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evergreen, the KFRI Newsletter is currently brought out in March and September each year and is intended for free private distribution within the Institute and the Kerala Forest Department. Free copies will also be sent upon request to other persons or institutions connected with forestry activities. The views expressed in the Newsletter are those of the authors and do not necessarily reflect views of the Institute. All interested persons are invited to send comments and opinions. The Newsletter Committee reserves the right to choose among contributions and edit wherever necessary.

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Vegetative Propagation of *Gymnema sylvestre*

Gymnema sylvestre, a large woody climber, locally known as Chakkarakolli occurs in deciduous forests of Kerala up to an altitude of 600 m above m.s.l. The leaves of the plant have ability to suppress the taste of sugar. The active component is an organic acid known as gymnemic acid which has similar atomic structure as glucose. Recent pharmacological and clinical studies have shown that gymnemic acid acts in two sites, on taste buds in the oral cavity and on the absorptive surface in the intestine. In both locations the absorption of glucose is prevented by blocking the receptive surface due to the structural analogy. The effect lasts only for a couple of hours after consuming the leaves. The dried leaves of the plant are used for the treatment of diabetics and preparation of herbal medicine like Diabatea.

G. sylvestre can easily be grown in homesteads as ornamental climbers. Within a period of two years the climber establishes well. As fruit formation is rare and the fruits contain limited number of seeds, vegetative propagation by shoot cuttings is found easy and dependable. The technique developed for large-scale vegetative propagation of *G. sylvestre* is as follows:

- Prune the growing tip of plant to trigger the sprouting of axillary buds which develop into small axillary shoots within a period of 45 days. Collect 8 to 10 cm long axillary shoots with 3 to 4 pairs of leaves from a mature plant with a sharp knife. The cut ends should be kept in water or in moist medium till they are brought to the propagation sites.
- Wash the cuttings thoroughly in water and treat them with 2000 ppm NAA (2mg of NAA / 1ml of 50% alcohol or 1g of talcum powder) by dipping the basal end in the NAA alcoholic solution for about 30 seconds or just rubbing in NAA talcum powder mixture. The role of this auxin treatment is only to enhance rooting percentage and the vigour of rooted cuttings. Rooting between 60 to 80% is possible even without any auxin treatment.
- Fill the tray or any container with vermiculite and plant the cuttings in rows. About 70 cuttings can be planted in a plastic tray of about 40 x 30 x 15 cm.
- Keep the container in partial shade and water them twice a day. If there is provision for misting, it will improve the rooting response.
- Examine the cuttings after 20 days. Rooting occurs between 15 to 25 days. Transplant the rooted cuttings to polythene bags filled with 3:1 soil, cow dung mixture and keep them in shade for another month. By this time the cuttings will be ready for outplanting.

Maximum rooting of 90% was observed when both NAA treatment and mist were provided. With NAA treatment alone rooting was about 80%. With mist and without NAA treatment rooting varied between 70 to 80% and it was about 66% in controls.

K.K. Seethalakshmi
and
M. Kalusalingam
Division of Plant Physiology.

Indigenous Traps of Kani Tribals

Kani tribals, 'Kanikkars' inhabit the forests of Kollam and Thiruvananthapuram Districts of Kerala. Anthropologically their origin is from Australoid race. Long head, black and curled hairs, raised nose and restricted beard to the lower chin are the typical characters of ancient Kanikkars.

They were leading a hunter-gather and shifting cultivation life style in the past. Kanikkars have the history of trapping, snaring, capturing or poaching elephants, tigers and wild pigs. But with the advent of modern civilisation and forest legislations, they abandoned shifting cultivation and now practice settled agriculture of cash crops. The skills of hunting and trapping of wild animals are still utilized by them to control the crop raiding animals.

Hunting is mingled with many of their rituals and it was part of their life, before Wildlife Protection Act (1972) was enacted. It was done communally as well as individually. While going for community hunting all male members will participate. Pellet bow is the chief weapon. Fibre of *Sterculia* sp. is used as the bow string. Instead of the usual pointed arrows, polished stone pellets were utilized in the bow. This is efficiently used to kill jungle fowl, Malabar giant squirrel and fruit bats. In addition to hunting, they trap the animals which come to the vicinity of settlements, for which many deathtraps are designed by them. Locally available materials like stone, bamboo, reed poles and plant fibres are utilized for making these traps.

Mouse trap (Rat trap)

This is operated for trapping field rats and mice. It is constructed using a piece of bamboo. A noose and trigger mechanism is placed inside the bamboo trap. When the rat touches the bait kept in the bamboo, the noose is tightened by the release of trigger mechanism, killing the rat instantly. Important feature of this trap is its simplicity and efficiency. Since no metallic parts are employed, bait shyness was very less. Usually the noose is made of fibre obtained from *Helicteres sterculia* and dried tapioca or a piece of dry fish as bait.

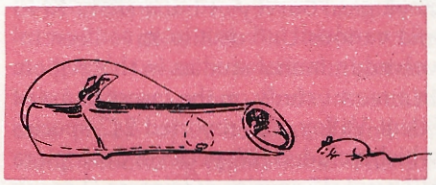

Fig. 1. Mouse trap

Pitfall trap

This is basically a pit dug on the ground and covered with twigs and leaf branches. After studying the movements of individual wild boar, a hole is dug on its path way. Then it is covered with branches and leaves and sprinkled with loose soil. When an unsuspecting animal is fallen in the pit it is killed and cooked. Even though it is mainly used to trap wild boar, barking deer, mouse deer and blacknaped hare were also caught in the pitfall trap. On an average, the pit may have a depth of 150 to 180 cm and a width of 60 to 90 cm. They place rotten intestine of fish or chicken as groundbait on the concealed pit to attract wild pigs.

"Talle" and "Parippu" (Deadfall trap)

These traps are made of rock stones with one side flat as deadfall. Smaller version is called "Parippu" and the bigger one "Talle". In "Parippu" a single stone is precariously placed in a standing position with the support of a stick. Whenever an animal picks up the bait placed below the stone the stick will slide from the stone and will fall on the victim crushing it. Bandicoot rat and other small rodents are generally caught in this trap, which are highly enjoyed by the Kanis.

A bigger version of the deadfall trap known as "Talle" is complicated and can silence any species up to the size of barking deer. Bamboo fences are made as leads into the trap and when the trigger is activated, while an animal is trying to pass through the fine cobweb mesh kept below the rack of bamboo, with heavy rock pieces the stones will fall on the victim and the animal will be crushed. They used to set this device only when they are in need of meat. Animals like, wild boar, barking deer, mouse deer, blacknaped hare and porcupine are caught in this trap.

