

DISSERTATION

On

An intensive study on

Agro forestry Marketing of Nagabali Agriculture Cooperative Society Ltd

RAYAGADA

**A Dissertation submitted for impartial fulfillment of the requirement for the award of
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Mr. Deepak Bara

CERTIFICATE

This is to certify that the dissertation entitled “An Intensive Study On Agro-forestry Marketing of Nagabali Agriculture Cooperative Society” is an original research work carried out by Mr. Deepak Bara under my guidance and supervision . No part of this work has been submitted for any other degree earlier.

Date: 14.02.2023

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DECLARATION

I hereby declare that dissertation entitled “**An Intensive Study on Agro FORESTRY MARKETING of Nagabali Agriculture Cooperative Society**” is the outcome of research work carried out by me under the guidance of Dr. Sanjeeb K. Hota.

I further declare that this dissertation has not been submitted previously for the award of any degree either in this Institution or any other institute.

Mr. Deepak Bara

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**An intensive study on
Agro forestry Marketing of Nagabali agriculture cooperative society Ltd
RAYAGADA**

ABSTRACT

The Cooperative sector plays a vital role in the economic development of the country and hence it has been recognized as an integral part of our national economy. The Cooperative movement, which is the largest Socio-economic movement in the world, has contributed significantly to the alleviation of poverty, creation of productive employment as well as the enhancement of social integration in the country.

The study is based on primary data collected from Nagabali Agriculture Cooperative Society Ltd. during the period from 2020-21. The business activities, analysis of growth, performance, and profitability has been studied during the study period. Primary data analysis is also done based on primary information collected from beneficiaries Nagabali Agriculture Cooperative Society Ltd.in the year 2020-21.

Based on the existing literature survey objectives were formed for the study. To examine the growth of Nagabali Agriculture Cooperative Society Ltd., To analyze the performance of Nagabali Agriculture Cooperative Society Ltd., and to analyze the profitability of Nagabali Agriculture Cooperative Society Ltd. The methodology for the study is based on descriptive analysis of Nagabali Agriculture Cooperative Society Ltd for comparison.



CHAPTER - 1

INTRODUCTION

AGROFORESTRY is a land-use management system in which trees or shrubs are grown around or among crops or pastureland. This intentional combination of agriculture and forestry as varied benefits, including increased biodiversity and reduced erosion. The benefits of agroforestry are reduced poverty through increased production of wood and other products, increased food security by restoring soil fertility for food crops, multifunctional site use, reduced global warming and hunger risk by increasing the number of drought-resistant trees and the subsequent production of fruits, nuts and edible oils, reduced deforestation and pressure on woodlands by providing farm-grown fuelwood, reduced need for toxic chemicals, improved human nutrition through more diverse farm outputs, growing space for medicinal plants, etc. Agro-forestry is being practiced in Rayagada (OD), India, in all the districts falling in seven agroclimatic zones and these are in the form of traditional adoption since time immemorial to recent industrial agroforestry.

SIGNIFICANCE:

The Nagabali Agriculture Cooperative Society Ltd. Is situated in rural area and plays a vital role in rural credit delivery system. They provide short-term and medium-term loan to agricultural farmers to meet their financial requirement and marketing of the products. The study has been done to study the marketing of the product of the society.

Objectives of the study:

Based on the existing literature the following objectives were formed for the present study.

1. To examine the growth of The Nagabali Agriculture Cooperative Society Ltd.
2. To analyze the performance of The Nagabali Agriculture Cooperative Society Ltd.
3. To analyze the profitability of The Nagabali Agriculture Cooperative Society Ltd.

METHODOLOGY:

The study is based on primary data analysis. Four blocks farmer data of The Nagabali Agriculture Cooperative Society Ltd. Were selected from Rayagada District of Odisha based on their performance.

LITERATURE REVIEW

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CHAPTER - 2

AGROFORESTRY IN INDIA

Agro forestry can be defined a science of designing and utilizing land management systems which involve integration of woody components such as trees, palms, bamboos, shrubs and agricultural crops including pasture/ animals, simultaneously on the same piece of land and at the same time, such that it satisfies the socio-economic as well as the ecological needs of the people. The development of agriculture over time and the desire of humans to bring more and more land under cultivation of crops has led to increased interaction with natural resources. Also, the increased demographic pressure due to rapid rise in population has forced man to derive maximum productivity out of the limited land resources. Important agro forestry practices include: silvopasture, alley cropping, Agri-horticulture, Agri-silviculture etc.

