TECHNOLOGY OF PRODUCING TEAK TIMBER FOR FARMERS IN THAILAND: TOWARD SUSTAINABLE MANAGEMENT

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ABSTRACT

Teak, *Tectona grandis* L. is the premier high quality cabinet wood of the world, and the decline of natural resources and prudent management objectives, as well as the desire to develop valuable resources turned man's attention to its artificial culture in plantation. In the world, teak plantations have been developed in 36 or more nations including native countries such as Thailand, and form 75% of the fine quality tropical tree species plantation areas as of 2000. In general, planting teak would be profitable.

In Thailand, forest areas decreased drastically due to conversion into agricultural lands amidst the remarkable economic development. The forests which accounted for 53% of the country's total areas in 1961 decreased to 26% in 1993, and most sharply decreased from 42 to 13% in northeast Thailand. On the critical forest situation including lack of domestic timber, the Royal Forest Department (RFD) started the subsidiary reforestation projects in 1994 in order to promote the reforestation of indigenous economic tree species such as teak in private farmlands. The teak plantation area by 2001 accounted for 45%, 150,000 hectares among the whole reforested area of 350,000 hectares. However, 56.8% of the whole reforested area was converted to other land use of cash crops, para rubber etc., because some farmers were disappointed with poorer growth of teak than supposed; couldn't wait for 10 or more years without benefits before teak harvesting. Many factors affected the success of teak planting programmes including sites etc. Thus, what could prompt farmers to keep their motivation for sustainable teak plantation management were required.

JIRCAS has carried out a joint research project with RFD in order to back up farm forestry management involving teak, and has contributed to the improvement of local livelihood since 2006. The research project focuses on the development of technologies for farmers such as future resource and profitability evaluation including suitable site selection, high productivity including low cost regeneration. A study site was set in northeast Thailand.

As for the future resource and profit evaluation, a yield table for teak plantation in northeast Thailand was developed as a tool for estimating future teak tree size and growing stock. Also, a soil suitability map for teak plantation in Udon Thani and Nong Bua Lam Phu Provinces was developed. Farmers could estimate their future yield by the combined usage of the soil suitability map and the yield table. The map currently covers only two provinces, 1.5 million hectares, but the know-how will be made available in order to extend map coverage to other provinces.

As for the profitability evaluation tool of teak farm forestry, a simulation system with discounted cash flow analysis was constructed. Since the conditions on site area, site quality, household economy etc. varies by farmer, management treatments vary in plant spacing, weeding, fertilization and others. The simulation system can contribute to explore better choice of treatment for increase in profitability. Recent study shows that a 20-year rotation (cutting cycle) is generally preferable to a 15-year case, especially at the sites of medium quality; spacing 2 x 4 m is better than 4 x 4 m at the sites of good quality in any of 15- or 20-year rotation, but 4 x 4 m is better at the sites of medium quality.

As for the low cost regeneration method, coppicing is supposed to be effective, because coppicing improved the initial-year balance of payments by 50% or more through a simulation study. However, an experimental study on how to control sprouts from a stump should be continued.

As for the high profitability technology, thinning is the most effective to control tree growth and stem quality. But the previous studies on teak plantations were not conducted enough, and our experimental study about thinning effects on teak growth is still going on in ratio and schedule of thinning at least several years. In the next step, the yield table which doesn't involve thinning effects, will be revised to consider a case with thinning treatment.

In international frameworks, REDD-plus (reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement

of forest carbon stocks in developing countries) is becoming a more important machanism. An evaluation technology of carbon accumulation capacity of popular indiginous tree species as teak in Thailand is also studied under the joint research project. Because it would be able to contribute towards motivating farmers or local people to manage their forest through the REDD-plus mechanism.

KEYWORDS

Tectona grandis L., farm forestry, profitability, sustainable plantation management

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JIRCAS

Technology of Producing Teak Timber for Farmers in Thailand: Toward Sustainable Management

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Japan International Research Center for Agricultural Sciences

1

Overview of the presentation

- Background
  - What is teak?
  - Why is teak on Thailand?
- Brief of RFD-JIRCAS joint research project
  - Outcomes and on-going experiments
- Approach to future concept by the project

2

What is teak ?