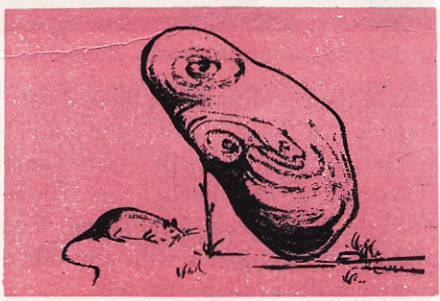

Fig. 2. Deadfall trap

Tree trap

These traps are set on trees and operated only when particular species of trees

were in flowers or with fruits. Palm civets coming for feeding on the fruits of *Bridelia retusa* were killed by this method. An individual tree is isolated from other ones, by cutting and removing the neighbouring ones. A path way is then provided to the tree top, through a long log placed in a slanting position on the ground.

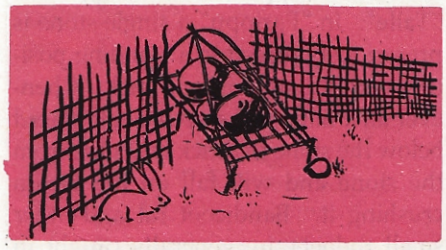

Fig. 3. Another deadfall trap

Approach to the top of the tree from the base will be denied by placing thorns and branches with leaves on the main trunk of the tree. A noose is then kept on the log, leading to the trunk. When the animal passes through the wooden log the noose will close on its neck and the animal will be killed instantly. Palm civets are killed using this trap.

Fig. 4. Tree trap

One of the peculiarities of these death-traps is that these traps kill the animal while trapping it. Since the aim of Kanis is to consume the animals, it serves their purpose. These traps are highly efficient and can be compared with any other commercially available models.

E.A. Jayson
and
G. Christopher
Division of Wildlife Biology

Insect Diversity in Silent Valley National Park

The Silent Valley which forms the core area of the Nilgiri Biosphere Reserve, is a typical humid tropical rain forest situated on a plateau about 1000 m above m.s.l. It covers an area of 9000 ha and exhibits considerable variations in the floristic composition, physiognomy and life forms, mainly due to climatic, edaphic, and altitudinal variations. Four types of vegetations are found in this area viz., west-coast tropical evergreen forests, subtropical broad-leaved hill forests, montane wet temperate forests and grasslands. On account of the remarkable interplay of climatic, edaphic and vegetational conditions, the fauna is very characteristic.

With the formation of the Silent Valley National Park, several agencies like the Zoological Survey of India (ZSI), KFRI and various Universities have been involved in faunal studies in this region. In a recent study on the insect fauna of Silent Valley, ZSI reported 242 species which included 128 species of Coleoptera (10 new), 15 species of Diptera (1 new), 39 species of Hemiptera (6 new), 2 species of Homoptera (both new), 27 species of Lepidoptera and 33 species of Orthoptera (1 new). Since this study was only for a short duration, only a small collection of insects could be made. It is noteworthy to mention here that 8.2% of the insects collected were new to scinece.

Recently a study on Lepidoptera of Silent Valley was made based on collections from four sites (two disturbed and two comparatively lessdisturbed). Over a period of two years, collections were made from selected sites using light traps and net sweeps during five days per month over the five summer months each year. The collection sites represented about 20 km^2 of the 80km^2 Silent Valley National Park. About 500 species of Lepidoptera were collected, of which 95 sepcies were butterflies and the remaining moths. Among the butterflies five were protected species and 13 were very rare species (The Wildlife Protection Act, 1972). Most of the unidentified moths were microlepidopterans and it is likely that many of these unidentified species may turn out to be new species. It has been estimated that the oriental region has 146,277 described species of Lepidoptera. Considering this, the 500 species collected from Silent Valley is a small number. The fact that the insects collected in this study form only a small fraction of the faunal diversity. Many species collected from Silent Valley were common to the Malaysian fauna and significant differences have been noted between specimens collected from Silent Valley and other areas in Kerala suggesting endemism due to geographical isolation.

The insects so far reported from the Silent Valley National Park represent only a small fraction of the fauna, as the surveys were by far incomplete. An examination of the faunal elements recorded from Silent Valley indicates survival of many rare and endemic species. Due to deforestation, conversion of natural forests to plantations as well as due to increased human interactions, the species and genetic diversity of insects are apparently being continuously eroded in many tropical forests but we have no record of these changes. In India, several forest insects have been sought to be protected through legislation, but we do not have sufficient information on their current status. The scanty information on the faunal elements of Silent Valley indirectly points to the flaws in the existing infrastructure for research on insect taxonomy which is insufficient to meet the challenges for understanding and conserving biodiversity. The neglect shown by applied biologists and funding agencies towards taxonomic research is a serious setback to biodiversity research. With the current awareness and spirit on conservation of biodiversity, all encouragement must be given to systematic biologists to perform their task with perfection.

George Mathew
Entomology Division

Sustainable Forest Plantation Management

An interview with Dr. Sadanandan Nambiar, Chief Research Scientist, CSIRO Forestry and Forest Products Division, Australia

Evergreen: Dr.Nambiar, you are very much involved with promoting the idea of sustainable forest plantations in Australia and abroad. How do you define sustainability?

Sadanandan: Well, a friend once told me that defining sustainaiblity is like trying to define God. It is difficult to give a definition of sustainability. From my experience in research on forestry and land use systems, I believe that a sustainable land use system should protect the soil base, conserve water and nutrients. Such a system should minimize stress like the ones from pests and diseases. Land management should also operate within boundaries of resilience and, most important, it should care for the environment and people. However, sustainable forestry often raises a kaleidoscope of ideas and expectaitons.

Evergreen: In your opinion, when exactly does a land use system become unsustainable?

Sadanandan: Loss of soil quality is a very good indicator of unsustainability. In some cases, this can result in adverse environmental impacts. Pests, diseases, and a weak genetic base can result in unsustainability. A poor management and economic peformance can also result in unsustainability, and often this is a common reason.

Evergreen: We are interested to know that unsustainability can result in adverse environmental impacts. Can you give an example from any country?

Sadanandan: A good example I can give you is the increase in soil salinity experienced in many parts of Australia. The early immigrants to that continent cleared large areas of forests for agriculture. This resulted in rising water tables, which pushed up the deep seated salts to the upper layers, causing severe salinity. If the trees had been there on this land, their high rates of transpiration would have kept the water table from rising.

Evergreen: What do you do in Australia to reverse this situation?

Sadanandan: It is a lesson we have learned at a great cost. But this has really made us to invest more effort in sustainable land use system. Today Australia uses on 2% of its cultivated land for wood producing plantations. This 2% land is giving 50% of Australia's wood production in plantation forestry. We have achieved it through sustainable land management practices.

