Teaknet Bulletin

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Editorial

How useful is TEAKNET? That is the question. After 15 years of its existence we are forced to ask this question again. What has been happening? TEAKNET started off in Myanmar with much expectations and has been functioning well enough. Its membership grew to 20 institutional members and 110 individual members. However, the network suffered a major setback after the change in the government in Myanmar and consequent restrictions on communications. In 2008, the headquarters was shifted to India but there was a gap in the activity due to the sudden demise of Dr. K. M. Bhat, the Coordinator. The network could be reactivated only in June 2009 but by then many old members had dropped out. An international workshop on teak was conducted in November 2009 mainly to inform people that TEAKNET is back again. The workshop generated much interest and brought out the global situation with respect to teak with clarity. The major point highlighted was the increasing gap between the supply and demand and the need to increase the production and develop a better marketing strategy for teakwood. The TEAKNET work plan for 2010 consisted of a selected set of activities which would eventually address these issues. An international workshop is planned to be held in Costa Rica to go into details of coordinated efforts to be made for genetic improvement of teak and also to unify the log grading rules for teakwood which were considered as the most important issues of the time. Similarly, efforts have been initiated by FAO, Rome to develop an international database on teak resources on behalf of TEAKNET.

Many novel ways have been thought of making the network useful to its members. One such means is the updated bibliography on teak which can be browsed by its members from the TEAKNET site. Similar is the case with the directory of researchers, growers and traders. From now onwards, the members can also download *Teak Planner* a growth simulator for teak plantations. However, remember that its applicability is restricted to growing conditions similar to that prevailing in Kerala, India. The intention behind such a release of the software was to make the members know about the logic and the methods employed in the development of the software and prompt similar attempts in other parts of the world.

In the last issue of the bulletin, it was requested that the recipients of the bulletin may communicate any information of value, to the Coordinator, so that the same can be displayed in the website for wider access. There have not been much response in this regard and the readers are reminded of this request once again.

The major attraction of this issue is a futuristic overview of the teak sector provided by Raymond Keogh. He systematically explores the current and future scenarios with respect to technology, investment sources, stakeholder composition, environmental culture and development of the sector. A very frequently asked question on teak is about its profitability as a plantation species. Projections made from experience in Kerala, India are put here for general reference. However, the conditions may be different in other regions. The readers are again requested to share their experience in this regard from other parts of the world.

TEAKNET would like to take up more active forms of service such as conducting training programmes on teak cultivation and management, consultancy assignments on teak, market intelligence on teakwood, among others, when it develops the necessary financial base. Although it is necessary to mobilize donor assistance for such services, a substantial part of that can be achieved through membership support. The readers of this bulletin are requested to enroll themselves or renew their membership, once more.

KFRI TEAKNET

International Conference on Teak

An international conference on teak will be held at Turrialba, Costa Rica during March 2011. The conference will be jointly organized by CATIE, FAO of the United Nations and TEAKNET. The First Announcement in this regard will be made in May 2010.

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Buddha in teak

K. Jayaraman
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What we seek is everywhere. We only have to chip off the unwanted. Even Buddha comes out of a block of teak provided we eliminate the rest from it!

Why teak and TEAKNET?

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Coordinator, TEAKNET

Why teak and TEAKNET? - A legitimate question. Teak, a high value timber needs no more verbose narration as its qualities are well acknowledged and proven over time. Let us look at some of the more recent scenarios. Continued rapid growth of the construction sector (in view of the increasing income) but for the recent recession, and teak's reputation as a high quality timber suitable for a wide array of uses have increased its demand. This is reflected in the global surge in teakwood price, which will continue to increase in the context of the growing demand for tropical timber. The international workshop on Production and Marketing of Teakwood conducted recently at the Kerala Forest Research Institute (KFRI), Peechi, India drew attention to the prevailing high grade tropical hardwood crisis, which is expected to grow further in the coming years. The global demand for tropical hardwood was estimated to be 136 million m^3 by 2050. Teak would at best account for only 10 per cent of this demand, indicating enormous unsatisfied demand and consequent soaring prices. Expanding teak cultivation to new areas, increasing the productivity of existing plantations and devising better marketing strategies including a good market intelligence system are some of the proposed solutions.

