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Establishment of Tree Health Helpline for the State of Kerala

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CONTENTS

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ABSTRACT

The Kerala Forest Research Institute (KFRI) established the Tree Health Helpline on 23rd November 2009 to render scientific advice to forest tree farmers regarding problems faced by them on tree planting, management and related issues. This encompassed problems faced at single tree level to plantation.

The project entitled "The establishment of Tree Health Helpline for the State of Kerala" was launched with the financial support from the Kerala State Council for Science, Technology and Environment. The Helpline desk managed problems related to site selection, species site matching, planting, thinning, soil testing, fertilization, pest, disease and weed management, landscape level afforestation, tree or wood sample identification, preservative treatments and economic valuation. The technical support for the programme was given by various Divisions of KFRI like Soil science, Entomology, Pathology, Botany, Silviculture, Wood science, Statistics, Wildlife and Physiology.

During the period 2009 to 2012, 284 queries related to various forest tree species received from the public and forest department were attended. While majority of the problems could be handled at the institute level, some were referred to concerned institutions / experts outside the Institute.

1. INTRODUCTION

The interest of public on tree planting particularly of forest tree species has considerably increased during the past few years. Initiatives and awareness building efforts by the Government, media and many grass root level non-governmental organizations have given stimulation to individuals, organizations and various industrial establishments for tree planting. The initiation to plant mangrove trees in the coastal belts at personal and organizational levels, the efforts by major industries to establish green belts around their factories, efforts to stablilize the coastal zone by massive tree planting in the wake of the 2004 Tsunami, the initiative by the Education Department to make available quality saplings to school students and to monitor their growth on a large scale manner and the eagerness of many families to plant trees in homesteads are examples of increased sensitivity in the state towards tree planting. However, support and assistance from the scientific community to solve many tree planting related issues are yet to reach the tree lovers and farmers.

The Kerala Forest Research Institute (KFRI) which is serving as a hub of tropical forest research during the past three and a half decades took the initiative to establish a Tree Health Helpline desk to address tree health problems encountered by farmers interested in forest tree species.

The project entitled "The establishment of tree helath helpline for the State of Kerala" launched on 23rd November 2009 with the financial support from the Kerala State Council for Science Technology and Environment envisaged to develop a mechanism to attend to queries and to offer recommendations to farmers to solve their problems related to site selection, species site matching, planting, thinning, soil testing, fertilization, pest, disease, weed management, landscape level afforestation, tree or wood sample identification, preservative treatments and economic valuation. The technical support for the programme was offered by various Divisions of KFRI like Soil Science, Entomology, Pathology, Botany, Silviculture, Wood Science, Statistics, Wildlife and Physiology. The specific objectives of the programme were the following:

1. To establish a comprehensive helpline at KFRI to address tree health problems.
2. To develop keys and protocols for identifying and managing pests and diseases of trees.
3. To try and execute non-hazardous management practices for tree health problems.
4. To evolve a proactive early warning system that would warn incipient pest and disease outbreaks.

2. METHODS

Unlike most agricultural crops, trees have a long rotation time and more are for growth. The time and space taken up by the tree/s can be utilized effectively when problems with tree health are effectively tackled and handled at the earliest point of time. Through the "Tree Health Helpline", KFRI is trying to answer various queries related to tree growing, thereby helping the growers to take better care of the trees they grow. To ensure a wide window for communicating tree related problems, the Tree Health Helpline has undertaken the following tasks.

2.1 Launching of the helpline

The Tree health helpline was launched on 23rd November 2009 at KFRI by the honorable Forest Minister Shri. Binoy Viswam and ample publicity was received across the state through news paper coverage.

2.2 Database compilation

One of the initial activities of the project was the compilation of tree health problems attended attended by KFRI in the past three decades. The rationale behind was that the old record consists of information on the time and place of the problem, symptoms, causative factors and the remedies recommended on tree health issues. The database was made easily searchable so that a query received could be matched with existing information if any so that it could be answered immediately.

2.3 Query reception

A dedicated query reception facility has been set up at KFRI Peechi, Thrissur. Queries were accepted over telephone calls, e-mail, and also by post. A dedicated telephone and computer facilities were utilized for the real time recording of the information received. Client's name and address with phone number were recorded along with the tree problems to ensure further contacts and follow up.

2.4 Processing and replying queries

When a query was received, it was compared with the database for any similar existing information. In the case of information already available it was communicated to the client immediately. Fresh problems as well as those required further investigation were referred to the concerned subject expert. If needed the matter was subjected to further examination at multidisciplinary level with involvement of different scientists. The recommendation received at the Helpline Desk was subsequently communicated to the client. Where ever needed additional information was collected from the client for more clarity on the problem brought out and if required the expert/s themselves conducted field visit to gather specific information on the issue.

2.5 Information Dissemination

Brochures and stickers in Malayalam and English on tree management, pest and disease management both were prepared and distributed to the public, farmers and students. Media coverage was also ensured so as to extend the service of the Helpline to a large section of the tree growers.

2.6 Research backup

The team of researchers associated with this project has been monitoring various tree health problems and has fair information on the emerging and the general pattern of tree health problems of the state. Studies on different aspects like pathology, soil quality, tree health and site analysis had conducted wherever needed to answer specific queries and to attend new issues. Microbiological studies were also carried out to identify various diseases encountered in plants. The research team analyzed the problems received and prepared reports on tree health problems of the state with pro-active measures to solve tree health issues.

3. RESULTS AND DISCUSSION

The queries attended by the Helpline belonged to fifteen categories covering pest attack, diseases incidences, seedling availability, market value of timber species, harvesting time, plant species site matching, fertilizer application, physiological problems, timber quality, planting methods, seed processing methods, social issues related with trees, micronutrient deficiency, multidisciplinary and publicity.