Evergreen: As a person born in Kerala, you would know a lot about the land use system in Kerala too. What are the key issues of sustainable land use in Kerala?

Sadanandan: I haven't got much field experience in Kerala. However, I reckon the most critical issue is the impact of population or land use. Rice fields have been converted to housing estates surrounded by a fringe of coconut trees. Kerala's native vegetation seems to be under serious threat - pressure on land and water is indeed severe.

Evergreen: What do you think about our forest plantations?

Sadanandan: Well, I cannot claim much first hand information about the productivity of different types of plantations in Kerala? But from what I have read from your own reports, the productivity of eucalypt plantations is very low. The MAI of 5 or $6 m^3 ha^{-1}$ you get from your eucalypt plantations is little compared to nearly 30-45 they get in Brazil. Obviously there is something seirously limiting the productivity of these plantations in Kerala. In a State which is facing serious shortfalls in wood supply it might be a wasted opportunity.

Evergreen: What could be wrong with them?

Sadanandan: This is what we should try to find out now through our joint efforts. We (CSIRO) are in the process of developing a collaborative research programme with KFRI for the next five years. This collaboration has been possible through the significant support of the Australian Centre for International Agriculture (ACIAR), and as you are aware ACIAR has been very keen on this project. Many scientists from Australia will be visiting Kerala and KFRI scientists will be able to interact with them and get to know more closely about the sustainable plantation management in Australia. I am very optimistic about the outcome of the project. The know-how generated from this project will be useful for both India and Australia. I am most encouraged by the scientific quality and enthusiasm of KFRI colleagues.

Evergreen: What are the prospects of continuing this collaboration between CSIRO and KFRI?

Sadanandan: I can see good prospects of continued collaboration for our mutual

advantage. Presently we are planning to collaborate in eucalypt plantation research. In future it could extend to other areas of forestry also. First let us strive to make this first project a great success. I am looking forward to welcoming KFRI scientists in my Program in Australis - and I hope to do whatever I can to build on this co-operation and good will.

Evergreen: Thank you, Dr. Nambiar.

Interviewed by Dr. Jose Kallarackal,
Plant Physiology Division

Weather Data of Peechi (1996)

The total rainfall at Peechi amounted to 2472 mm during the year. It was about 106 mm less than in the previous year. The South West Monsoon contributed to about 2158 mm and North East Monsoon to about 315 mm. The number of rainy days, when rainfall was greater than 10 mm, was 61 days which is about 13 days less than that of the previous year. Summer showers were rare, and months of January and February did not receive any rain. On 10th March, the first summer shower of 1.6 mm was obtained followed by small showers in April which contributed to about 89 mm. Two more rainy days in May (20th and 24th) contributed to a total of 140 mm in May. From 6th June onwards, the Monsoon began. July had the maximum rainfall, raining except seven days amounting to 581 mm. August, September and October also received good rains. November was comparatively devoid of rains except one day (9 mm). In December there occurred a total of 70 mm. The monthly averages of the various weather parameters measured at the KFRI Weather Station are presented in Table 1. The annual rainfall from 1988 onwards and the monthly rainfall for 1996 are presented graphically in Fig.1 a and b respectively.

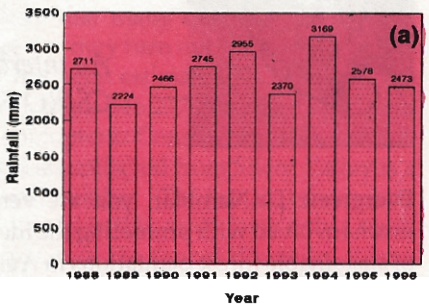

Fig. 1 (a) Cumulated annual rainfall from 1988 to 1996 at Peechi

A maximum temperature of 41oC was observed for 5 days in March (13-16th and 23rd), while a minimum temperature of 17oC was observed on 26th January. Averages of mean monthly maximum relative humidities varied between 75% (April) and 87% (Sept., Oct. and Nov.) whereas the mean monthly minimum r.h. ranged between 30% (Mar) and 70% (Aug) during the year. Mean bright sunshine was high in February (8.9h) and was low in July 1.3 h).

Highlights

Days with highest maximum temperature	:	13-16th & 23rd March(41^{0}C)
Month with highest mean maximum temp.	:	March (39.2^{0}C)
Day with lowest minimum temperature	:	26th January (17^{0}C)
Month with lowest mean minimum temp.	:	January (20.1^{0}C)
Day with highest maximum r.h.	:	10th November (96%)
Months with highest mean maximum r.h.	:	Sept, Oct & Nov.(87%)
Day with least minimum r.h.	:	13th March (23%)
Month with mean minimum r.h.	:	April (39%)
Total rainfall for the year	:	2472 mm
Total number of rainy days	:	61 days
Day with maximum rainfall	:	28th Sept. (142 mm)
Month with maximum rainfall	:	July (581 mm)
Month with maximum rainy days	:	July (18 days)
Day with maximum bright sunshine	:	2nd March (10.4 h)
Month with mean maximum bright sunshine	:	February (8.9 h)
Month with mean minimum bright sunshine	:	July (1.3 h)

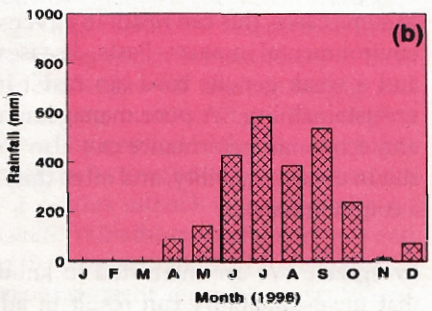

Fig. 1 (b) Cumulated monthly rainfall for 1996 at Peechi

Table 1. Monthly averages of weather data for 1996 at Peechi (Latitude 10°32'N longitude 76°20'E Altitude 100 m)

Month	Mean Temp(°C)		Mean r.h.(%)		Rainfall	Daily mean Bright Sunshine
	Max.	Min.	Max.	Min.	(mm)	(h)
January	35.30	20.10	78.00	42.00	0.00 (0)	8.40
February	37.90	21.50	77.00	38.00	0.00 (0)	8.90
March	39.20	29.80	76.00	30.00	1.60 (0)	8.80
April	37.70	23.00	75.00	39.00	89.00 (4)	6.10
May	35.10	23.40	78.00	49.00	140.00 (3)	5.40
June	31.40	22.20	81.00	62.00	428.00 (12)	3.50
July	29.80	21.50	83.00	65.00	580.60 (18)	1.30
August	29.90	21.80	86.00	70.00	384.60 (9)	1.90
September	30.80	22.10	87.00	68.00	533.40 (9)	3.50
October	31.90	21.30	87.30	64.00	236.40 (6)	5.30
November	32.50	21.80	87.00	60.00	9.00 (0)	6.60
December	31.60	30.40	85.00	54.00	70.00 (2)	5.50

*r.h. : Relative humidity; the figures in parentheses indicate the number of rainy days when rainfall was > = 10 mm

Jose Kallarackal
and
C.K. Somen
Plant Physiology Division

Ailanthus triphysa - best suited for degraded land

Ailanthus triphysa, Matty or Perumaram in vernacular is one of the best matchwood species in India, especially for match splints. Since the species has an aromatic resin called 'matty pal' in its wood, the splints need no waxing. Other matchwood species like *Bombax* sp., *Evodia lunu-ankenda* s, etc. require waxing of splints, and hence the match industry prefers matty. Experiments at KFRI have shown that *A. triphysa* grows very well in lateritic and degraded soils, where many other species fail to thrive. Container grown three-months-old seedlings are preferable to reforest the degraded areas with *A. triphysa*.