Agro forestry research is over 100 years old in India, but organized research came to the forefront during the last century in some ICAR Institutes namely Central Soil and Water Conservation Research and Training Institute, Dehradun, Central Arid Zone Research Institute, Jodhpur, Indian Grassland and Fodder Research Institute, Jhansi. The research in this field has made us understand importance of agro forestry in managing local ecosystems and satisfying the needs of the rural population. The research has also demonstrated that different agroforestry practices are prevalent in different parts of the country

IMPORTANCE OF AGRO FORESTRY

Agro forestry systems, due to their ecological and economic importance, can significantly help to address major challenges to present day agriculture i.e. environmental health degradation, climate change and deteriorating economic conditions of farmers. In view of the present scenarios of degrading environmental health and climate change, they can play significant role by carbon sequestration and moderating climatic conditions. In addition to this, they can help in improving economic conditions of the farmers by enhancing total yield and input use efficiency.

CHALLENGES TO AGRO FORESTRY IN INDIA

- There is lack of superior quality planting material and seed availability, only 10% of the planting material being of high quality.
- Insufficient research on agro forestry models also poses a challenge, providing limited information on their suitability in different regions.
- Infrastructure for marketing of produce from agro forestry is available only in few states. As a result, most of the profit is absorbed by middlemen, making agro forestry an economically unviable venture for farmers.
- Legislation regarding tree felling and wood transportation is complex and costly, which may prove to be a barrier in convincing a farmer to adopt an agro forestry model.

It is concluded that Agro forestry systems are sustainable land use systems which can maintain or enhance total yield by combining annual food crops with perennial tree crops on same unit of land by using the management practices most suitable to the social and cultural characteristics of the local people as well as economic and ecological conditions of that area. Thus, before implementing any plantation programme in an area, objectives should be clearly defined, keeping in view the problems related to soil, water or climate as well socio-economic status of the people. Thus, if implemented and managed properly based on systematic research, agro forestry systems can prove highly beneficial by

improving environmental health, enhancing productivity and input use efficiency along with improving economic conditions of the farmers, which is need of the hour.

CHAPTER - 3

AGROFORESTRY IN ODISHA

Orissa is traditionally an agrarian state. It is endowed with vast natural resources, diversified agro-edaphic conditions, rich flora and fauna, wide range of land holdings, various socio-cultural groups and people with multiple economic strata. These factors have led to evolve a variety of agroforestry systems and practices. The traditional agroforestry systems which are prevailing in the state since time immemorial are broadly Agri silvicultural, silvipastoral and agrisilvipastoral systems. The prominent Agri silvicultural systems include podu/jhum cultivation, multipurpose trees on farm lands, multiple species tree gardens and agroforestry for fuel wood production. The important silvipastoral systems are trees on pasture, fodder trees and shrubs on forest land and live fence of fodder trees and shrubs. The very old agrihorticultural system prevailing in the state is home garden. Interventions of Orissa University of Agriculture and Technology and various Government and Non-Government agencies have resulted in the development of some improved agroforestry practices in recent years. Some of the improved agroforestry practices are Acacia mangium based Agri silvicultural practices, Guava based Agri silvicultural practices, coconut based agroforestry practices, Eucalyptus (Clonal) based Agri silvicultural practices, windbreaks, timber tree based Agri silvicultural practices, Sesbania grandiflora based Agri silvicultural practice, Acacia mangium based silvipastoral system, mangium-guava based silvipastoral practices, improved home gardens, commercial block plantations on farmlands and apsilvicultural practice.