3.1 Pest attack

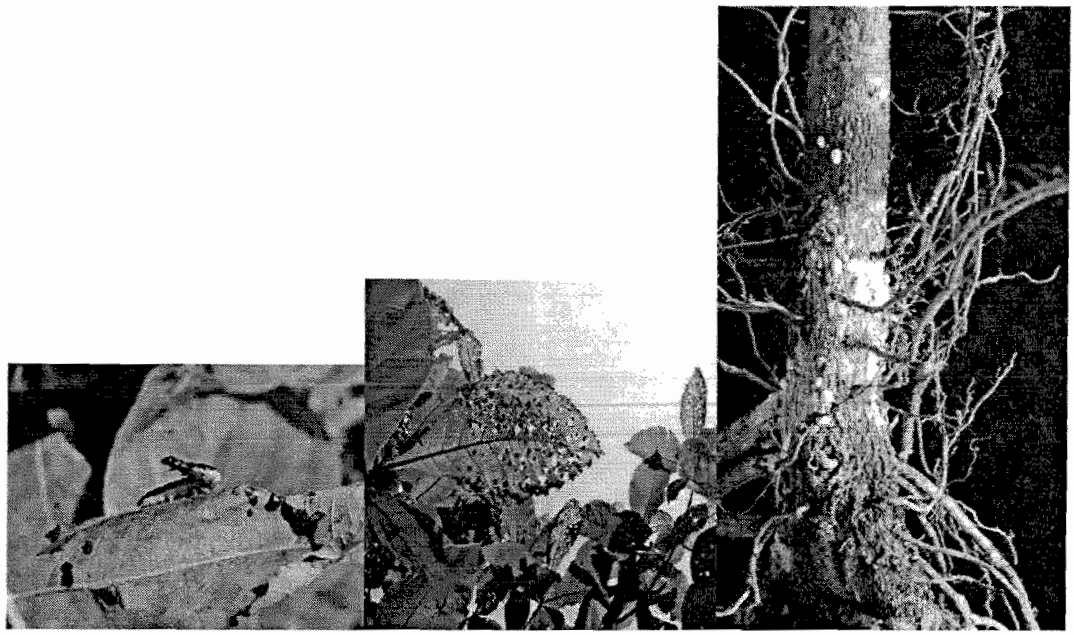

Fig 1: Insect attack on trees

Table 3.1 gives details on pest attack to different trees and recommendations suggested through tree health helpline. Descriptions on insecticidal preparations suggested by the helpline are attached in Appendix 1.

Table 3.1 Pest attack of different trees and recommendation given

Sl No	Trees species	Pest	No	Symptom reported	Recommendation: Biocide/pesticides
1	*Swietenia macrophylla*	*Hypsipyla robusta*	6	Top shoot boring	Rogor (Mohandas, 2000)
2	*Nephelium lappaceum*	Unidentified insect	1	Leaf feeding	Neem oil mixture ((Alexander *et al.*, 2009)
3	*Litchi chinensis*	Unidentified insect	2	Leaf feeding	Neem oil mixture (Alexander *et al.*, 2009)
4	*Mangifera indica*	Insect attack	4	Drying of branches, black appearance on the bark,	Neem oil mixture (Alexander *et al.*, 2009)
5	*Tectona grandis*	*Hyblaea puera*	6	Defoliation	HpNPV, Delfin (Sudheendrakumar et al.,2004)
		Sahyadrassus malabaricus	8	Stem boring	Ekalux 1% (Nair, 1982)
		Eutectona machaeralis	2	Leaf feeding	not of serious concern, seasonal,control not recommended (Sudheendrakumar and Sajeev 2011)
		Termite	1	Feeding by termite	Actara (https://www.syngenta-crop.co.ek/products/actara/product-label.aspx)
		Mealy bug (*Paracoccus marginatus*)	1	Drying up of seedlings. Infestation noted on the root.	Confidor (Sudheendrakumar, 2010)
		White grub	3	Yellow spots and curling of leaves.	Chloropyrophos (Varma, 2001)
8	*Phyllanthus emblica*	Mealy bug	2	Drying up, some white colored insects noted.	Tobacco decoction (Alexander *et al.*, 2009)
9	*Albizia falcataria*	*Inderbella*	1	Bark feeding	0.5%Cypermethrin (Mathew,1992)
10	*Gmelina arborea*	*Sahyadrassus malabaricus*	1	Drying up of plant due to stem boring.	Ekalux 1%(Nair, 1982)

Of the 38 queries pertaining to ten different tree species were received. 55 percentages of on pest attack of teak. Of these 28 percentages of questions were on the teak defoliator - *Hyblaea puera*. Thirty eight questions were on the trunk borer- *Sahyadrassus* attack, nine percentages on the teak skeletonizer - *Eutectona* and five percentages query was concerning mealy bug attack. There was sixteen percentages of questions on *Hypsiphyla* attack on Mahagony. Problems related to Mango (10.52 percentage), Litchi (5 percentage) and Rambuttan (2 percentage) could not be investigated in detail. However immediate control measures were recommended. Mealy bug attack on Indian gooseberry (5 percentages) was also attended. Details of the recommendation given are presented in Appendix 1.

3.2 Diseases

Figure 2: Disease due to fungal attack in teak

Table 3.2 explains the details of quires received on diseases symptoms, identification and suggested recommendations for different trees through tree health helpline.

Table 3.2 Diseases reported on different tree species, identification and recommendations

Sl No.	Trees species	Causative organism identified	No	Symptoms reported	Recommendation
1	*Tectona grandis*	*Alternaria, Colletotrichum* (Fungus)	1	Curling and drying of teak seedlings	Bavistin, Dithane M – 45 (Sharma *et al.*, 1`985, Agarwal et al., 2005)
		Phomopsis (Fungus)	1	Peeling of external bark	Bavistin (Sharma *et al.*, 1`985)
		Rhizoctonia sp. (Fungus)	1	Collar rot	Terraclor/Vitavax (Sharma *et al.*, 1985)
		Unidentified fungus	8	Drying of leaves	Bavistin, Calixin (Sharma *et al.*, 1985)
			1	Decaying at the point of root meeting and extends as a pod.	Nil
		Pink disease (Bacterial)	2	Peeling of external skin of teak	Bordeaux mixture (Alexander *et al.*, 2009).
2	*Calamus*	*Colletrotrichum sp.* *(Fungus)*	1	Foliar infection	Bavistin (Sharma *et al.*, 1985)
3	*Artocarpus heterophyllus*	Unknown fungus	2	Drying up of tree	Bavistin (Sharma *et al.*, 1985)
4	*Acacia mangium*	Unknown fungus	2	Yellowing of leaves and drying up of roots.	Calixin (Sharma *et al.*, 1985)