E.P. Indira
Genetics Division

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Research Reports

KFRI Research Report 106
Status survey of primates in Shendurney Wildlife Sanctuary and adjacent areas. Investigator: Dr. K.K. Ramachandran, 1996.

Abstract

A survey of primates was conducted during December 1992 to June 1995 in the Shendurney Wildlife Sanctuary and adjacent areas of Kerala State to map the distribution of the primates. The survey reveals that the primate population of the Sanctuary consists of four species viz., the bonnet macaque (*Macaca radiata*), lion-tailed macaque (*Macaca silenus*), Nilgiri langur(*Presbytis johni*) and slender loris (*Loris tardigradus*).

Bonnet macaque is the most common primate in almost all types of wooded forests. They are highly adaptable and range more frequently in the peripheral areas of the Sanctuary especially in the Thenmala Village area, often attaining a minor pest status. The number of bonnet macaques in the study area was estimated to be 513 individuals in 34 troops. Lion-tailed macaques are found only in the evergreen and semi-evergreen forests of the Sanctuary. Maximum sightings were from the catchments of rivers Umi Ar and Chendurny Ar, followed by the evergreen forests in the Rockwood area which is contiguous with the Kulathupuzha Reserved Forest south of the Sanctuary. Lion-tailed macaque in the area consists of nine troops with 131 individuals. Nilgiri langur troops are present in moist deciduous, semi-evergreen and evergreen forests in the area. The Nilgiri langur was estimated as 25 troops with 142 individuals. Slender loris was sighted only once.

KFRI Research Report 110
Water relations and photosynthesis of the oil palm in Peninsular India. Investigator: Dr. Jose Kallarackal, 1996.

Abstract

This project, 'Water relations and photosynthesis of oil palm in Peninsular India' was sponsored by the Department of Biotechnology (DBT), Govt. of India to investigate the environmental constraints, if any, related to the optimum physiological peformance of the newly introduced oil palm (*Elaeis guineensis* Jacq.) in Andhra Pradesh, Karnataka and Maharashtra. This report presents the results of the studies on microclimate and its effects on water consumption and photosynthesis of the crop planted in three sites, one each in the above States.

Using an automated weather station, microclimate parameters such as atmospheric temperature, relative humidity, vapour pressure deficit (VPD), wind velocity, photosynthetically active radiation measured as photon flux density (PFD), net radiation, soil temperature and soil heat flux were studied at the three sites during 7-8 visits spread over 19 months.

Temperature at the study sites ranged between 12°C and 35°C. The VPD ranged between 0.3 and 4.5 kPa. The PFD was not limiting at any site.

The water and carbon dioxide exchange through the leaves showed that leaf No.8 or 9 showed the maximum values for the above parameters. The light saturation of photosynthesis was obtained at = 1000 µmol m^2S^{-1}. The maximum photosynthetic rate obtained ranged between 7.5 and 11.5 µmol m^2S^{-1}. This range is at the middle level when compared to reported values from other oil palm growing countries. Similarly, maximum stomatal conductance obtained was 500 mmol m^2S^{-1}. Closure of stomata was noticed when the VPD increased from 1.0 kPa. The stomatal conductance was severely reduced when the VPD reached = 1.9 kPa so that this would reduce the photosynthesis considerably.

The water status of the plants as examined from the predawn water potentials indicate that the plants were not water stressed during the study period because the plants were irrigated in all the sites. All the sites had a prolonged dry season that created high levels of water deficits and as such, at none of the sites, oil plam could be grown as a rainfed crop. Soil water availability has been found a major factor effecting the crop yield in oil plam studied elsewhere. Although several management practices are available for soil water management, irrigation might the only alternative at all the sites studied.

Water loss by transpiration as estimated for a dry day (without rain) showed that it ranged from 2.0 to 5.5 mm per day. There is a possibility that this figure would get reduced when the plants reach maturity because of canopy closure that will reduce ventilation.

The leaf growth has been measured from the increase in leaf number and leaf area. At all the three sites, the leaf number increased by approximately 2 per month and leaf area increased by 5 to 11 m^2 per month. However, the leaf area increase was much lower when compared to the data for similar aged plants in Malaysia. The best growth was noted at the site in Karnataka.

Based on the conclusions drawn from the above study, several recommendations have been given.

KFRI Research Report 111
Fungicidal management of quick wilt disease of pepper in forest plantation. Investigators: Dr. M.I. Mohamed Ali, Dr. M. Balasundaran and Dr. K. Yesodharan, December 1996.

Abstract

Black pepper, *Piper nigrum* L. is an important spice crop of Kerala. Among the various diseases affecting black pepper, foot rot (quick wilt) disease caused by *Phytophthora capsici* is the most destructive. A fungicidal trial to control the disease was carried out in a pepper plantation of Wayanad Wildlife Sanctuary using bordeaux mixture (1%), copper oxychloride (0.1%) Ridomil (0.1%) and Akomin (0.2%). The basins of the vines were drenched with the fungicide solution @ 5 litres/vine and sprayed profusely over the leaves as pre-monsoon (south-west) and pre-north east monsoon treatments. The percentage of disease control ranged from approximately 52 to 66%, 29 to 55%, 71 to 82% and 40 to 78% respectively in four treatments given during May 1993, September 1993, December 1993 and June 1994. Mortality of the vines observed at the end of 2-year-period ranged between 13-18% in fungicide-treatment plots while it was 59% in untreated control plots. Copper oxychloride was found to be the least effective. The following treatment schedule has been suggested against *Phytophthora* foot rot in forest plantations based on the results of the present study.