Ease of cultivation and growing demand have made teak one of the widely preferred plantation species in the tropics. Teak cultivation is an extremely viable investment, with a potential to earn a rate of return of over 30 per cent under favourable conditions. This is important because many other plantation crops like tea and coffee are facing problems due to price fluctuations in the international market. These crops are labour intensive and require constant care and high input management whereas the case of teak plantations is just the opposite. Unfortunately, teak investments received a bad name in the hands of "ponzi" investment companies, who fleeced the public with exaggerated claims of growth and profitability and failing to actually make the investments. Although it may take 50 to 60 years to produce very high quality logs, teak can be grown for much shorter rotations; alternatively intermediate yields from thinning could more than recoup all the initial investments within 10 years.

So far, a large chunk of teak timber especially of large dimension logs came from natural forests. Continued exploitation has led to destruction of these forests and there is need to restore the conditions of these forests for many compelling reasons. Teak plantations can be looked as alternative sources of timber with productivity levels higher to that of natural stands, but at the same time, having many functional roles as of natural forests with respect to carbon sequestration and protection of soil, among others.

TEAKNET emerged as a result of realization of the high potential teak in serving some of the above needs. Although currently functioning largely as an information network, the organization has high potential in bringing together all the stakeholders associated with teak. Distinct categories of these stakeholders can be identified having specific requirements. Let us have a more realistic analysis of the expectations of these groups.

Group	Requirements
Growers	Need advice on teak cultivation, Prefer to have training programmes in management of teak plantations, Look for new innovations in production technology, Better markets for the products
Traders/ Industrialists	Market intelligence on availability and price of teakwood, Unification of log grading rules , Better pricing mechanism, Liberal trading policies, Innovations in wood processing
Researchers	Clearly defined research targets, Better infrastructure facilities, Funds for research projects, Access to information, Facility for transfer of genetic material
Others (Policy makers, Donor agencies)	Statistics on teak resources, Information on global trends, Guidelines for policy making

We see that the networking cannot be restricted to just information exchange but calls for intensive and dynamic activities leading to strong links not only within each group but also across the groups of stakeholders. However, the hard fact is that network itself needs financial resources to make its plans materialize. The expectation is that a large part of the resources would come from the members but donor support will be crucial especially in organizing international events.

The shape of things to come in the teak sector

Raymond M. Keogh
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In 2009, I explored the future of teak and its associated tropical high-grade hardwood sector and called for a transformation of the teak sector (Keogh 2009a and 2009b). I concluded that the sector can realise its full potential and function as a lucrative developmental tool - lucrative in the sense that all stakeholders (large and small; rich and poor) stand to gain substantial benefits. These benefits can be achieved in a manner that enhances processes designed to solve the current *tropical hardwood crisis*. This crisis has arisen because annual demand for tropical hardwoods is many times greater than what current sources are able to supply on a sustainable basis. Most of the current volume in the market depends on deforestation and degradation of natural forests. The unsustainable nature of supply is the tropical hardwood crisis. To solve the crisis future timber must arise from sustainably managed natural forests and complementary plantations.

I have made a case in the above publications that it is not reasonable to depend on natural forest for the majority of hardwood timber supply. Although not ruled out as sources of quality timber, natural forests are more efficient as refuges for conservation purposes. I do not propose to examine the virtues of natural forests versus plantations here. Rather, I present a simple overview of likely differences that will be encountered between the current and future teak plantations in terms of changes in:

Technology;
Investment sources;
Stakeholder composition;
Environmental culture; and
Development.

These aspects, which need to be changed if the teak sector is to make an optimal impact as a development tool, are explored below.

Technology

Today most commercial teak plantations are monocultures with restricted silvicultural options. Revenue tends to be late and the plantations produce a wide range of diameters throughout the rotation. I foresee plantations based on individual teak trees that can maintain the integrity of their shape and wood characteristics under a wide range of spacings, from relatively high densities to open-grown conditions. These arrangements will allow the grower to adopt silviculture to a wide range of strategies, including limiting thinnings to mature interventions and final fellings, or final fellings only. It would allow for wide initial spacing, permitting mixed cropping, particularly in the early years of the rotation, leading to early economic returns, better Internal Rates of Return, improved protection of the soil and the possibility of increasing the area of teak on slopes that are unacceptable under monocultures. This approach has the possibility of allowing follow-on crops to be planted before final felling, thus providing a continuous forest cover. The key is to focus research on developing an open-grown and acceptable volume-producing tree. A comparison between the current and future situation, in terms of technology is outlined in the following Table:

Current situation	Future situation
Restricted silvicultural options	Grower choice
Monocultures	Mixed cropping
Wide range of diameters	Large diameters
Late revenues	Early economic returns

Investment sources

In the past, large-scale teak plantations were normally left to governments. This was mainly a legacy of the colonial systems. Today, this form of investment is stagnant and is likely to diminish into the foreseeable future. On the other hand, governments may continue to play an important role in providing indirect support to the private sector and to community growers.