Organism descriptor(s): Acacia mangium, Cocos nucifera, Eucalyptus, plants, Psidium, Psidium guajava, Sesbania grandiflora

Descriptor(s): agroforestry, agroforestry systems, agrosilvicultural systems, agrisilvipastoral systems, beekeeping, coconuts, crops, fodder crops, fodder plants, forestry practices, fuel plantations, fuelwood, guavas, home gardens, live fences,

multipurpose trees, pastures, plantations, shrubs, silvipastoral systems, trees, windbreaks, woody plants

Identifier(s): feed crops, agroforestry, agro-forestry, Agri silvicultural systems, agrosilvicultural, agrisilvipastoral systems, apiculture, forestry operations, firewood, home gardens, homestead gardens, living fences, grazing lands, silvipastoral systems, sylvipastoral systems, sylvipastoral systems, Orissa

Geographical Location(s): Odisha, India

Broader term(s): Acacia, Mimosoideae, Fabaceae, Fabales, eudicots, angiosperms, Spermatophyta, plants, eukaryotes, Cocos, Aceraceae, Arecales, commelinids, monocotyledons, Myrtaceae, Myrtales, Psidium, Sesbania, Papilionoidea, India, Commonwealth of Nations, lower-middle income countries, medium Human Development Index countries, South Asia, Asia.



CHAPTER - 4

NAGABALI AGRICULTURE COOPERATIVE SOCIETY LIMITED (NACSL)

INTRODUCTION:

Nagabali Agriculture Cooperative Society Limited (NACSL) focuses on empowering the associated members and enabling them to enhance their livelihood security, increase their incomes and improve their overall quality of life *by means of self-support and mutual cooperation through Plantation, agro-forestry, farm/non-farm-based Income Generation activities and marketing.* ((Regd. No. SH / 01 / RD / 2012 / 11 / RD / 2014) It is registered under Odisha Cooperative Society Act 1962).

This institution was established in March 2012, when JK Paper Ltd. (JKPL) decided to strengthen its farm forestry programme and increased focus on development of pulpwood plantations in the vicinity of its mill at Jaykaypur. With availability of unutilized degraded lands belonging to small and marginal farmers, agroforestry models were designed to bring such lands under productive use through trees planted in combination with agricultural crops like cereals, pulses, maize, vegetables, or cotton. NACSL was registered as an agriculture cooperative in Nov 2012.

AIMS AND OBJECTIVES

- Promote cultivation of forest, medicinal, agro & horticulture trees and crops in members land and land held by Cooperative on lease basis from others.
- To take up production, collection and selling/trading of forest, agro & horticulture produce/by-products and organic manures to its members & outside.
- Trading and services for procurement of agriculture inputs such as plants, saplings, seeds, fertilizers/manures, pesticides, hire of tractors and other mechanized farm equipment to its members & outside.

- To introduce and promote scientific practices among the members for enhancing production and productivity of their lands through training and capacity building activities.
- Receive loans and grants from Govt., funding agencies/ NGOs, Banks and other financial institutions.
- Provide loan facilities to its members for taking up cultivation of forestry, agro-forestry, agriculture and allied activities.
- Transport services to its members for marketing of their produce.
- Take up land development/ reclamation and water harvesting activities in members land and land hold by Cooperative on lease basis from others
- To arrange & provide storage /cold storage facility and training to its members for their produce.
- To undertake nursery raising activity & selling of seedlings.
- Provide services for improving agriculture, health care, insurance and education to the members and their family members.
- To set up Agri clinics/ Community radio stations for dissemination of information for the benefit of farmers.

BACKGROUND OF THE OPERATIONAL AREA

Nagabali Agricultural Cooperative Society Ltd (NACSL) is located in the Rayagada district of Odisha State in India which is amongst the most economically backward regions of the Country. It has been involved in improving livelihood of its members through development of their waste and marginal lands through agroforestry since June 2012.

Rayagada a mineral rich district in the southern part of Odisha is divided into eleven administrative units (Blocks) with a total geographical area of 7,587,450 Ha out of which cultivated area is 1,289,620 Ha (17% of total) and area under forest is around 40% of the total area. Classified as part of the Eastern Ghat Zone it is characterized by hot, moist and sub-humid climate and consists of brown forest, lateritic, red alluvial, black and mixed red soil groups.

The district generates income mainly through agriculture-based activities, major crops grown are paddy, Cotton, pulses, minor millets, ground nut, potato and maize. Almost 80% of the farmers are small and marginal farmers and irrigation covers only 26% of agricultural area.

A predominantly tribal population, poor literacy rate and high dependence on rainfed agriculture makes the district one of the most economically disadvantaged in the country. It is estimated that more than 70% of small and marginal farmers are presently living in poverty. This project is aiming to create additional livelihood opportunities for these farmers and thereby to increase household incomes in its operational area in Rayagada district.