After a few pre-monsoon showers in May-June, drench the basins (up to 50 cm radius) of the vine with 1% bordeaux mixture or 0.2% copper oxychloride @ 5 litres/vine. Spray the foliage of the vines profusely with 1% bordeaux mixture. Apply bordeaux paste (10%) over the stem of the vine up to a height of 1 m above the ground. Subsequently, drench the soil with 0.2% Akomin @ 5 litres/vine and spray the vines profusely with Akomin during August-September. The effectiveness of application of bordeaux mixture and Akomin has to be evaluated at least for two years and the efficiency of the fungicide vis-a-vis its economc advantage has to be reviewed. Hence, these recommendations against foot rot disease of pepper can be considered only as a preliminary one.

KFRI Research Report 112
Use of mycorrhizal and nitrogen fixing symbionts in reforestation of degraded acid soils of Kerala. Investigators: Dr. J.K. Sharma, Dr. K.V. Sankaran, Dr. M. Balasundaran, Dr. S. Sankar, 1996.

Abstract

Several monosporal VAM cultures, raised from spores isolated from the rhizosphere soils under *Acacia auriculiformis*, *Casuarina equisetifolia* and *Pterocarpus marsupium* and other VAM cultures obtained from various sources were screened under glasshouse conditions to select the most efficient ones for enhancing the growth of each of the three test tree species. Inoculation with VAM fungi was found to benefit the growth and biomass production of *Acacia*, *Casuarina* and *Pterocarpus*. However, the response

to inoculation varied with different isolates of VAM fungi. A significant increase in total P content was also observed in the inoculated plants. Based on overall performance and a cluster analysis of the data, the most efficient VAM selected for field studies were *Glomus calidonius* and *Glomus mosseae* for *Acacia*, culture M-23 and *G. fasciculatum* (V-10) for *Casuarina* and *G. intraradices* and culture *G. mosseae* (V-8) for *Pterocarpus*.

Several of forty cultures of *Rhizobium* and *Frankia*, isolated from the nodules of *A. auriculiformis*, *P. marsupium* and *C. equisetifolia* were subjected to authentification. The *Rhizobium* isolates were further screened for acid/alkali production and tolerance to acid-aluminium stress. All the isolates were screened for their efficiency in the glasshouse and two best strains selected for each of the test species. The isolates A-19 and A-16 obtained from *A. auriculiformis* P-8 and P-9 from *P. marsupium* and C-2 and C-3 from *C. equisetifolia* were found to be superior as compared to others in the ANOVA followed by a cluster analysis. These strains were selected for field trials.

In glasshouse trials on the effect of fertilizers on seedling growth and symbionts significant differences (P=0.05) were observed between various treatments. The behaviour of all the three species was different in terms of influence of phosphorus and nitrogen on various growth parameters of plants and VAM and N, fixing symbionts. In *A. auriculiformis* and *P. marsupium*, significant difference was observed between treatments, no definite trend emerged on the seedlings biomass due to ferilizer application in combination with the symbionts. In *A. auriculiformis* highest VAM infection was recorded in dual inoculation treatments. Generally, in all the fertilizer treatments number of nodules was higher in seedlings with dual inoculation. There was no evidence of pronounced influence of either phosphorus or nitrogen on nodulation. In *P. marsupium*, treatment with both the dosage of nitrogen i.e. N1 (20 ppm), N2 (40 ppm) resulted in higher VA mycorrhizal infection of roots, however, higher dosage of N and P (i.e. N2P2) resulted in poor VAM colonization. Phosphorus did not show any significant impact on VAM colonization. Nodulation was poor in fertilizer treated seedlings, especially N1 and N2, apparently P treatments had higher nodulation. In *C. equisetifolia* only fertilizer treatments in combination with symbionts gave enhanced biomass. Low dose of phosphorus (15 ppm) in combination with nitrogen appeared to increase VAM colonization, at higher level of P (30 ppm), the colonization decreased. Root nodulation was poor in all the fertilizer treatments.

Significant difference (P-0.01) was observed between treatments (VAM, N2 fixing symbionts and fertilizer) in height and diameter of field planted 1-year-old *A. auriculiformis*. All the treatments responded favourably to fertilizer application. The percent increase in growth (height and diameter) was more in symbiont-inoculated plants than control, especially in fertilized seedlings. Maximum percent increase in height was 57.4 (*G. calidonius*) and 56.2 (*G. calidonius* + *Rhizobium* A-19 Calicut) whereas for diamter growth the maximum increase was 84.5% (*Glomus intraradices* + *Rhizobium* A-16 Panamaram), followed by 70.0% (*G. calidonius*). In control the increase in height and diameter growth was 11.5% and 41.4%.

KFRI Research Report 113
Fungal pathogens as a potential threat to tropical acacias - case study of India. Investigators: Dr. J.K. Sharma and Smt. E.J. Maria Florence, December 1996.

Abstract

A disease survey conducted in *Acacia aulacocarpa*, *A. crassicarpa*, *A. mangium* and *A. auriculiformis* trial plots and plantations in the States of Kerala, Tamil Nadu, Karntaka and West Bengal revealed a large number of new and serious diseases. All the four acacias suffered more from foliar disease than diseases of other parts. The maximum number of diseases was recorded on *A. auriculiformis* (28), followed by *A. mangium* (23), *A. crassicarpa* (17) and *A. aulacocarpa* (13). All the diseases recorded on *A. aulacocarpa* and *A. crassicarpa* are new records for India. In the case of *A. mangium* and *A. auriculiformis* except for a few diseases already recorded, the rest are new disease records. Although the number of diseases appeared to be high, the number of fungal genera causing diseases was not high as different species of the same genus produced variable symptoms. The genera most commonly associated with the disease symptoms were *Colletotrichum*, *Pestalotiopsis*, *Alternaria*, *Curvularia* and *Phomopsis*.

Although some of the foliar diseases such as Phomopsis foliar spot of *A. aulacocarpa*, Colletotrichum foliar spot, Cerospsoridium foliar spot, an unidentified foliar spot and powdery mildew of *A. mangium* were quite severe resulting in premature defoliation, stem and root disease recorded in various Acacia species were most damaging as they caused mortality of trees. In *A. aulacocarpa* and *A. crassicarpa* root rot caused by unknown basidiomycetes was responsible for mortality. In *A. mangium* root rot caused by *Ganoderma* and dieback by *Hendersonula* were the most serious diseases causing extensive mortality. In *A. auriculiformis* also, dieback caused by *Hendersonula* was the most damaging disease.

Considering the spectrum of disease in various parts of India the study suggests that further surveys covering other States where species/provenance trials have been established and acacias are grown on a large scale, are required to gain a better picture of the disease situation in India.

KFRI Research Report 115
A manual of non-wood forest products plants of Kerala State, India. Final Report of the project No. KFRI 198/93. Investigator: Dr. K.K.N. Nair, 1996.