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Private retail schemes appeared from the 1980s but suffered many setbacks from undesirable, often fraudulent, practices. This form of investment will diminish unless strong industry norms are introduced and applied.

Community planting has been supported by the communities themselves, governments and donors, but there are many examples of poor practice in the teak sector, particularly in terms of the planting material used, the quality of management and marketing. Communities are likely to continue planting into the future, but will require a substantial change in approach in order to develop their full potential (see Stakeholder Composition below). New sources of investment for the future teak sector are possible, including large-scale institutional investments which are uncommon today. A comparison between the current and possible future scenario, in terms of investment sources, is illustrated below:

Current Situation	Future Situation
Government investment (limited/stagnant)	Less
Private retail schemes (relatively common)	Less (?)
Community (local/donor support)	Some
Little alternative investments	Large-scale alternative investments (e.g. institutional investments)

Stakeholder composition

Enormous potential could be leveraged through initiatives that enable local communities and the private sector to combine forces for mutual gain. Currently, stakeholders tend to be fragmented; for example, donors seldom work with the private sector. However, the private and community sectors, working in unison, are the most appropriate entities for developing new plantations. A range of incentives could be developed by donors and aid agencies to entice the private sector to cooperate with communities. For example, private companies could gain access to Fair Trade markets by incorporating small growers into their marketing strategies. This could overcome the unfair prices that small growers often have to accept because of their lack of negotiating ability or power in the market place.

In simple terms, basic shifts in attitude are needed to allow stakeholders to be receptive to making the radical changes necessary to enable the teak sector overcome its current limitations. Governments and aid agencies have a catalyst role to play in linking the private and community stakeholders and enabling a new dynamic sector to emerge through cooperation as outlined in the following table:

Current Situation	Future Situation
Stakeholders fragmented	Co-operation
Direct Government support (poor)	Indirect government support
Aid agency role (restricted)	Agencies catalyst role
Communities (lack negotiating power in the market place)	Link community and private sector undertakings
Private sector (isolated)	

Environmental culture

It is often claimed that plantations have little direct effect on natural forests. To ensure that new plantations impact positively on natural ecosystems they must be designed in such a way to deliberately allow benefits to accrue. A range of models are possible to achieve this objective. One such design is the '*harvest transfer*' scheme. This would allow an area of natural forest to be harvested over a shorter period than normal (e.g. 30 rather than 60 years). During the harvesting period new plantations would be created. Thereafter the natural forest would be left in fallow and the plantations would provide the harvest. Many such models are possible to envisage.

A new 'environmental culture' needs to be developed for the teak sector that examines all aspects of teak cultivation, from its influence on the environment to its impact in the market place, as illustrated below:

Current Situation	Future Situation
Little sectoral contribution to the environment	Plantation estate sustainable
Weak link between natural forests and plantations	Complement output from plantations & natural forests (direct link)
Environmental benefits of teak not exploited to the full	Creation of a superior versatile industrial raw material (apply Life Cycle Analysis)

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Development

Each of the four components that have been examined (technology, investment sources, stakeholder composition and environmental culture) can be improved separately to enhance the teak sector. However, maximum gains will be achieved if they are enhanced together. In this way the teak sector could be transformed from an entity that has little impact on development into a mechanism that will generate wealth for a wide spectrum of stakeholders while, at the same time, impact positively on the supply of a renewable and versatile raw material for industry, as demonstrated below:

Current Situation	Future Situation
Developmental impact low	Sector functions as a developmental mechanism
Low impact on generation of wealth, particularly for small growers	Generation of wealth: of particular relevance to community growers

In time, it should be possible to transfer gains made in the teak sector to the wider high-grade tropical hardwood sector. Such an approach could provide solutions to help solve the tropical hardwood crisis and enable humanity to continue enjoying the benefits of tropical timbers on a sustainable basis.