COVERAGE & DEMOGRAPHY

- No of Farmers Member = 2363 (Female :375 & Male :1870) • Total Share Generated in Rs. Lakhs = 49.91 as on 31.03.2021 • Total No of Loans disbursed = 2449 no's
- Total amount of Loan disbursed Rs Lakhs = 501.79 • Total No of Joint Liability Group Formed = 279
- Total Village covered = 100 no's (Total House Hold 11,165nos)
- Block = 5nos. (Rayagada, Kolnara, Ramanaguda, Kalyansingpur & Kashipur)
Total GP = 35nos
- Total area covered in Ha. through different farm and agri. Activities = 4215

Agro-Forestry Activity under taken during the year 2012 to 2021 as on 31.03.2022

<i>Sl. No.</i>	<i>Crop</i>	<i>Area in Acre No of Farmers</i>	
1	Plantation and Agro-forestry		12,107
2	Maize	340	300
3	Arhar	903	740
	Cotton	4250	2203

4	Turmeric	2	45
5	Vegetable	3	79
6	Nutritional Kitchen Garden		1083
7	Backyard Plantation		133

HEALTH AND AWARENESS CAMPS:

The co-operative organized 57 no's of Health Camps in its 60 operational villages with the help of JKPM-CSR team since April 2012 and 5430 no's patient treated for different diseases along with medicine distribution.

Details of area Harvested, Loan repaid and asset creation till 30.05.2022.

NACSL harvested 1,24, 202Mt.of Eucalyptus and Subabul wood of 2801nos members and adjoining farmers on 3608 acres. This was sold to JK Paper Mills. The details of loan repaid to banks and procurement of wood are in following Table.

No of Farmers	Area Harvested	Wood (inharvested)	Cost of wood (Rs.)	Repayment In Loan	Net received (Rs.in(Rs.In
3025	4140	1,24,202	5216	981	4235

Utilization of pulpwood sale proceeds by farmers

Health Treatment 396nos		Investment on Gold 735nos	
Children's education		413nos	Investment in Land 147nos
House renovation and construction	336nos	Marriage & Social Ceremony 526nos	
Motor cycle purchase	533nos	Clearance of gold and other loan 256nos	
Man-days generated through harvesting 2,80,404days and reduced migration			

FUTURE PLAN OF NACSL

- Proper Monitoring and management of existing crops.
- Exploring of other trade channel for existing crops product.
- Diversification of activities through identification of suitable business opportunities for its members other than farm forestry programme.

SYNERGY:

Funding Partner: JK Paper Ltd, IOB, Jaykaypur, DEG & NABARD.

Nagabali Agriculture Co-operative Limited (NACSL) associated with various line department like Agriculture, ICRISAT, Hort., Indian Overseas Bank, SPARSH NGO, JKPL –CSR wing, DEG, NABARD, GIZ, ACCESS – ASSIST, Minor Irrigation, Animal Husbandry etc. for providing maximum services to its beneficiaries in a synergetic way (Tech /Finance) .

AWARD AND RECOGNITION:

On the 64th All India Co-Operative Week 2017 “Nagabali Agriculture Cooperative Society Limited” awarded as the “BEST EMERGING COOPERATIVE SOCIETY” by Koraput District Co-operative Union for 2016-17 amongst all cooperative in Koraput, Nawarangpur, Rayagada & Malkanagiri Dist.



CHAPTER – 5

Analysis

state government initiatives in the promotion of agroforestry in Rayagada, Odisha

ODISHA is gifted with rich natural resources, Odisha climatic conditions (temperature and rainfall), and liberalized industrial policies, which makes it favorable to set-up agro-based and wood-based industries to process the raw material produced from agroforestry systems. Agroforestry initiatives had started during the 1990s itself in ODISHA, to meet the demands of wood-based industries after the recommendations of the NFP, 1988, which directed wood-based industries to generate their raw resources rather than depend on the Forest Department for their requirements. The government of India launched the National Agroforestry Policy (NAP), 2014 to identify bottlenecks in the expansion of agroforestry in the country and pathways to remove the constraints systematically. The main objectives of NAP are to encourage-age and expand tree plantation in complementary and integrated manner to improve productivity, employment, income and livelihood of rural households, especially the small-holder farmers. This will help to protect and stabilize ecosystems and promote resilient cropping and farming systems, meet the raw material requirements of wood based industries, supplement the availability of agroforestry products (AFPs), such as the fuel wood, non-timber forest produce and small timber of the rural and tribal populations. Increasing the tree cover in agroforestry systems will reduce the pressure on existing natural forests. There is a need to develop capacity and strengthen research in agroforestry and create a massive people's movement for achieving these objectives. The Central Government has directed all the states to change the forest produce, timber felling and transit rules for farm-grown trees to ease the tree felling operation and minimize the pressure on natural forest. Further, recently, bamboo has been de-notified by the central government as timber under the Indian Forest Act (1927), exempting it from timber-felling and transit rules when grown outside the forest areas, to easily harvest it without legal hurdles to meet the requirement. The National Bamboo Mission (NBM) and State Bamboo Mission of the concerned states support the cultivation of bamboo species in farmlands by providing financial support to farmers. Greening programmes like farm forestry and social forestry are found to be effective in many districts in ODISHA, which were initiated in the early 1970s.