5	*Pterocarpus santalinus*	Unknown fungus	1	Peeling of external skin just above soil	Bordeaux mixture (Alexander *et al.*, 2009).
6	*Casuarina equisetifolia*	*Botrydiplodia* and *Phomopsis*(Fungus)	1		Bavistin (Sharma *et al.*, 1985)
7	*Saraca asoca*	Unknown fungus	2	Drying up of seedling	Bavistin (Sharma *et al.*, 1985)
8	*Diospyros peregrina*	Unknown fungus	1	Fruit fall	Calixin , Bavistin or Dithane (Sharma *et al.*, 1985)
9	*Citrus medica*	Unknown fungus	1	Sap is oozing out	Bavistin (Sharma *et al.*, 1985)
10	*Mangifera indica*	Pink disease	1	Branches dying	Remove the affected branches just 5 cm above and apply Boudreaux paste at the cut ends (Alexander *et al.*, 2009).
11	*Phyllanthus emblica*	Pink disease	1		
12	*Flacourtia jangomas*	Pink disease	1		

Twenty eight queries pertaining to diseases on 12 different tree species were received. Among them 14 queries were on teak. Bacterial and fungal diseases were identified on teak. Four different types of fungi, Alternaria, *Colletotrichum, Phomopsis* and *Rhizoctonia sp.* were identified from teak trees. Bavistin, Dithane M – 45, Terraclor / Vitavax, Bavistin, Calixin were recommended against fungus attack on trees. Two instances of pink diseases caused by bacteria were reported and two diseases each on Jackfruit tree, Mangium and Asoka tree were reported. All were due to the fungal attack.

Apart from teak, pink diseases was reported from *Puneala plum* , Indian gooseberry and Mango tree. Application of Bordon paste was recommended after removing the affected part of the specific tree.

3.3 Seedling availability

Requests pertaining to seedling availability from farmers are summaraised in table 3.3. The queries were focused on seedling availability, price and available source.

Table 3.3 Queries related to procurement of seedlings

Sl no	Tree pecies	No	Source	cost
1	*Aphanamixis rohituka*	1	Unknown	
2	*Borassus flabellifer*	1	Unknown	
3	*Cassia fistula*	1	KFRI	10
4	*Casuarina equisetifolia*	1	Kerala Agricultural University	10
5	*Couroupita guianensis*	1	Unknown	
6	*Crataeva nurvala*	1	Unknown	
7	*Cycas*	1	Kerala Agricultural University	500
8	*Ficus auriculata*	1	KFRI	10
9	*Ficus microcarpa*	1	KFRI	10
10	*Delonix regia*	1	KFRI	10
11	*Holarrhena antidysenterica*	1	Unknown	
12	*Mangifera indica*	1	KFRI	10
13	*Myristica beddomei*	1	Unknown	
14	*Myristica fragrans*	2	Kerala Agricultural University	25
15	*Olea uropaea*	1	Unknown	
16	*Plumeria alba*	1	Kerala Agricultural University	50

17	*Dalbergia sissoides*	1	KFRI	10
18	*Salacia chinensis*	1	Unknown	
19	*Santalum album*	1	KFRI	15
20	*Sweitenia mahagoni*	3	KFRI	10
21	*Symplocos racemos*	1	Unknown	
22	*Tectona grandis*	10	KFRI	10

Thirty five queries on twenty three different species of seedlings were received. most of the queries were pertaining to teak. Regarding the availability of teak seedlings, they are usually available in KFRI nursery at a rate of Rs. 10/- per seedling. Other than teak, seedlings of *Cassia fistula*, *Ficus auriculata*, *Ficus microcarpa* , *Gulmohar*, *Mangifera indica*, *Rosewood, Santalum album* and *Sweitenia mahagoni* were also available in KFRI nursery (http:// www.kfri.res.in/ downloads/KFRI-Seedlings-Propagules.pdf). For other species such as *Casuarina*, *Cycas*, *Myristica fragrans* and *Plumeria alba*, farmers were directed to contact the Kerala Agriculture University nursery at Mannuthi, Thrissur.

3.4 Volume and Market Value

Many farmers showed interest to know the volume estimate and market value of trees to be harvested and sold from their homestead. In such cases the measurements of the tree including the girth and height were collected from them. The volume estimation was done as per the standard volume table (Krishnankutty, 2011) available for the

species. The table 3.4 shows the volume estimate and market value of species referred by the farmers.

Table 3.4 Calculated volume and estimated market value of timber species

Sl no	Tree species	Girth (cm)	Volume(m^3)	Value/Cubic feet
1.	*Mangifera indica*	203.2 cm	2.688	400–500/cubic feet
		243.84 cm	4.105	
2.	*Tectona grandis*	165.1 cm	2.014	2500/cubic feet
3.	*Artocarpus heterophyllus*	165.1 cm	1.374	
4.	*Prunus cerasoides*	10.2 cm	not available	
5.	*Artocarpus hirsutus*	182.88	2.358	800-1200/cubic feet
		127 cm	0.981	
		176 cm	2.083	
		198.12 cm	2.808	
6.	*Ailanthus triphysa*	190.5 cm	1.851	400–700/ cubic feet
7.	*Macaranga indica*	190.5 cm	not available	250- 350/ cubic feet
8.	*Gliricidia sepium*	45.72	not available	250- 350/ cubic feet

Volume estimate and market value were given for five different timber species (Krishnankutty, 2011). Usually the farmers sell their trees based on a rough estimate of the volume and a rough value provided by the purchaser. By getting the correct information on the volume of a tree and the market price the farmer can get the correct value for their trees. In the case of three species volume estimation could not be done in the absence of a volume table.

3.5 Harvesting time

Table table: 3.5 summarizes the information provided to the farmers on harvesting time of seven different timber species.

Table 3.5 Harvesting time of different timber species

Sl no	Tree species	No	Harvesting age (years)
1	*Pterocarpus santalinus*	2	30 – 35
2	*Prunus cerasoides*	1	8 – 9
3	*Acacia catechu*	1	7-8
4	*Tectona grandis*	5	55 – 60
5	*Sweitenia mahagoni*	3	25
6	*Santalum album*	1	15
7	*Dalbergia latifolia*	2	90

Sixteen queries on seven different tree species were received. The highest numbers of queries were on teak. In large plantations, a periodical thinning schedule (KFRI Information Bulletin 13) is followed which will yield wood usable for certain purposes. Harvesting period of rose wood is 90 years but rosewood having more than 50 years is also recommended to harvest.

3.6 Species site Matching

Table 3.6 summarizes the recommendations given on species site matching. Details of the planting location were collected through discussion with the farmer. Wherever needed field visit was made to gather information on the planting site to make appropriate decision and suggest recommendation.