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Nilambur teak suggested for geographic indication registration

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Nilambur teak has been suggested for Geographic Indication Registration based on its special characteristics. The superiority of Nilambur teak for shipbuilding and structural purposes due to the large size, tree form, colour and workability has been well documented in Forestry Journals and Management Plans during the last two centuries. Rapid depletion of the natural forest teak of Nilambur prompted the policy makers and forest conservators of British India to raise plantations by the middle of the nineteenth century. The superior quality of Nilambur teak with respect to the tree form and fast growth shown in International Provenance trials in Africa, Latin America, Indonesia and in India itself was recognized by silviculturalists and tree breeders. Recent DNA studies conducted by Kerala Forest Research Institute on genetic diversity of teak growing in the natural forests of the Western Ghats, Eastern Ghats and Central India using AFLP and microsatellite markers revealed the genetic identity and uniqueness of Nilambur teak. The higher number of alleles and presence of rare alleles in Nilambur provenance among other international teak provenances planted in Africa, reported by scientists abroad further confirmed its genetic superiority. The consistent superiority of teak originated from the specific territory of Nilambur Valley located between 11° 26’ and 11° 9’ North latitude and 75° 48’ and 76° 33’ East longitude in North Kerala, India render it a product for consideration for Geographic Indication Registration under IPR and TRIPS.

Management of pollen flow to increase seed productivity in teak

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Factors determining the level and structure of genetic variation within plant species include evolutionary history, population density, mating system and mechanism of gene flow. Information on mating system and pollen flow in teak are essential, because most of the teak seed orchards established in India and other countries are not regularly flowering and fruiting as expected. Hence, production of good clones was suggested as a means to increase productivity and consequently rooted cuttings and micro-propagated plantlets were developed and they are under evaluation in many states so that these clones could be used as planting materials.

Though there are efforts to produce improved clones for plantation establishment, production of improved seeds is essential, because only through seeds, genetic diversity could be maintained and advanced generations could be evolved. Moreover, teak, which prefers more genetic diversity, is a highly cross pollinated species with high genetic diversity within population . Thus, in this long rotation tree crop, deployment of very few clones to establish plantations should be analysed thoroughly before launching large scale planting. In the meantime, efforts should be continued to improve the seed production in teak seed orchards and seed production areas.

Fruit productivity

Studies conducted at Kerala Forest Research Institute (KFRI) and elsewhere have shown that only less than 1 per cent of the total flowers turn to mature fruits, though thousands of flowers are produced per tree in plantations and natural forests. Insufficient pollination was reported to be one of the reasons for low fruit productivity (Hedegart, 1973; Tangmitcharoen and Owens, 1996; Indira and Mohanadas, 2002).

Pollinators

Studies at KFRI and Teak Improvement Centre, Thailand have also shown that though there are a variety of insects visiting the teak flowers, the dominant ones are from Hymenoptera. Mathew *et al*. (1987) have also noted the hymenopterans particularly the solitary bees, *Prosopsis pratensis, Allodape marginata* and *Halictus* sp., to be the most potential pollinators.

During 2000-02, observations in natural forests and plantations in Kerala revealed that most of the insect visitors spend their time among the inflorescences of a single tree. But bigger wasps move very fast among the inflorescences of a single tree as well as to the adjacent trees. The Hymenopteran group of insects was again identified as the potential pollinators. These include solitary bees and wasps. Wasps and solitary bees namely, *Halictus tectonae* Narendran & Jobiraj, *Anthophora zonata* (Linn.) and *A. niveo-cincta* Smith are main pollinators which carry a load of pollen on the under side of their abdomen and hind legs (Mohanadas, *et al*., 2002 ; Indira and Mohanadas, 2002). They were found to be very active, visiting several inflorescences in the same tree as well as in different trees in a short time.

Mating system and pollen flow

Studies were conducted at KFRI during 2002-05 so as to analyse the mating system and pollen flow in teak. Three populations of teak were selected, one having good insect activity, another with moderate activity and the third population with very few insects.

Fruits were collected from these plots and analysed for the number of seeds. The results show that only 19 per cent of the fruits brought from the population with low insect activity had seeds while 47 per cent fruits collected from the site with large number of insects, and 32 per cent fruits from the area of moderate insect activity had seeds (Table 1). The rest of the fruits were seedless. The percentage of more than one-seeded fruits was also high in the plot with good insect activity. In the population having low insect activity, more than two seeded fruits were absent. The results again confirm the active role of pollinators.

The above-mentioned three populations were also analysed for mating system and pollen flow using DNA markers. Microsatellite markers were employed for parentage analysis of the seeds collected from selected mother trees. Higher out crossing rate (89-96 %) was observed among the teak trees in all the populations. These results are in agreement with the earlier report in teak through Isozyme studies (89-95 %) by Kjaer and Suangtho (1995). The results from our experiments also show that in the population with good pollinator activity, single male parents donated pollen up to 7 other trees (female parents) leading to multi tree mating, while in teak populations with low or moderate insect activity, the maximum number of trees to which a single male parent contributed pollen was only three (Figure 1) indicating the importance of pollinators in preserving the genetic diversity through dynamic pollen flow.