Teak is a name of tree species.

The big teak, GBH 10.2m, 1500 year-old in the Sak Yai Forest Park, Uttaradit Province, Thailand.

Vimanmek Mansion, Thailand, build in 1900. It is the world's largest golden teakwood mansion. (http://www.vimanmek.com)

3

Background of teak, *Tectona grandis* L.

- Naturally grown in India, Myanmar, Thailand and Lao
- The premier cultivated high quality cabinet wood of the world
- The decline of natural resources
- The increase of teak plantations, because of its profitablity in general

Teak plantation was established in 36 or more nations in tropical area etc., and forms 75% of the fine quality tropical tree species plantation areas as of 2000 (Bhat et al.,2008).

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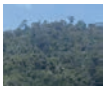
Deforestation and reforestation in Thailand

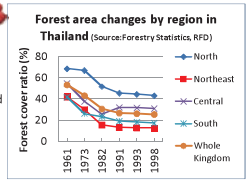


Tropical monsoon forests

Economic development

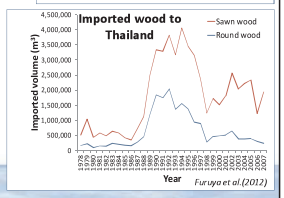
Agricultural expansion and deforestation

Forest cover declined in 1961 and 1998:
53% to 25% in the whole Kingdom of Thailand
42% to 12% in northeast region of Thailand



Lack of domestic timber resources

Sharp increase in imported wood in 1987



Furuya et al.(2012)

Royal Forest Department (RFD)(*) started the Reforestation promotion projects for farmers

Totally 350,000 ha of tree plantations were reforested during 1994–2001

(*) Royal Forest Department (RFD): established in 1896, governs forest and tree plantation in Thailand.

5

Problems toward sustainable plantation management for farmers

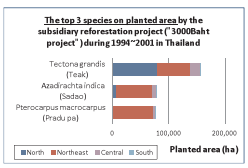
Typical landscape of teak plantation

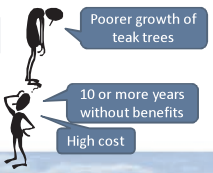
Tree plantation established on farmlands by farmers

Teak was the most preferred.
Teak plantation accounts for 45%, 150,000 ha of the whole reforested area.

Teak competes with cash crops.

56.8% of the established plantation was converted to other landuse





Suitable measures were required toward sustainable teak plantation management.

Source) Private plantation Office, Royal Forest Department, Thailand

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The RFD-JIRCAS joint research project

Taking advantage of the forestry technologies in Japan and the attainment of RFD-JICA projects (1981-2004)

- JIRCAS Forestry Div.
  - started the research project with the Research Bureau of Royal Forest Department (RFD) under MOU in 2006.
- The objective
  - is to back up teak farm orestry management, and contribute to the improvement of the rural livelihood.
- Primary points
  - Evaluation of future resource and profit
  - High productivity with cost effective growing and tending methods

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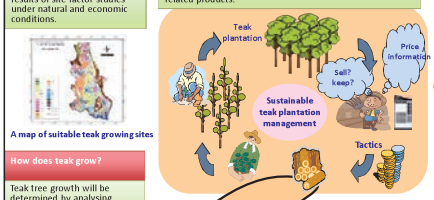
RFD-JIRCAS joint research project

Development of techniques for teak farm forestry with sustainability

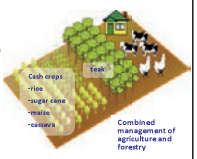
What are suitable locations for teak plantation?
A map locating a suitable site for growing teak will be produced by analysing the results of site factor studies under natural and economic conditions.

How can teak be made more marketable?
Strategies for better teak market ability and sounder teak plantation management will be proposed based on a field study of the marketing and pricing of teak wood and related products.

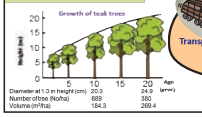
How profitable is combined management?
A comprehensible profitability estimation program will be developed that farmers can easily use.