Abstract

The manual provides exhaustive details on selected 150 species of non wood or non-timber forest produce plants of Kerala State. The plant taxa dealt with belong to categories of products like medicine, spices and condiments, gums and resins, dyes, tanning materials, essential oils, detergents and cosmetics, narcotics and beverages, fibres and floss, food and fodder, fats and oils, paper and pulp, poisons and pesticides, cottage industries and few others with certain specific uses. For each taxon, the details provided are nomenclature, local names of plants and products, detailed plant descriptions, ecology and phenology, district-wise distribution in Kerala, world distribution and information on product(s) extracted and their uses. For each taxon, distribution maps for Kerala is provided and wherever illustrations are not referred to in the nomenclature part, a sketch of the plant is also given to facilitate easy identificaiton.

In the manual, various species are arranged alphabetically by their up-to-date botanical names. All the botanical names used in the text have also been indexed towards end. Also, a classified list of species belonging to different product categories and a glossary of medical terms used in the manual is provided to facilitate any reference.

KFRI Research Report 116
Palm resources of Kerala and their utilization. Investigators: Dr. C. Renuka, Dr. K.M. Bhat, Dr. S. Chand Basha, December 1996.

Abstract

Palms are an important group among monocots which are of immense service to mankind. They form a vital component of forest and agricultural ecosystems, providing a wide range of economic products necessary for daily life. Besides the common cultivated palms like coconut, arecanut and oil palm, and over a dozen introduced ornamental palms and rattans (canes), there are seven species of wild and semi wild plams presently found in Kerala State. Of these seven species, a few namely, *Borassus flabellifer, Corypha umbraculifera* and *Caryota urens* are widely exploited in the State. They are sometimes cultivated in farmlands and homesteads. Whereas the remaining, namely, *Arenga wightii, Bentinckia condapanna, Phoenix humilis* and *Pinanga dicksonii* which confined to certain remote forest localities are little-known for their utility. This report highlights the botanical, ecological and utilisation aspects of the above-said seven species of palms, mainly based on field studies and literature survey, and discusses appropriate conservation measures to be adopted to augment the palm resources of the State.

KFERI Research Report 117
Statistical analyses package for forest mensuration. Investigator: Dr. K. Jayaraman, December, 1996.

Abstract

A software package dealing with certain statistical analyses in forest mensuration was developed. The package consists of three modules, viz., SAMPLE, TREEVOL and TREEBIOM.

SAMPLE deals with parameter estimation for sampling from finite populations. The module covers a wide array of sampling plans commonly used in forestry. The module allows the user to specify the sampling plan used and provides a frame for entering and editing data. The estimates of population parameters like mean, total and ratio are made available by the programme with correspond standard errors.

TREEVOL is for developing prediction equations for commercial volume at tree level based on measurements of diameter at breast height (dbh) and height of dbh alone. The programme accepts billet level or tree level data, selects the best fitting regression function from a set of candidate functions for predicting commercial volume and provides the user a volume table for the range specified.

TREEBIOM is useful for developing biomass prediction equations for the whole tree or its components like stem, branches and leaves based on diameter at breasthegiht (dbh) and height or dbh alone. The programme offers facilities for entering and editing measurements on dry weight and fresh weight of samples, develops estimates of dry weight at tree level, selects the best fitting regression function from a candidate set of functions for predicting biomass and provides a biomass table for the range specified.

The package fills in the need for a self contained user-friendly software for executing certain important statistical applications in forest mensuration and is conceived to be useful for a wide array of professionals in forestry and allied fields. The present version of the package is PC based, runs under DOS 3.0 and above and requires a minimum of 384 KB run time memory.

KFRI Research Report 118
Expert system for designing experiments in forestry. Final Report of the project No. KFRI 188/93. Investigators: Smt. P. Rugmini, Dr. K. Jayaraman, Dr. V.K. Bhadran, 1997.

Abstract

The possibility of using expert system in designing expriments in forestry was explored by organizing the concerned knowledge base and incorporating the

same into an expert system shell. Designs commonly used in forestry experiments in different contexts were first identified and the circumstances under which these designs are suggestible were worked out. Together with the algorithms for constructing the designs formed the knowledge base for the expert system. The knowledge base incorporated into the expert system shell GENEX formed the product designated as DESIGNEX.

The software DESIGNEX runs under DOS environment. Minimum memory of 640 KB is required for running the software. The system can identify appropriate experimental designs based on the user-given information about the expeirmental context. The programme also generates field layout plans of the designs for the user. The product will be useful to researchers in forestry and allied fields in designing their experiments.

New Research Projects

KFRI 261/96: Micropropagation of three valuable timber species in Bay Islands

Investigators : Dr.E.M. Muralidharan, Dr.A.B. Mandal (Central Agricultural Research Institute, Port Blair)

Objectives : i. to develop methods for micropropagation of *Pterocarpus dalbergeoides, Terminalia bialata* and *Diospyros marmorata*, ii. to standardize methods for rapid clonal multiplication of selected genotypes of the three species, iii. to produce, harden and transfer to soil sufficient plantlets for conducting a field trial.

Funded by : Department of Biotechnology, New Delhi

Duration : Nov. 1996 - Dec. 1999

KFRI 264/96: Establishment of pilot-scale bamboo stand for edible shoot production in Kerala.

Principal Investigator : Dr. M.S. Muktesh Kumar

Objectives : i. Interfunction of edible bamboos from different parts of India (indigenous/exotic), ii.establishment of a bamboo shoot stand by planting the propagules in a suitable area, iii. study the feasibility of production of edible shoot for commercialization.

Funded by : Kerala Forest Department

Duration : 3 years (Dec. 1997 - Nov. 1999)

KFRI 265/97 : Ecological and Social Importance of the Sacred Grove in Kerala

Principal Investigator : Dr. U.M. Chandra shekara
Co-investigator : Dr. S. Sankar

Objectives : i. to study the ecosystem structure and broad functional attributes of a sacred grove in the context of the land-use systems outside the sacred grove boundary, ii. to reveal the socio-cultural reasons for maintaining the sacred grove, iii. to analyse the use and abuse of a sacred grove in order to identify effective strategies with the help of local community to conserve and manage the grove.

Funded by : UNESCO, New Delhi
Duration : Jan. 1997 - Feb. 1998

KFRI 268/97 : Investigations into heartwood formation in intensively managed teak plantations

Investigators : Dr. K.M. Bhat, Dr. Jose Kallarackal, Sri. K.C. Chacko

Objectives : i. to determine the age at which heartwood formation begins in fast-growing teak, ii. to examine the correlation between heartwood formation and site factors, iii. to establish the relationship between high input management and heartwood quality and yield.
Funded by : M/S. Sterling Tree Magnum (India) Pvt. Ltd.
Duration : 3 years (Jan. 1997 - Dec. 1999)

KFRI 269/97 : Modelling the growth of teak and real time monitoring of tree health in STM teak plantaitons.