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Table 1. Percentage of seeds in fruits collected from populations with different levels of insect activity

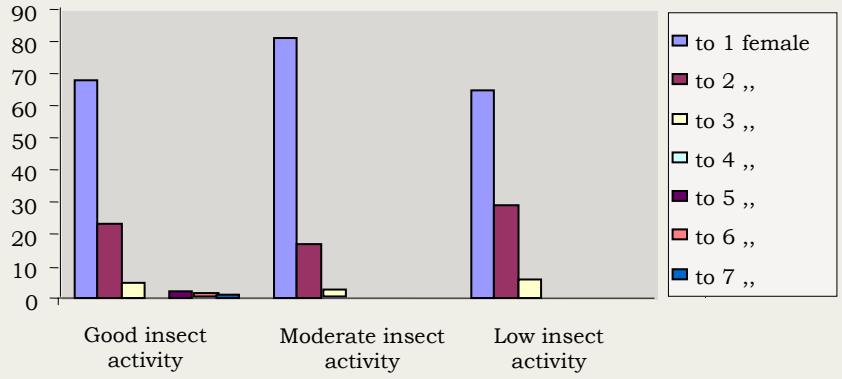
Fruits having	Population with good insect activity (%)	Population with moderate insect activity (%)	Population with low insect activity (%)
One seed	38.89	28.13	18.2
Two seeds	6.21	3.34	1.1
Three seeds	1.63	0.58	0
Four seeds	0.65	0.28	0
Total (with at least one seed)	**47.38**	**32.31**	**19.3**
Seedless fruits	52.62	67.69	80.7

The pollen dispersal analysis using DNA markers from the teak populations showed that the pollen dispersal was mainly in the distance below 200 m (Sabna Prabha *et al*., 2007). It indicates the extent of pollen dilution zone to be given in seed orchards to restrict pollen from outside.

Management of seed orchard

Correct choice of orchard site, spacing between clones, light intensity, water availability, supply of nutrients and choice of rootstock (if clones are grafts) are the main criteria to be practised for improving the fruit productivity in seed production areas including seed orchards (Indira, 2006).

Figure 1. Percentage of male parents donating pollen



Teak is reported to be partially self-incompatible (Hedegart,1973; Tangmitcharoen and Owens, 1996 and Indira and Mohanadas, 2002). The percentage of stigmas pollinated and the number of pollen on stigma are found to be significantly reduced during rainy days due to low pollinator activity (Mohanadas *et al*., 2002). Hence, high pollinator activity is essential to produce enough seeds. As types and abundance of pollinators influence the rate of multi-parental mating and multi-seeded fruits, presence of active pollinators should be ensured in teak seed orchards and seed stands. These pollinators should be introduced to seed orchards and seed production areas so that more seed productivity and genetic diversity are ensured. As noted earlier, the pollen dilution zone must be more than 200 m in seed orchards to restrict pollen from outside. Interaction between orchard site and clone origin is also reported earlier where clones from a particular locality flowered at one site but failed to bloom in other sites (Indira, 2005). Asynchrony in flowering leads to poor pollination and fruit setting, primarily due to site and genetic factors (Vasudeva *et al*., 2000; Rao, 2005). Thus selection of suitable clones for a particular location assumes considerable importance. In order to avoid the genotype-site interaction leading to very poor flowering and asynchrony in flowering and also to keep the identity of particular provenances, it is suggested to establish seed orchards with the local clones. Later, seeds from different seed orchards may be mixed up according to the need and purpose.

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Profitability of teak plantations : The Kerala experience

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One of the many attractive features of teak is the high returns on the investment other than strength and durability of wood, resistance to pests and diseases and also less demanding management that is required. In the past, there have been many dubious attempts from some private firms to collect money through investment bonds giving exaggerated claims on the rate of returns from teak plantations. With the recent renewed interest in teak, there have been many queries regarding realistic expectations on the profitability of teak plantations. Kerala Forest Research Institute had developed a growth simulator using which physical and financial projections can be made on the status of teak plantations given its initial status. The software is named *Teak Planner* which is available at a reasonable price from the KFRI library (Email: sarojam@kfri.org). Some projections made using this simulator are given below for general reference. For details about the methods employed by the simulator, the reader is referred to manuals associated with the software. All the projections are applicable at prevailing rates and conditions in the State of Kerala, India. Transfer to other regions of the country or the world is to be done with caution.