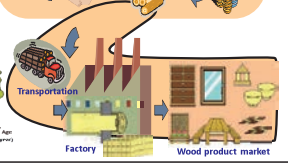


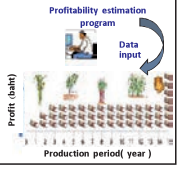
A map of suitable teak growing sites



How does teak grow?
Teak tree growth will be determined by analysing actual field census data of teak trees.







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Usage of the Soil suitability map and the Yield table for teak plantation as a tool for future tree size and growing stock

Convenient. I can estimate future amount of yield in my teak plantation.

Sample of SSC 1: 15 year-old, mean H19.1m, stand volume 199m³/ha.

500,000 baht/ha as estimated value

Gap

No market value as estimated

Soil suitability class (SSC) (H−L; I−S)

Site class for productivity (H−L; I−S)

For more details, please visit Research highlight 2012 on JIRCAS web-site,http://www.jircas.affrc.go.jp/

Sample of SSC 5f: 15 year-old, mean H 7.0m, stand volume 35m³/ha.

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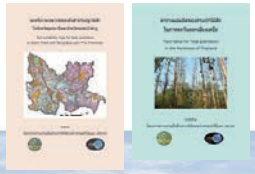
Both products of the project are on public at URLs and fields

Homepage of RFD

http://forprod.forest.go.th/forprod/ebook/e-book.html

Homepage of JIRCAS as the Archives

http://www.jircas.affrc.go.jp/DB/DB09/index.html



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Experimental study on coppice method

Teak stump and coppices

Coppice method can decrease cost of regeneration without planting.

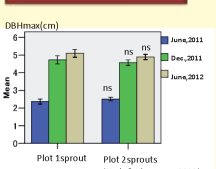
But, we need to investigate growth performance of teak coppice on timber production.

How many sprouts to keep ?

When to cut sprouts ?

A goal of this study: making a manual of teak coppice method in timber production for farmers!

Preliminary result of 1.5 year after sprouting



Coppice size was not different up to 1.5 year-old on the treatment of 1 sprout and 2 sprouts.

Plot of 1 sprout per stump

Plot of 2 sprouts per stump

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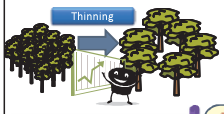
Experimental study on thinning method



Teak timber price higher as the D-size bigger

Thinning can accelerate tree size growth.
→ Increase of harvest income

But, we need to investigate thinning effects on teak plantation.

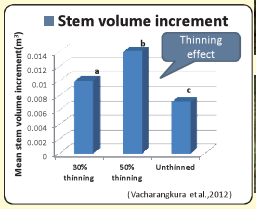
When ?

How many trees to cut ?

How to select trees to cut ?

A goal of this study: improving our Yield table by including thinning schedule for farmers!

Preliminary result of 1 year after thinning



50% thinning

Control

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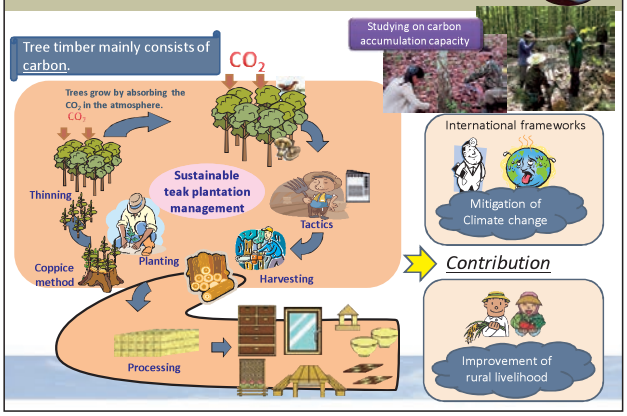
Approach to future concept by the project



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- The project is supported by the researchers of Forestry and Forest Products Research Institute, Japan(FFPRI).
- I would like to express my appreciation to the officers from Forest Management Bureau No.6 (Udon Thani) and to many farmers for their kind support we have received during collecting data.
- The attainment of Japan International Cooperation Agency (JICA) projects with RFD(1981-2004) was of benefit for implementing the project.