Table 3.6: Queries on plant species site matching and recommendation

Sl No	Nature of query and Description	No	Species recommended
1	11 cent normal land with a house covering about 3 cent	1	*Mangifera indica, Pongamia pinnata, Azadiracta indica, Toona ciliata.*(Sujanapal, 2012; Pillai, 2012)
2	Planting in the border of a *Hevea braziliansis* plantation	2	*Tectona grandis*. (Pandalai,2012)
3	Suitability of species for planting along the sides of a canal.	1	*Pongamia pinnata, Casuarina equisetifolia, Azadiracta indica, Tectona grandis, Thyrsostachys oliveri, Saraca asoka* (Pandalai, 2011)
4	Suitability of a location for raising medicinal plant and forestry nursery	1	The site was found to be ideal for establishing a model nursery to raise seedlings (Pandalai, 2012)
5	Shade trees and fruit trees that can be planted in home steads.	1	Shade trees – *Michelia champaca, Cassia fistula, Azadirachta indica, Pongamia pinnata, Mangifera indica, Swietenia mahogani, Phyllanthus emblica, Syzygium cumini, Caesalpinia coriaria* Fruit trees – *Garcinia gummi-gatta, Atrocarpus heterophyllus, Mangifera indica, Anacardium occidentale, Spondias pinnata.* (Pandalai, 2011)
6	Species suited for introduction in an area originaly planted with *Tectona grandis*	1	*Ailanthus triphysa, Prunus cerasoides, Gliricidia sepium,* *Ochlandra travancorica* (Sujanapal, 2012)
7	Species suited for higher altitude	1	*Grevillea robusta, Tropical pine tree* (Pandalai, 2010).
8	Species suited for rocky area	1	*Bambusa polymorpha, Thyrsostachys oliveri* (Pandalai, 2009)
9	Trees suitable for planting in a 5 acres homestead normal land	1	*Phyllanthus emblica, Garcinia gummi-*

			gatta,Caesalpina sappan, Aegle marmelos, Saraca asoka, Artocarpus incises (Pandalai, 2009).
10	Species suited for planting in a location subject to water logging for about three months in an year	2	*Lagerstroemia speciosa, Acacia nilotica, Neolamarckia cadamba* Pandalai, 2009).

3.7 Fertilizer Application

Details of recommendations given to farmers for fertilizer application of for Teak and Mahogany is given in table 3.7

Table 3.7 Recommendation given for fertilizer application

Sl No	Tree species	No.	Fertilizer application
1	*Tectona grandis*	7	Mix 250g Ground nut cake, 250g Bone meal, 100g Neem cake, 100g Potashr (KFRI Information bulletin 13)
2	*Swietenia macrophylla*	1	Cow dung and Neem cake or compost (Thomas *et al.*,2012)

Eight queries were received on fertilizer application of which seven were on teak. A mixture of ground nut cake (two fifty grams), bone meal (two fifty grams), neem cake (hundred grams) and potash (hundred grams) was recommended. A single query was there on Mahagony and a mixture of cow dung and neem cake or compost was recommended for it.

3.8 Physiological Problems

Queries on physiological problems related to tree health and recommendations suggested are given in table 3.8.

Table 3.8 tree species, physiological problems and recommendation given

Sl No	Tree species	No.	Symptoms reported	Recommendation
1	*Artocarpus hirsutus*	2	Liquid oozing out from 15m height.	Apply an antifungal agent (Jose, 2012)
2	*Dalbergia*	1	Sap oozing out from rosewood	Clean the blister area with any antifungal agent (Jose, 2011)
3	*Artocarpus heterophyllus*	1	Leaf shedding followed by mud deposition	Remove newly deposited mud and watering the tree (Jose, 2010)

Four queries received related on physiological problems on trees. Liquid oozing out from *Artocarpus hirsutus* was reported and application of an antifungal agent was suggested to prevent secondary infection. Sap oozing out was reported from *Dalbergia* and identified as water blister. Application of antifungal agent was suggested to avoid secondary infection in the blister area. An inquiry on Shedding of leaves from the jack fruit tree after depositing mud from the nearby canal was received. Tree help line advised him to remove the newly deposited mud from the base of the tree as early as possible and do watering at the base of the tree.

3.9 Timber Use

There were questions on uses of various timber species. Information pertain to this is listed in table 3.9. KFRI Research report "A Hand book of Kerala Timbers" (Nazma *et al.*, 1981) gave authentic information on timber uses.

Table 3.9 Use of different tree species timber use

Sl No	Tree species	No.	Recommendation
1	*Syzygyium cumini*	1	Making furniture
2	*Ailanthus triphysa*	3	Making match box
3	*Gliricidia sepium* of 100 years	1	Furniture purposes
4	*Holoptelea integrifolia*	1	Medicinal value
5	60 year old *Achras zapota*	2	Making furniture
6	*Sapindus emarginatus*	1	Packing cases
7	*Artocarpus hirsutus*	2	Wood works
8	*Azadirachta indica*	1	Making shutters of window

Syzygyium cumini, 60 year old *Achras zapota* and *Gliricidia sepium* of about 100 years are advised for making furniture. Three queries about *Ailanthus triphysa* received and its timber is of good quality for making match box. *Holoptelea integrifolia* has no timber value but possess good medicinal properties. *Sapindus* tree is non – durable and can be used only for packing cases. It cannot use for furniture or construction purposes. *Artocarpus hirsutus* was recommended as a good tree for different wood works.

Azadrictha indica can use for making thee shutters of window but not good for making frames.

3.10 Planting Methods

Some queries received in the Helpline desk were related to planting methods of various tree species (Table 3.10)

Table 3.10 planting methods of some tree species

Sl No	Tree species	No.	Planting methods
1	*Myristica fragrans*	1	spacing - 8m X 8m, provide shade, avoid water logging
2	*Santalum album*	2	Planting is done during monsoon season. Pits of 50 cm^3 are dug at a distance of 3m. *Casuarina, albizia, Cassia siamea* and *Acacia* are planted as host plants
3	*Tectona grandis*	7	Spacing – 2m X 2m, 2500 plants can plant in 1 hectare. Thinning is carried out in 4, 8, 12, 18, 28, 40 and 50 years.
4	*Swietenia macrophylla*	1	Spacing - 2X2m, use cow dung

Nutmeg requires shade for optimum growth. Hence suitable banana varieties can be planted on both sides at a distance of 1m from the pit. This will provide shade in the early stages. Generally nutmeg is cultivated as an intercrop in coconut gardens. Hence the required shade for the growth of plants will be provided by the main crop like coconut. Pits of 90cm x 90cm x 90 cm are dug at a spacing of 8m x 8m with the onset of South West monsoon. The pits are filled with top soil and compost or well decomposed cattle manure and seedlings are planted (Alexander *et al.*, 2009).