Assumptions used in the projections

Site quality	: I as per the All India Yield Table for teak.
Initial number of trees planted	: 2500 per hectare.
Thinning schedule	: Optimum thinning schedule that maximizes the NPV.
Discount rate	: 9 per cent, the current interest rate for long term loans.
Monetary value	: In absolute terms including the inflation rate.
Rate of increase in price of teakwood	: 7 per cent equivalent to the rate of long term change in the government depot price of teakwood in Kerala.
Rate of increase in input cost	: 7 per cent equivalent to the rate of long term change in the wholesale price index of India.
Weeding intensity	: High as practiced by the Kerala Forest Department in good sites (Refer *Teak Planner* Manual for details).
Management regime	: As practiced by the Kerala Forest Department.
Land rent	: Rs 1300 ha^{-1} yr^{-1}, the rate charged by the Kerala Forest Department.

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Physical and financial projections of returns from teak

Age (Year)	Number of trees (No./ha)	Diameter (cm)	MAI (m^3/ha/yr)	Main crop (m^3/ha)	Accum. thinning Yield (m^3/ha)	NPV ('000 Rs)	IRR (%)	BCR
5	2500	5.4	6.738	15	18	-13	0	0
10	635	15.6	6.134	43	19	301	41.9	4
15	356	25.1	7.389	77	34	857	36.6	8
20	251	33.8	8.607	114	58	1559	31.5	12
25	198	41.6	9.571	151	88	2309	27.7	17
30	168	48.5	10.28	188	120	3034	24.8	20
35	148	54.7	10.772	223	154	3690	22.6	23
40	135	60.1	11.086	255	189	4252	20.9	25
45	126	64.9	11.258	285	222	4711	19.5	27
50	120	69.1	11.319	312	254	5063	18.3	27
55	116	72.7	11.293	336	285	5318	17.3	28
60	113	75.9	11.199	358	314	5484	16.5	28
65	111	78.6	11.054	378	341	5572	15.8	27
70	110	81	10.871	395	366	5593	15.2	27

NPV : Net Present Value of future returns IRR : Internal Rate of Return BCR : Benefit-Cost Ratio

Examination of the above table would indicate that the optimal rotation age to be followed is 70 years in order to maximize the NPV. However, private planters especially small growers may not like to wait for that long. We can expect a moderate 20 per cent return on our investments with rotation age of 40 to 50 years as practiced in Kerala. Although the IRR is highest at 10 years, it is not preferable as the NPV is too small at that stage. At 20 years, the benefit cost ratio is around 12. The claims made by many private firms earlier may also be of similar order after financial discounting. The BCR as reported is the ratio of the discounted summed up cash flow over the discounted summed up cost. For instance, a BCR for 28 means that for every unit of money spent, the expected returns are of the order 28 in terms of the current cost.

The projections shown are in line with the All India Yield Table where the status of main crop (residual stock) and accumulated thinnings are shown for five every years meaning it to be a trajectory or reference guide to be used for thinning. It never means that one should actually thin the stands every five years. Larger the deviation from the reference stocking, lesser will be the NPV realized.

It is to be noted that the Forest Department in Kerala follows a least intensive form of management. Under intensive management with fertilizers, irrigation and plant protection, the returns could be much higher. A related question is whether the teakwood of faster grown trees would have inferior quality. Research at KFRI has shown that for faster grown teak, strength and proportion of heartwood are not inferior to that of regular cases but wood durability gets affected. Use of preservative treatments is suggested for improving the quality of wood in such cases.

Purchase cost of land is excluded from the above calculations as the land purchased can be viewed as an asset bringing returns on its own due to price escalations in real estate.

Disclaimer : The yield and financial returns from teak plantations are dependent on a number of factors and the above note depicts only a general picture based on conditions prevailing in Kerala. The readers are still advised to confirm the credibility of any private firm issuing bonds to attract investments even if the claims are as moderate as above.

Teaknet Bulletin is a biannual electronic newsletter of TEAKNET brought out in March and September of every year through its website. It is intended for circulation among the members of TEAKNET and other stakeholders of global teak sector. The views expressed in the newsletter are those of the authors and do not necessarily reflect the views of the organization. The readers are welcome to express their opinions or pass on information of value to teak growers, traders, researchers or others concerned with teak. However, TEAKNET reserves the right to choose the contributions for publishing and also to make necessary editorial modifications in the articles.

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