, shoot length, root to shoot ratio, seedling dry weight and the vigour index. Electrical conductivity of seed leachates was negatively associated with the vigour index, seedling dry weight and root length and was found to be the best indicator to assess seed vigour. The GCV and PCV were highest for electrical conductivity of seed leachates followed by the vigour index, seedling dry weight, root to shoot ratio, root length and shoot length. Heritability and genetic advance followed the same trend. This revealed that electrical conductivity of seed leachates, seedling dry weight, vigour index, root length and shoot length are the traits with ample variability for which selection can be effective in the material studied. Upon seed coating with alginate, significant variation for electrical conductivity of seed leachates, first count of germination, rate of

germination, root length and vigour index was observed.

Alpha-amylase activity and induction pattern for coated and uncoated seeds exhibited variation among genotypes. Coated seeds showed higher activity compared to uncoated ones and peak activity in the coated seeds was between 12 h to 24 h. In the uncoated seeds it varied from 12 h to 72 h after keeping of germination. The alpha-amylase pattern also revealed high mobility band for treated seeds, indicating usefulness of seed coating for early induction of alpha-amylases. The ANOVA for early vigour related traits upon seed coating and accelerated ageing revealed significant variation for first count of germination, time for 5 cm root and shoot growth, per cent normal seedlings, root and shoot length and seedling dry weight. Coated seeds did not perform well after accelerated ageing compared to uncoated seeds, except for the genotypes Chittiga Mugad, M-141, Hakkalsali and Gopal Doddiga which are highly vigours and can retain vigour and seed viability for long.

Therefore, genotypes with inherently low vigour can be invigorated by coating with sodium alginate to overcome the harsh rainfed upland environment and make them perform better.

SEED SCIENCE AND TECHNOLOGY

Influence of Source to Sink Relationship on Seed Yield and Quality in Soybean (*Glycine max*(L.) Merrill)

SIDDHALINGESH B. KURTAKOTI

2001

MAJOR ADVISOR : Dr. M.B. KURDIKERI

Field experiments were conducted to study the "Influence of Source to Sink Relationship on Seed Yield and Quality in Soybean in the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Dharwad during kharif 1999. The study on influence of stages (vegetative, flowering and podding stages) and levels of defoliation (10, 20, 30, 40 and 50%) on seed yield and quality of soybean JS-335 variety indicated that all the growth parameters, seed yield and its attributes and seed quality parameters declined linearly with every 10 per cent increase in defoliation level in all the stages of defoliation. The 50 per cent defoliation level caused significantly the highest reduction in yield and quality attributes at flowering stage.

The study on the influence of pod removal levels (10, 20, 30, 40 and 50%) on seed yield and quality on soybean JS-335 and Monetta varieties indicated that majority of the growth parameters, seed yield and yield components declined linearly with every 10 per cent increase in the pod removal level in both the varieties. Moderate depodding upto 30 per cent increased the seed weight to mention the expected seed yield in both the varieties. The various seed quality parameters were superior over control at 30 per cent pod removal and afterwards these parameters declined with further increase in pod removal level in both the varieties. The oil content declined linearly with increase in pod removal levels while, protein content increased in both the varieties.

AGRICULTURAL ECONOMICS

Production and Marketing of Hybrid Cotton Seeds in Northern Karnataka - An Economic Analysis

B. M. CHULAKI

2001

MAJOR ADVISOR : Dr. S. M. MUNDINAMANI

Seed is a very vital input and dynamic instrument for increasing agricultural production. The present study analysed the costs and returns structure and production efficiency of private and public agencies in major hybrid (DCH-32) cotton seed producing districts viz., Gadag and Koppal of Karnataka. The primary data required for the study was collected (during 1999-2000) from 100 seed growers comprising 50 each from private and public agencies. The data subjected to Cobb-Douglas production function and frontier production function analysis besides tabular presentation. The results revealed that the per acre production cost estimated to be Rs. 1,00,656.28 and Rs. 1,03,11.45 in KSSC and Mahyco seed growers, respectively. The per acre yields of seed obtained were 5.93 quintals in KSSC and 6.14 quintals in Mahyco seed growers group. The net returns proved to be higher in Mahyco seed growers (Rs. 83,396.39) than in KSSC seed