Sandal trees can be planted during June, July and August months. Area proposed for planting is completely clear felled. Pits of 50 cm^3 are dug at a distance of 3m which are filled with a mixture od red earth and farmyard manure before planting. Healthy sandal seedlings, preferably above 30cm in height are planted in pits. Tree species like *Casuarina, Albizia, Cassia siamea* and *Acacia* are planted as host plants. Soil work is to be done to a radius of 50 cm once in six months. Host plants tending to over grow sandal are pruned. Climber cutting will be necessary from the third year onwards. Replacement of dead plant is done in the same planting season, and if necessary second replacement may be done during the second planting season (Srinivasan *et al.*, 1992)

The spacing required for planting teak is 2m X 2m. About 2500 plants can be planted per hectare. Stumps should be planted during pre monsoon showers. Stumps are planted remaining shoot portion just above the ground level. Holes of stump length are to be made using a crow bar at the planting site and stumps may be planted in such a way that the shoot portion is just above the ground level. If necessary fertilizers can be applied in the field. Generally, thinning is carried out in 4, 8, 12, 18, 28, 40 and 50 years. In first two thinning, alternate diagonal rows and alternate planting rows respectively are removed mechanically. Further thinning is optional, in which selected trees are thinned to facilitate better growth (KFRI Information Bulletin No.13).

Spacing advised for planting mahogany is 2m X 2m. Application of cow dung and manures are suggested for the proper growth of the plant (Thomas *et al.*, 2012).

3.11 Seed Processing

The seed processing methods of four different species are presented in Table 3.11

Table 3.11 seed processing methods

Sl No	Species	No.	Processing method
1	*Swietenia macrophylla*	1	Deposit 3 kg seeds in a bed of 12m X 1.2m X 30 cm lbh. Cover it with a layer of soil. Irrigate daily, cover bed with newspaper or straw, Provide shade.
2	*Terminalia bellirica*	1	Sow 4kg of *Terminalia bellirica* seed in a bed with 12m length, 1.2 m breadth and 30 cm height. Cover the seeds with a layer of soil. Irrigate daily and cover the bed with newspaper or straw.
3	*Mimusops elengi*	1	6 kg *Mimosups elangi* can sow in a bed of 12m X 1.20m X 30cm lbh. Cover seeds with a layer of soil, irrigate daily and cover the bed with newspaper or straw.
4	*Tectona grandis*	1	Pre sowing treatment is required. 6 kg seeds can sow in a bed of 12m X 1.20m X 30 cm lbh. 1000 stumps can produce from this bed.

For Mahagony seeds a bed is constructed by 12m X 1.20m X 30cm lbh. Mix sand to the bed and sow 3 kg seeds of mahogany. Cover the seeds with a layer of soil. Irrigate daily and cover the bed with newspaper or straw. Remove covering when the sprouting starts. Provide shade if needed. After flushing of 3-4 leaves, plant the seedlings. Wet the bed thoroughly before removing the seedlings to avoid breaking of roots (ISTA, 2010).

For sowing 4 kg of *Terminalia bellirica*, bed of 12m X 1.20m X 30 cm lbh is required. Before sowing the sand may be mixed in the bed. Cover the seeds with a layer of soil. Then irrigate daily and cover the bed with newspaper or straw. Remove covering

when the sprouting starts. Provide shade if needed. After flushing of 3-4 leaves plant the seedlings. Wet the bed thoroughly before removing the seedlings to avoid breaking of roots (ISTA, 2010) .

For 6 kg *Mimosups elangi* a bed of 12m X 1.20m X 30 cm lbh is needed. Mix the sand to the bed and sow seeds. Cover the seeds with a layer of bed. Then irrigate daily and cover the bed with newspaper or straw. Remove covering when the sprouting starts. Provide shade if needed. After flushing of 3-4 leaves plant the seedlings. Wet the bed thoroughly before removing the seedlings to avoid breaking of roots (ISTA, 2010).

Pre sowing treatments are necessary for teak seedlings. They include soaking the seeds in water during night and drying under partial shade during day. The process need to be repeated daily for a week. After this step, the seeds are soaked in cow dung solution for 24 hrs before sowing. 6 kg of *Tectona grandis* can be sown in a bed of 12m X 1.20m X 30 cm lbh. The seeds are covered with fine sieved soil. Thousand good quality stumps can be obtained from each bed.

3.12 Social Issues

There was one request received from the public regarding the possibility of falling of an unhealthy *Ficus religiosa* tree standing near a temple. The site was visited and the tree was found to pose no danger and a recommendation to retain the tree was conveyed to the caller.

3.13 Micronutrient issues

Only one problem was brought to our notice. Clustering of leaves on the top of 2 years old teak plantation was reported by one farmer. Photographs of the affected plant were received. The problem was identified as a micronutrient problem and foliar application of

a micronutrient preparation (multiplex) at the rate of 5gms/litre twice in a week was recommended (Sujatha, 2003).

3.14 Multidisciplinary

Topics of multidisciplinary nature were more compared to all other categories. Details are given in table 3.14.

Table 3.14 Queries on multidisciplinary problems and recommendation given

Sl No	Species	Problem/query	Recommendation
1	*Santalum album*	Available varieties of sandal and suitable host plants	Only *Santalum album* is available in Kerala. Host plant- Leguminous plants (Sujanapal, 2012)
		Details of harvesting	Harvesting regulated by state forest departments (Thomas, 2010).
		Legal issues on export	Govt. of India has banned export of round logs. Handicrafts are permitted for export (Pandalai, 2012).
	Dalbergia	Total species of Dalbergia and their conservation status.	*Dalbergia latifolia* Roxb. and *D. sissoides* Grah. Ex Wight & Arn (Sasidharan and Thulasidas, 2011).
3	*Tectona grandis*	Legal issues on cutting teak	Regulated through Forest Department (Sajeev, 2011)
		Drying of a teak tree	The tree had dried due to some chemical input.
		Preservative treatments	A mixture of diesel oil and coal oil can be applied on the wood then plained and can be painted and used (Thulasidas,2011).