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Thank you for your attention

Field seminar for farmers in Nong Bua Lam Phu Province, Feb. 2012

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Chair Saito: Now we'd like to invite the next speaker, Dr. Iwao Noda. He is a director of the forestry division of JIRCAS and project leader of JIRCAS's project on forestry sustainability. His expertise is in the area of forest management and planning. He has been involved in the research project promoting teak farm forestry for small-scale farmers in Thailand since 2006. The title of his presentation is "Technology of Producing Teak Timber for Farmers in Thailand: Toward Sustainable Management." Dr. Noda, please.

Dr. Iwao Noda: Thank you, Chairman. Thank you all for coming today. In my presentation I'd like to describe our activities and effort through our joint research project. JIRCAS Forestry Division is conducting a joint research project with the Royal Forest Department in Thailand about promoting teak farm forestry of timber production. The RFD is an organization to govern state forests and private forest plantation promotion, including a research section.

Before starting the presentation let me give you an overview of my presentation. First, for the background I'd like to show you what teak is and what we focus on in Thailand, so I will explain the matters in Thailand related to starting a joint research project between RFD and the JIRCAS Forestry Division. Second, I will briefly explain our objectives and a few products through our project. Finally, I will show our approach to future concepts by the project.

Teak is the name of a tree species. It can grow in Thailand. We can find very big teak in Sak Yai Forest Park located in the northern part of Thailand. The park name, Sak Yai, means big teak, so it means big teak forest park. And also on the right-hand side, the picture shows a popular sightseeing spot. The name is Vimanmek Mansion in Bangkok which was established over 110 years ago. It is the world's largest golden teakwood building. So it means teak has been utilized for a long period of time.

The scientific name is *Tectona grandis*, which naturally grows in India, Myanmar, Thailand, and Laos. The timber is well-known as fine high-quality cabinet wood in the world because of its high durability, weather resistance, and fine texture. Nowadays the natural resources of teak have declined in the world, but on the other hand, teak plantation is increasing because of its profitable features. So you can see on the right-hand side, the picture shows rectangular areas. Inside the rectangular areas, teak plantations have been established already in 36 and more nations inside these areas, tropical areas so far. The areas are set from 75 percent of the fine quality tropical tree species as of 2000. Let's see the situation in Thailand.

The typical forest cover of tropical monsoon forests declined with agricultural expansion and economic development. And also, in northeast Thailand, the forest cover ratio went from 42 percent down to 12 percent for around 30 years until the 1990s. The change of decline was the most serious in Thailand.

In 1987, we can see the increase so much, an increase in the amount of imported wood because of a lack of domestic timber resources. Therefore, RFD started the reforestation promotion project for farmers on the basis on Thai government policy. As a result, in total 350,000 hectares of tree plantations were reforested on private farmland from 1994 to 2001.

The bar graph shows the top three tree species preferred by farmers. Teak was by far the most preferred. Teak accounted for 45 percent; it means 150,000 hectares of the whole reforested areas. It means in the plantations.

This photo is a typical landscape of a teak plantation managed by a farmer. An important point is the teak is planted on farmland. That is different from Japanese features. For farmers, teak is one of the cash crops, such as cassava, maize, and sugarcane, so teak competes with cash crops. After several years, almost 60 percent of established plantation was converted to other cash crops, other crops. To consider the reason, the RFD conducted questionnaires to farmers and found that the growth of teak was poorer than supposed. Farmers pay the initial cost for land preparation and planting but they must spend ten or more years without benefits before harvest. Therefore,

any measures were required towards sustainable teak plantation management.

After learning such problems of the teak farmers, JIRCAS, we in the Forestry Division, noticed it is possible to take advantage of Japanese technology in timber production and the attainments of the JICA-RFD ODA project. The Japan International Cooperation Agency, so-called JICA, conducted an ODA project for forestation and extension with RFD in Thailand from 1981 to 2004.

JIRCAS started the joint research project with the Research Bureau of RFD under a MOU in 2006; the objectives are to back-up teak farm forestry management and contribute to the improvement of rural livelihood. The primary point was evaluation of future resources and profit and high productivity with cost effective growing and tending methods.

This is a brief image of the project to show the contents.