Investigators : Dr.K. Jayaraman, Sri. K.C. Chacko, Dr. P. Vijayakumaran Nair

Objectives : i. to evaluate the status of teak trees periodically in STM plantations using real time data, ii. to assess the effects of different input variables on the growth of teak, iii. to develop a process-based growth prediction model for teak under intensive management.

Funded by : M/S. Sterling Tree Magnum (India) Pvt. Ltd.
Duration : 3 years

KFRI 270/97 : Assessment of pest problems in intensively managed STM plantations.

Investigators : Dr. R.V. Varma, Dr. V.V. Sudheendrakumar, Sri. T.V. Sajeev

Objectives :i. to identify major pests in intensively managed teak plantations of STM and determine their impact, ii. to examine how the intensive management practices like irrigation and fertilizer application affect pest dynamics.

Funded by : M/S. Sterling Tree Magnum (India) Pvt. Ltd.
Duration : Jan. 1997 - Dec. 1999

Participation in Seminars, Symposia and Workshops

International

Smt. N. Sarojam attended the Discussion Forum on Information Services in the Asia-Pacific to examine Forestry Information Systems in the Asia Pacific at CIFOR, Indonesia during 30 October to 1 November 1996.

Smt. M.P. Sujatha attended the Second International Short Course on Sustainable Tropical Forest Management organized by Universiti Pertanian Malaysia, Malaysia during 4-16 November, 1996.

Dr. E.M. Muralidharan, participated in the Training Course on "Molecular Approaches in Plant Population Genetics and Systematics held at Forest Research Institute, Malaysia (FRIM), Kuala Lumpur, Malaysia during 12-24 January, 1997.

Dr.J.K. Sharma participated in Tree Seed Pathology Meeting at Opocno, Czech Republic during 9-11 October 1996 and presented a paper on Seed Pathology of Tropical Hardwoods. Dr. Sharma also participated in Pine Germplasm Meeting organized by FAO and IPGRI at Opocno, Czech Republic during 14-16 October 1996 for framing technical guidelines for the safe movement of Pine Germplasm. He presented information on various pine diseases prevalent in South Asia.

National

Dr.K.S.S. Nair(Director) participated in a Symposium on Technology for Biological Control held at the Entomology Research Institute, Chennai on 11 October 1996. He released books published by the Entomology Research Institute in the inaugural function; chaired a Technical Session of the Symposium and presented a paper on "Solar light traps for monitoring pest populatons".

Dr.U.M. Chandrashekara attended the Regional Workshop on Community based Conservation at Indian Institute of Public Administration, New Delhi during 9-11 February, 1997 and presented a paper on Community-based conservation: the case of Chinnar Wildlife Sanctuary (U.M. Chandrashekara and S. Sankar).

Dr. E.M. Muralidharan, participated in the National Symposium on Emerging Trends in Plant Tissue Culture and Molecular Biology at Osmania University, Hyderabad during 29-31 January, 1997, and presented two poster papers: High frequency organogenesis in *Clausena indica* - a tree host of sandal (T.B. Suma, Sunil Thomas and E.M. Muralidharan) and *In vitro* regeneration in three species of rattan (*Calamus* spp.) (K. Valsala and E.M. Muralidharan).

Dr. Jose Kallarackal attended the Annual Review Workshop of Western Ghats Projects held on 12 February 1997 at the Ministry of Environment and Forests, New Delhi.

Dr. R. Gnanaharan, Dr. K.K. Seethalakshmi, Mr. T. Surendran and Dr. Muktesh Kumar participated in the Naitonal Seminar on Bamboos held in Bangalore during 28-29 November 1996 and presented the following papers.

- Potential of Indian bamboos for making furniture (R. Gnanaharan)
- Practical suggestions for minimizing the harvest wastage of reed bamboos (R. Gnanaharan and C. Mohanan)
- Slivering and chemical protection - a viable alternative for long-term storage of reed bamboos (C. Mohanan and R. Gnanaharan)
- Status of information on bamboos occurring in India -(K.K. Seethalakshmi, M.S. Muktesh Kumar, N. Sarojam, and K. Sankara Pillai)
- Bambusetum - a means to conserve our bamboos (T. Surendran and K.C. Chacko)

Smt.. P. Rugmini attended the 9th Kerala Science Congress held at Thiruvananthapuram during 27-29 January, 1997 and presented a paper entitled Designing experiments in forestry through expert system (P. Rugmini, K. Jayaraman and V.K. Bhadran).

Dr. R. Gnanaharan participated in the Workshop on Indian Rural Bamboo, organized by KFRI on 18-19 September 1996. The efficacy of preservative treatment of bamboo thorns was explained to the participants in the field.

Dr. P.S. Easa and Dr. E.A. Jayson attended the Pan-Asian Ornithological Congress organized by SACON at Coimbatore from 9 to 16 November 1996. Dr. Jayson presented a paper on Birds of Chimmony Wildlife Sanctuary, Kerala.

Dr. K.K. Ramachandran attended the 'Small population dynamics and the tools of recovery training wokshop - Lion-tailed macaque as a case study' during 10 to 13 October 1996 at Coimbatore, organized by Zoo-Outreach Organization and Central Zoo Authority. He presented a paper on 'Population characteristics of Lion-tailed macaque in Silent Valley National Park.

Dr. P.S. Easa attended the Seminar on

Biodiversity in the Western Ghats organised by Centre for Ecological Sciences, Bangalore at IISS during 5-8 November 1996 and presented a paper on Freshwater fish diversity in Kerala part of Nilgiri Biosphere Reserve.

Dr. P.S. Easa and Dr. E.A. Jayson attended the seminar on Biodiversity of High Ranges organized by High Range Wildlife and Environment Preservation Association, Munnar on October 2, 1996 and presented a paper on Vertebrate diversity in High Ranges.

Dr. P.S. Easa, Dr. E.A. Jayson and Sri. P. Padmanabhan participated in the India-Ecodevelopment Workshop - Periyar Tiger Reserve - at Thiruvananthapuram, organized by Kerala Forest Department during 3-5 October 1996. Dr. P.S. Easa presented a theme paper - Faunistic research in Kerala - a review.

Sri. P. Padmanabhan and Dr. P.S. Easa attended the National Conference on Tropical Bees and Environment at Bangalore during 19 to 21 December 1996. Sri.P. Padmanabhan presented a paper entitled 'Problems and prospects of Beekeeping in Kerala, India'.

Dr. R. Gnanaharan attended the Indian Rubberwood Task Force meeting held at Kottayam on 9 October 1996.

Guest lectures

Dr.R. Gnanaharan gave guest lectures to the participants of Refresher Course at SFS College, Coimbatore on 23 September 1996.