	Desmodium heterocarpon	Description of the species	*Desmodium heterocarpous* Family Fabaceae; herb; hairy branches, three foliate. Flowering time- October to December (Sasidharan , 2010)
4	*Olea europaea*	Seedling availability, Planting methods and area of olive plants.	Generally not grown in Kerala (Sujanapal, 2012)
5	*Wrightia tinctoria*	Medicinal importance	Effective against skin treatments (Sujanapal, 2012).
6	*Artocarpus heterophyllus*	Not fruiting	May be genetic problem (Sajeev, 2012)
7	*Cassine kedarnathii*	properties	Water storing property in the bark (Sujanapal, 2012)
8	water	Water testing laboratory in Thrissur	Kerala water authority, Quality control rregional laboratory, Kizhakkumpattukara, Thrissur – 680005. Ph – 0487 – 2338380, 9447736619. Email – kwaqcsdtcr@eth.net. (Sajeev, 2012)
9	Medicinal plants	Development of medical garden	Contacted with siviculture department(Sujanapal, 2012)
10	slugs	Identification	*Deroceras* genus (Sajeev, 2011)
12	*Mangifera indica*	Preservation	Apply mixture of diesel and coal oil, paint (Sajeev, 2010)
13	*Artocarpus hirsustus*	Preservation	Apply mixture of diesel and coal oil, paint (Sajeev, 2011)
14	Unknown seed	identification	Kakkumkai (*Entada rheedei*) (Sujanapal, 2012)
17	Unknown timber	Needed Identification	Identified as Rosewood (*Dalbergia lattifolia*) (Sujanapal, 2012)

18	*Annona muricata*	Price details	Market price is Rs. 80 - 120 / kg (Sajeev, 2012)
19	*Piper longum*	Planting details	Being a shade loving can plant as an inter crop. Water is essential. The twig containing 3 – 4 leaflets planted in a polythene cover and later transplanted (Sajeev, 2010)
20	Karinthalli	Scientific name	Scientific name is *'Diospyros assimilis'* (Sasidharan, 2011)
22	Urruppu	Scientific name	*Hopea parviflora* (Sasidharan, 2011)
23	Medicinal use	Aaru plant (*Chassalia curviflora*)	Use for hair growth but no aunthentic knowledge (Sasidharan, 2011).
24	Soil testing	Place for soil testing	contact the district soil testing lab (Sajeev, 2012)
25	*Hevea braziliansis*	Processing of rubber	Provided contact numbers of scientist KFRI wood science dept.(9995186346), (Nazma *et al.*, 1981)
26	Kambili puzhu (*Asura conferta*)	Present inside the house	Spaying kerosene mixed with 501 bar soap (Sajeev, 2011)
27	Seven years old *Litchi chinensis*	Not flowering	Proper environment, location soil and irrigation methods are explained in detail. Description added below (Pandalai, 2010).
8	*Simarouba glauca*	Would like to know more about Paradise tree (Lakshmitharu)	Native of America. Distributed in all Districts of Kerala. Eco-friendly tree and checks soil erosion, supports soil microbial life and improves groundwater position (Sasidharan, 2010).

29	*Swietenia macrophylla* and *Tectona grandis*	Planting mahogany and teak 3 meters away from home.	Not advised to plant very near to buildings (Sajeev, 2012).
30	Sadhu tree, Sanyasi maram	Description	may be *Ficus religiosa* (Sujanapal, 2012).
31	Name of a tree	Tree with yellow flowers near Thrissur North Bus stand?	the tree is *Peltophorum pterocarpum* (Sasidharan, 2009)
32	Tree species in Thrissur district	Total tree species, Rare tree species, Distribution pattern of trees	Total Trees: 370 Flowering Plants: 1829 Mangroves: 8 Plains: 161 Exotics: 61 Evergreen & Shola : 171 Semi-evergreen: 148 Deciduous: 109 Rare trees: 18 (Sasidharan, 2009)

3.15 Referred problems

Some queries were referred to specific boards or universities like Agriculture University, coconut board, rubber board and Cardamom research institute. Table 3.15 shows the details of the problems referred to other institutions from tree health helpline.

Table 3.15 problems and referred problems

Sl No	Tree species	No	Nature of problem reported	Referred to
1.	*Citrus reticulata*	1	Method for planting orange, its seedling availability and fertilizer application.	KAU
2.	*Theobroma cacao*	2	General information	KAU
3.	*Cocos nucifera*	3	Coconut falling	Coconut Development Board
4.	*Musa paradisiaca*	4	Seedling availability	KAU
5.	*Cocos nucifera*	5	Seedling availability	KAU
6.	*Phyllanthus emblica*	6	Soil testing	Soil testing laboratory, Thrissur
7.	*Cocos nucifera*	7	disease	Coconut Development Board
8.	*Cocos nucifera*	8	Fertilizer application	Coconut Development Board
9.	*Hevea braziliansis*	9	Drying of 2 year old rubber trees. Leaves on the top are drying. About 160 trees.	Asked them to contact Rubber board.
10.	*Cocos nucifera*	10	Which Medicinal plants can be grown in between coconut plantation? Availability of the concerned seeds.	Coconut Development Board
11.	*Mangifera indica*	2	10 – 12 year old *Mangifera indica* (Mango) tree not flowering.	KAU

12.	*Mangifera indica*	1	Rooting hormones for *Mangifera indica*	KAU
13.	*Myristica fragrans*	1	Graphting Method for nutmeg tree	K A U
14.	*Carica papaya*	2	Pappaya plant is attacked by Mealy bugs.	KAU
15.	*Hibiscus rosa-sinensis*	2	Mealy bugs	KAU
16.	*Psidium guajava*	1	Mealy bugs	KAU
17.	*Ficus auriculata*	1	Processing method of Ficus fruit	KAU
18.	*Elattaria cardomomum*	1	He would like to plant cardamom in between the coconut plantation. Where its seeds available? Is there any problem to plant cardamom in coconut plantation?	Cardamom Research Institute

Problems related with orange, cocoa, coconut, banana, mango tree, nutmeg, pappaya plant, hibiscus, guava and ficus were referred to Kerala Agriculture University (KAU) Thrissur. Planting methods, seedling availability, fertilizer application, insect attack were asked for recommendation. Problems with coconuts were directed to coconut development board. Rubber related tribulations were transferred to Rubber board. Cardamom seed availability, planting site related questions were given to Cardamom Research Institute.

3.16 Publicity

Advertisements for making helpline available to the public were made through media coverage, brochures and stickers.

Media

Commercials of helpline were made through print media and visual media.