growers (Rs. 78,699.11). The study revealed that hybrid cotton seed production was highly labour intensive. On an average the per acre mandays requirement was 1354. The application of chemical fertilizers was more than the recommended in both the category of seed growers. The marginal productivity analysis indicated that land and human labour were underutilized. While fertilizer, FYM and irrigation were used more than the optimal level. The average mean technical efficiency index of KSSC seed growers was 0.7204, while it was 0.7948 for Mahyco seed growers. The producer's share in consumers rupee was 52.96 per cent in KSSC and 53.03 per cent in Mahyco seed growers. No-availability of skilled labour, inadequate and untimely availability of capital, non-availability of financial assistance from KSSC/ Mahyco and non-existence of crop insurance and higher risk in production were the major problems confronting the seed growers.

AGRICULTURAL STATISTICS

Models of Production and Marketing and Space-Time Market Integration of Arrivals and Prices of Onion in North Karnataka

A. S. KAMBLE

2001

MAJOR ADVISOR : Y. N. HAWALDAR

Onion is one of the most important commercial vegetable crop grown in Karnataka, Bellary and Dharwad districts are leading in the cultivation of onion in North Karnataka. The study was conducted during the agriculture year 1999-2000. A total of 120 sample cultivations 60 each from Dharwad and Bellary district were selected and classified into three categories based on the size of holding as small, medium and large. The analytical techniques included were tabular and functional analysis. Tabular analysis and zero-order correlation analysis of production and marketing of agricultural commodities, treating data to be independent and identical, was revealed to be inadequate on the basis of large values of variances and coefficients of variations. Thus approach of weighted analysis and path analysis, seemed appropriate in explaining production and marketing of agricultural commodities.

The results showed that per ha cost of production of onion was Rs. 14504.25, 15495.32 and Rs. 16785.78 on small, medium and large farmers respectively. The average yield obtained were 187.95, 192.58 and 198.92 qtl/ha on small medium and large farmers respectively.

Multivariate type auto-cross regression models with constant values of mean hectare was shown to be the best in explaining space-time market integration of onion in North Karnataka. Space-time autoregression integrated moving average models with non-stationary mean function of independent X variables, called as STRIMAX models, with median polish and resistant and robust universal kriging have been found to be the potential of being of use in developing market integrated models incorporating the markets to which the producers sell their commodities.

FORESTRY

Effect of Different Forest Plantations on Soil Properties

RAMESH RATHOD

2001

MAJOR ADVISOR : Dr. K. V. DEVAR

An evaluation of soil properties under different forest tree covers is an important area of research to understand the impact of trees on soil properties. Litterfall brings about important changes in physical, chemical and biological characteristics of the soil and balances the nutrient reserve of soils. The study was carried out to evaluate soil physical and chemical properties and to quantify amount of litterfall and nutrient returned under different plantations viz. *Acacia auriculiformis*, *Acacia mangium*, *Casuarina equisetifolia* and *Tectona grandis*. Four soil profiles in each plantation and one in each control site was sampled at different depths (0-

15, 15-30, and 30-45 cm) and analysed for various soil properties. Plantations of trees decreased Munsell value, bulk density and pH. Whereas, organic carbon, exchangeable calcium and magnesium of the soils increased. The influence of the plantations on the available nutrient status of the soil was found to be negligible. Litter production followed the order *Acacia auriculiformis*, *Casuarina equisetifolia*, *Tectona grandis* and *Acacia mangium*. The nutrient return through litterfall followed the order $Ca > N > Mg > K$ and P in *Acacia auriculiformis* and $Ca > N > K > Mg$ and P in *Tectona grandis*, *Casuarina equisetifolia* and *Acacia mangium*.