Dr. K.K. Ramachandran gave a lecture on 'Wildlife Conservation' at the N.S.S. College, Nemmara on 17 February 1997. Dr. R. Gnanaharan took two classes for the M.Sc. (Wood Science & Technology) students of the FRI Deemed University, Dehra Dun on 7-8 January 1997.

Training

International

Dr. K. Mohanadas, Scientist, Entomology Division underwent a training in U.K. on pesticide spraying machinery during 1 to 22 February 1997 under the ODA supported collaborative project on Teak Defoliator Management.

Dr. K.V. Sankaran visited CSIRO Division of Forestry and Forest Products, Perth, Western Australia during 25 September to 20 Decenber 1996 to learn and evaluate forest management strategies employed in growing and harvesting short rotation eucalypt plantations in Australia.

National

Mr. K.C. Chacko and Dr. C. Mohanan attended a 10 days training course on Forest Tree Seed Technology at the Forest Research Institute, Dehra Dun during October 1996. The training was organized by ICFRE under the World Bank Projects. The resource persons were Dr. Elam and Prof.F.T. Bonner from U.S.A.

Mr. K.V. Mohammed Kunhi underwent a training at Naitonal Museum of Natural History, New Delhi during 12 to 25 December 1996.

Distinguished visitors

Dr. N.K. Joshi, Director General, ICFRE, Dehra Dun visited KFRI on 1 November 1996.

Mr. Irelio Sanchee Ramos, from Cuba visited the Institute on 19 September 1996.

Dr. Sadanandan Nambiar, Chief Research Scientist, CSIRO Forestry and Forest Products Division, Australia visited the Insitute on 16 and 17 December 1996.

Campus News

Dr. C. Mohanan was deputed as Scientist-in-Charge of KFRI Subcentre, Nilambur. He took charge of the Subcentre and Teak Museum on 4 November 1996.

Mr. T.V. Sajeev, joined as Scientist B in the Entomology Division in February 1997.

Dr. R.C. Pandalai took part in the "Grama Sabha" of Vaniampara Village on 27 September 1996 for assisting the members on the decentralised planning process initiated by the State Planning Board.

Mr. K.C. Chacko participated in the preliminary planning of linkages between Research Institutes in South India. The meeting was held at IFGTB, Coimbatore on 22nd November 1996.

Dr. P.S. Easa was nominated by Government to the Kerala State Wildlife Advisory Board.

Dr. P.S. Easa was nominated to the Board of Studies in Zoology and Wildlife Biology of AVC Autonomous College under Bharathidasan University, Tamil Nadu.

Resource person

Dr. K.K. Ramachandran served as a Resource Person for the 'Small population dynamics and the tools of recovery training workshop using Lion-tailed macaque as a case study' during 10 to 13 October 1996 at Coimbatore, organized by Zoo Outreach Organization and Central Zoo Authority.

Radio talks

Dr. E.A. Jayson delivered a talk on 'Racial characters and behaviour of dogs' in All India Radio, Trichur on 31 December 1996.

Ph.D. Degree

Dr. E.A. Jayson was awarded Ph.D. Degree in Zoology from Calicut University for the thesis entitled 'Synecological and behavioural studies on certain species of forest birds'.

Training Programme/Workshops Organized

KFRI organized workshops on "Mass clonal propagation of eucalypts planting stock" during 25 to 26 October 1996 and "Root trainer nurseries and organic potting media" during 27-29 October 1996 at KFRI, Peechi. The Workshops supported by World Bank funds were organized jointly with the Kerala Forest Department for the benefit of Forest Officials and field staff of KFD.

KFRI joined the Forest Department to organize a one-day Workshop on "Root-trainer technology and organic potting media" for 90 forest officials of Ernakulam Social Forestry Circle at KFRI, Peechi on 30 November 1996. The training programme was inaugurated by Mr. S. John Koilparambil, CCF (Social Forestry). The valedictory session was chaired by Dr. K.S.S. Nair, Director, KFRI. Mr. K.C. Chacko and Dr. R.C. Pandalai delivered lectures and conducted demonstrations.

A one-day Wood-based Industries Interaction Meeting was organized jointly by KFRI and the Kerala Forest Department at KFRI campus Peechi on 26 February 1997. Participants included officials from Industries Department, Kerala Small Industries Development Corporation, Kerala State Housing Board, Kerala State Construction Corporation, Plantation Corporation of Kerala Limited, Travancore Plywood Industries Limited, Forest Industries (Travancore) Limited and representative from pulp industry, sawmilling, joinery and furniture industry, plywood and panel industry, rubber and processing industry, officials of the Forest Department and scientists of KFRI. A total of 60 persons participated in the meeting.

The Inaugural session was followed by four technical sessions on Pulp Industry; Sawmilling, Joinery and Furniture Industry; Plywood and Panel Industry; and Rubber and Processing Industry. The concluding session was chaired by Sri. D.S. Rao Managing Director, KFDC. Sri. George Joseph representing the Industries Department stressed that the Industries Department will be glad to play a role in resolving conflicts between the Forest Department and wood using industries, to support training programmes and to establish a central wood processing equipments facility, Dr. K.S.S. Nair, Director, KFRI, promised to follow up the recommendations of the meeting for implementing them.

M.Sc. in Tropical Forestry

The Wageningen Agricultural University (WAU) in the Netherlands is offering a 17 months M.Sc. course in Tropical Forestry, starting every year in September. Core of the program is the M.Sc. thesis research. Two specializaitons: Social Forestry, and Silviculture and Forest Ecology. Applicants should have a B.Sc. in forestry (or equivalent), fluency in English, and preferably working experience. Application for the 1998-1999 course: before November 15, 1997.

For more information:

Department of Forestry, MSc Course Director Frits J Staudt

P.O. Box 342, 6700 AH Wageningen, The Netherlands

Wood-based Industries Interaction Meeting - Dr. K.S.S. Nair, Director, KFRI, welcomes the participants

Forthcoming Forestry/ Environment Events

26-29 August 1997. Symposium on Silviculture and Genetic Improvement of eucalyptus. Silvadex, Brazil, IUFRO Work Group S2.08.03. Contact: Coordinator of Technical Committee, EMBRAPA-CNPF, CP 319-CEP 83411-000, Colombo, Brazil. Email eucalypt@cmpf. embraapa.br

8-13 September 1997. Sustainble Management of Small Scale Forestry. Kyoto IUFRO S.08.03 Contact: Ikuo Ota, Graduate School of Agriculture, Kyota University, Kitashirakawa Sakyo, Kyoto 606-01, Japan. Fax: 81-75-753 6091. Emailikuota@kais kais.kyoto.u.ac.jp

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