Print media

Newspaper reports regarding the launch and inauguration were published on 24th November 2009, Tuesday in the 'Mathrubhumi' and 'Malayala Manorama'. The helpline was inaugurated by the Hon'ble minister Binoy Vishwam. An advertisement regarding different functions of helpline was brought out in the 'Metro Manorama' on 19 december 2009, Saturday. The participation of the members of the tree health helpline group in the programme related to the planting of trees was advertised in the'Mathrubhumi' and 'Metro Manorama' on December 18th , 2009, Friday.

Visual media

A visual coverage about the functioning of Tree Health Helpline was broadcast on the Asianet news channel on the 29 June 2011 and in the Money Time programme on 01 July 2012.

Advertisements for making helpline available to the public were made through media coverage, brochures and stickers.

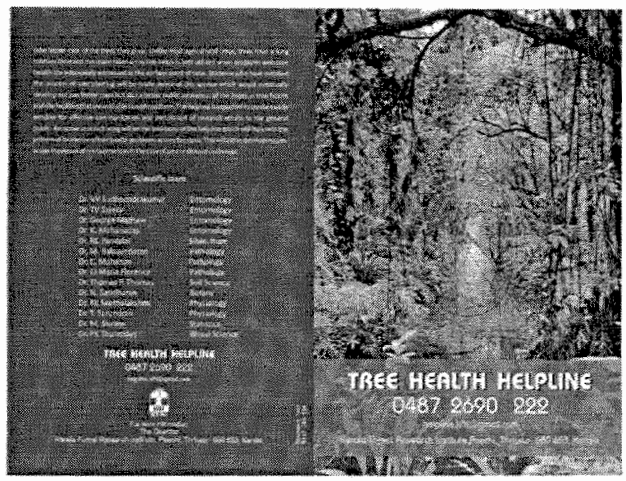

Figure 3: Helpline brochure in English

4. CONCLUSIONS

During 2009 to 2012, two hundred and eighty four queries related to various forest tree species received from the public and forest department were attended at the Tree Health Helpline desk. A majority of the problems could be handled by Kerala Forest Research Institute, while some were referred to concerned institutions / persons and a small number remained unanswered. The queries attended by the Helpline belonged to fifteen different themes including pest attack, diseases, seedling availability, market value of timber species, harvesting time, plant species site matching, fertilizer application, physiological problems, timber quality, planting methods, seed processing methods, social issues related with trees, micronutrient deficiency, multidisciplinary and publicity.

While most of the queries were related to already known aspects, few queries were on new topics. This included recording of the mealy bug (*Paracoccus marginatus*) attack in teak sapling and *Phomopsis* sp. infestation in teak. All scientists of KFRI had wholeheartedly participated in this programme and this has led to the success of this programme. The helpline has created an opportunity for the effective communication of KFRI research outcomes to the public.

Considering the importance of the programme, there was very good coverage of its activities in the media both in print and visual media. The establishment of a Tree Health Helpline desk has given a good opportunity to serve the public interested on forest trees and utilizing the vast knowledge accumulated by KFRI over the past three and a half decades. The appreciation and the support received from the public on this

service suggested that the programme need to be continued as a regular activity of the institute so as to encourage more and more tree planting in the State and elsewhere.

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Appendx I – Chemicals for Insesct Control

Diethane M- 45

Classification : Fungicide

Uses : Fungicide

Mode of application : 0.002% of the fungicide is foliar sprayed at an interval of 10 days for plants which are 6 months or less than six months.

Availability : Pesticide dealers

Bavistin

Classification : Fungicide

Uses : Wide spectrum Fungicide

Mode of application : Foliar spray - 0.02 – 1% (depending on the age) at an interval of 10 -15 days. *Soil drenching* – 2% at an interval of 7 – 10 days in field and 10 – 15 days in shade or secured condition

Availability : Pesticide dealers

Bordeaux paste

Classification : Fungicide

Uses : Wide spectrum Fungicide

Preparation : Dissolve 1 kg of powdered copper sulphate crystals in

50 liters of water. In another 50 liters of water, prepare milk of lime with 1 kg of quick lime. Pour the copper sulphate solution into the milk of lime slowly stirring the mixture all the while. Always use wooden, earthen or copper vessels for the preparation of Bordeaux mixture.

Caution : Test the mixture before use for the presence of free copper, which is harmful to the plants, by dipping a polished knife in it.If the blade shows a reddish colour due to the deposits of copper, add more lime till the blade is not stained on dipping.

Application : Apply bordeaux paste on the affected portion. Use the fungicide in the same day of preparation.

Availability : Pesticide dealers

Calixin

Classification : Fungicide

Uses : Wide spectrum Fungicide

Mode of application : Apply 1-2 percent Calixin in affected area

Availability : Pesticide dealers

Rogor

Classification : Insectcide

Uses : Effective against mahogany stem borer

Mode of application : Spot application with 0.5 percent Rogor in affected area

(Drop application)

Availability : Pesticide dealers

Monocrotophos (Dimecron)/ Quinalphos (Ekalux)/ Fenvalerate (Sumicidin)/ Cypermethrin

Classification : Insecticide

Uses : Broad spectrum insecticde

mode of action : Drenching with Monocrotophos (Dimecron)(0.1 percent)/ Quinalphos (Ekalux) (0.1percent)/ Fenvalerate (Sumicidin) (0.08 percent)/ Cypermethrin (0.5 percent)

Availability : Pesticide dealers

Vitavax/ Terraclor/ Plantamycin

Classification : Antibiotic

Uses : Effective against plant bacterial diseases

Mode of application : apply 0.01 percent

Availability : Pesticide dealerss

Chloropyrophos

Classification : Organophosphate Insecticide

Uses : Broad spectrum insecticide, Effective against termite

application : 0.5 per cent for pinpoint application and 0.03 to 0.12 percent wide area applications

Availability : Pesticide dealerss

Confidor

Classification : Systematic Insecticide

Uses : Wide spectrum insecticide

Mode of application : Foliar application

Availability : Pesticide dealerss

Actara

Classifcation : Systematic Insecticide

Uses : wide spectrum insecticide

Mode of application : Foliar spary and soil application

Availability : Pesticide dealers

Neem oil mixture

Classifcation : Organic pestcide

Uses : Wide spectrum insecticide

Preparation : Dissolve 60g soap in 150 ml warm water, add soap solution to neem oil and castor oil slowly and mix well. Dilute with 6 liters of water. Add 120 g garlic paste. Take the extract and spray

Mode of application : Spraying

Availability : Self preparation

Tobacco decoction

Classifcation : Organic pesticide

Uses : Wide spectrum insecticide

Preparation : Steep 500g of tobacco waste in 4.5 litre of water for 24 hours. Dissolve 120g of ordinary bar soap separately in 0.5 liter of water. Add the soap solution to the tobacco extract and stir vigorously. Add 5 liters of water to this stock solution and spray