Please see the center part. This is a concept of sustainable teak plantation management. Also, the left-hand side shows research topics on how to evaluate the site suitability, how to estimate future growing stock.

Basically we are recommending to farmers two or more zones of land allocation. It means not only teak plantation but also cultivation of cash crops in each zone. Teak plantation does not need much care after a few years so farmers can concentrate on other cash crops.

We have already developed two kinds of products in the project work so far. The soil suitability map for teak plantation and the yield table through not a few field surveys and studies. These two photographs show the same 15 years old in the same provinces in Thailand, but show extremely different growth of teak. I estimated the current value of each, the above case would be 500,000 baht per hectare, but the bottom case would be no value because as you can see the stem, bad shape, too slim, so it means it cannot expect market value.

If a farmer disregarded soil suitability before planting teak, the farmer would lose big income. Tree growth is affected by site quality. We evaluated the teak growth level through the field survey to produce site quality class and also to produce a yield table using a Japanese method.

The yield table shows future growing stock by the site quality class and by age and other conditions. On the other hand, the soil suitability map shows the soil suitability level for teak plantation. That is, the level is the soil suitability class we call SSC, ranking from 1 to 5. We coordinated the SSC to match the site quality class of the yield table. So if a farmer used the soil suitability map and yield table, the farmer could estimate future growing stock at any site on the map.

The soil suitability map now covers only two provinces, 1.5 million hectares, but the know-how is available for other provinces in Thailand.

The other day the RFD director general appreciated the map of our product and he set up a map-making project inside RFD by adapting our method to several provinces.

By the way, these two products are already publicly available at RFD and JIRCAS, both sites of homepages. Also we directly transferred such knowledge to Thai farmers when we have a chance to contact the farmer in the field.

From now I will show a few studies ongoing.

A coppice method can decrease the cost of regeneration without replanting. But for teak there are very few studies on the coppice method. We needed to investigate growth performance of the teak coppice on timber

production. For example, how many sprouts should be kept, when to cut the coppice, so we are conducting an experimental study to make a manual of the teak coppice method in timber production for farmers.

This is the example of experiments to investigate growth performance of two sprouts per stump. Please imagine two sprouts from one stump. Like insurance, if wind damages one sprout, the remaining one could be available, like that.

This is the preliminary result of 1.5 years after planting, sprouting. The two-sprout stump already shows competition with each other, but in the coppice site, one sprout is no different from the superior sprout per stump of two sprout plots. So it means the two-sprout condition might be recommended up to 1.5 years at least. Anyway, we need to keep observing the growth of performance. And next.

This is also primary technology. It can accelerate tree site growth. By the way, the teak timber price per cubic meter becomes higher, the diameter becomes bigger according to our study. The thinning can increase harvest income, but there are quite few studies on thinning effect in teak plantation. We cannot teach farmers when to conduct thinning, how much percentage to cut, and also cannot estimate future growth after thinning the property properly.

We started an experimental study in the project. This is the preliminary result of one year after thinning. The thinning ratio of 30 percent and 50 percent show significant thinning effect on the stem volume increment. We'd like to monitor the growth of dynamics to reach the goal to study, I mean to improve the yield table, including improving the yield table involving a thinning schedule for farmers.

By the way, timber mainly consists of carbon. Trees accumulate carbon dioxide, one of the greenhouse gases in the atmosphere. Carbon can return to the atmosphere only by burning the timber, so sustainable forest management can contribute not only improvement of rural livelihoods but also reduction of deforestation, carbon accumulation, and mitigation of climate change.

So in the international framework, REDD+ is becoming a more important mechanism. Objective scientific knowledge is demanded to evaluate the reduction of carbon emissions and enhancement of carbon stocks. So we hope to also contribute to international frameworks by promoting sustainable farm forestry in the future concept. As a new approach, our project evaluation technology of the carbon accumulation capacity of teak and other valuable local species in Thailand is studied.

I'd like to express acknowledgement of all the persons and organizations. By the way, we had a field seminar in February last year to transfer knowledge. We are not only transferring knowledge but also paying attention to exchange ideas and opinions with farmers in the field as well. We'd like to be close to farmers. Thank you for your kind attention.

Chair Saito: Thank you very much, Dr. Noda.