Application : Spraying

Availability : Self preparation

Hybcheck (Hyblaea puera Nucleo Polyhedrosis Virus)

Class	:	Biopesticide
Uses	:	Against *Hyblaea puera* Cramer (Teak defoliator)
Preparation	:	Mix the powder in water (2gm in 100 liters)
Application	:	Foliar spray
Availability	:	Kerala Forest Research Institute

Delfin (Bacillus thuringiensis)

Class	:	Biopesticide
Uses	:	Wide spectrum
Application	:	Foliar spray
Availability	:	Pesticide dealerss

Appendix II – Attended plants details

Sl no	Scientific name	Common name	
		English	Malayalam
1	*Acacia catechu*	Black catechu	Karingali
2	*Acacia mangium*	Black wattle/Forest mangrove	Manjium
3	*Acacia nilotica*	Babul tree	Babool
4	*Achras zapota*	Chiku	Chiku
5	*Aegle marmelos*	Bael tree	Koovalam
6	*Ailanthus triphysa*	Matti	Maharukh
7	*Albizia falcataris*	Silk plants	Albizia, Kattamaram
8	*Anacardium occidentale*	Cashew-nut tree	Kasumavu
9	*Annona muricata*	Prickly Custard Apple	Mullanchakka
10	*Artocarpus heterophyllus*	jackfruit tree	Plavu
11	*Artocarpus hirsutus*	Ayani	Wild jack
12	*Artocarpus incisus*	Bread fruit	Kadachakka
13	*Azadiracta indica*	Neem	Ariyaveppu
14	*Bambusa polymorpha*	Bengal Bamboo	Mula
15	*Borassus flabellifer*	Palmyra palm	Karimbana
16	*Caesalpinia coriaria*	Divi Divi	Divi Divi
17	*Caesalpinia sappan*	Sappan wood	Chappangam

18	*Carica papaya*	Pappaya	Pappaya
19	*Cassia fistula*	Goldem shower	Kanikonna
20	*Cassine kedarnathii*	Unknown	Neeral
21	*Casuarina equisetifolia*	Whistling tree	Kattadi
22	*Chassalia curviflora*	Wan guan hua/ Curved flower woody chassalia	Vellakurinji
23	*Citrus medica*	Wild Lemon	Ganapathi-naragam
24	*Citrus reticulata*	Mandarin Orange	Orange
25	*Cocos nucifera*	Coconut	Thengu
26	*Couroupita guianensis*	Cannon ball tree	Nagalingamaram
27	*Crataeva nurvala*	Tree leaved caper	Neermathalam
28	*Dalbergia sissoides*	Rosewood	Eetti
29	*Delonix regia*	Gul Mohur	Poomaram
30	*Desmodium heterocarpon*	Asian Tick Trefoil	Nilathuvara
31	*Diospyros assimilis*	Malabar Ebony	Karinthali
32	*Diospyros peregrina*	Wild Mangosteen	Panachi
33	*Elataria cardomomum*	Cardamom	Elakaya
34	*Ficus auriculata*	Elephant ear fig tree	Atthi
35	*Ficus auriculata*	Giant Indian Fig	Atthi
36	*Ficus microcarpa*	Chinese banyan	Ithi

37	*Ficus religiosa*	Peepal tree	Arayal
38	*Flacourtia jangomas*	Puneala plum	Luikka
39	*Garcinia gummi-gatta*	Malabar Gamboge	Kodampuli
40	*Gliricidia sepium*	Spotted Gliricidia	Seema konna
41	*Gmelina arborea*	Candahar tree	kumizhu
42	*Grevillea robusta*	Silver oak	Kalla
43	*Hevea braziliansis*	Rubber	Rubber
44	*Hibiscus rosa-sinensis*	Shoe flower	Chembarathi
45	*Hoalrrhena antidysenterica*	Kurchi	Kutakapala
46	*Holoptelea integrifolia*	Indian elm	Aavel
47	*Hopea parviflora*	White Kongu	Urippu
48	*Lagerstroemia speciosa*	Banaba	Manimaruthu
49	*Litchi chinensis*	Lichee	Litchi
50	*Macaranga indica*	Unknown	Vatta
51	*Mangifera indica*	Mango tree	Mavu
52	*Michelia champaca*	Yellow champa	Chembakam
53	*Mimosups elangi*	Bakul tree	Elangi
54	*Musa paradisiaca*	Banana	Vazha
55	*Myristica beddomei*	Wild Nutmeg	Kattujathi
56	*Myristica fragrans*	Nutmeg tree	Jathi

57	*Neolamarckia cadamba*	Kadam	Kadambu
58	*Nephelium lappaceum*	Rambuttan	Rambuttan
59	*Ochlandra travancorica*	Elephant bamboo	Eetta
60	*Olea europaea*	Olive	Olive
61	*Phyllanthus emblica*	Indian gooseberry	Nelli
62	*Piper longum*	Indian long pepper	Thippali
63	*Plumeria alba*	Cater pillar Tree/Pagoda Tree	Kumkumapoovu
64	*Pongamia pinnata*	Indian beech tree	Ungu
65	*Prunus cerasoides*	Himalayan wild cherry	Pathumukham
66	*Psidium guajava*	Guava	Pera
67	*Pterocarpus santalinus*	Red sandalwood	Rakthachandanam
68	*Salacia chinensis/ oblonga*	Lolly Vine/ Chinese salacia	Cherukoranti
69	*Santalum album*	Sandal tree	Chandanam
70	*Sapindus emarginatus*	Soapnut tree	Soapumka
71	*Saraca asoca*	Asoka tree	Ashokam
72	*Simarouba glauca*	Paradise tree	Lakshmitharu
73	*Spondias pinnata*	Indian hog plum	Ambazham
74	*Swietenia mahagoni*	Mahogany	Mahagony
75	*Symplocos racemosa*	Symplocos bark	Pachotti

76	*Syzygium cumini*	Black plum	Njaval
77	*Tectona grandis*	Teak	Thekku
78	*Terminalia bellirica*	Bedda nut tree	Thanni
79	*Theobroma cacao*	Cacao	Kokko
80	*Thyrsostachys oliveri*	Batton bamboo	Lathimula
81	*Toona ciliata*	Toon tree/Indian Mahagony	Arana maram
82	*Wrightia tinctoria*	Pala indigo	Dhanthappala

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