ODISHA government initiated the 'Rayagada Afforestation Programme' and 'Tree Cultivation in Private Lands' and 'Rayagada Biodiversity Conservation and Greening Project, to create awareness among farmers on tree farming for higher economic returns. Similarly, the involvement of wood-based industries for agroforestry is found beneficial for procurement of raw materials from agroforestry. Wood-based industries are also promoting industrial agroforestry with farmers

through contract farming with minimum support price for tree species like *Eucalyptus*, *Casuarina*, *Melia dubia*, *Ailanthus excelsa*, *Neolamarkia cadamba*, etc.

The wood sha-based industries also provide quality planting material (mostly clones), precision silvicultural techniques, harvest, and post-harvest technologies for higher net farm income in short rotation period of 3–6 years. The government has issued a special order to promote sandal cultivation in farm lands with 80% return to medium and large farmers. To pro-mote agroforestry in ODISHA, the government relaxed the timber transit rules and admitted free transport of 37 different tree species within the state. Research institutions (Indian Council of Forestry Research and Education (ICFRE), Rayagada Agricultural University (ODISHAAU) and Rayagada Forest Department (SFD)) and wood - based industries also involved in developing high-yielding clones for more productivity and higher income to farmers in short rotation period .the present scenario, agroforestry is promoted by providing quality planting materials (mostly clones), which are site-specific for obtaining more yield, and farmers are provided institutional support with tree insurance. The Wood-based industries purchase the pulp wood at a pre-decided support price or the market price, whichever is higher at the time of harvest, and also accelerate market linkage with the farmers⁷. These private industries adopt buy-back system of marketing with Minimum Support Price (MSP). Thus, agroforestry practices also bring positive externalities through Wood based industries for socio-economic and upliftment of farmers and economic benefits.

Agroforestry systems in Rayagada, Nagabali Agriculture Cooperative Society Ltd. Odisha

The prevailing agroforestry systems in ODISHA mostly depend on economic returns, size of land holding, edaphic and climatic factors, and socio-economic dimensions. In general, block plantation, home gardens and bund planting are the common practices of agroforestry systems found in the state and the trees are catering. the needs of small timber, raw material for wood-based industries, fuel, soil conservation, etc. Different types of agroforestry systems such as agrosilvicultural, Agri horticulture, silvipastoral, Horti silviculture and boundary plantations are commonly practiced in ODISHA the different agroforestry systems in the state¹⁴. It reveals that horticulture species and industrial species like *Casuarina*, *Eucalyptus*, *M. dubia*, *G. arborea*, etc. exists in the form of agrosilvicultural and Horti silviculture, with annual crops of farmers' choice (based on local condition) mostly groundnut, black gram, turmeric, cotton, cowpea, etc. Timber species like teak, *Gmelina*, *Albizia lebbeck*, neem, etc. are highly preferable in farm bunds. The farmer's foremost preferences towards tree farming in farmlands are less competition and interaction with annual crops and without much reduction crop yield. Table a l s o reveals that farmers preference for horticultural species due to sustainable income

from fruits and easy marketing. The marginal farmers (owners of up to 1 ha land) in the state widely practice traditional agroforestry due to lack of information about the advantages of industrial agroforestry and maintaining trees, especially in farm bunds to meet their daily needs.

The selection of tree species depends on quick economic returns, less maintenance, meeting local needs, etc. Farmers who are practicing traditional agroforestry systems do not receive much economic benefits other than meeting their day-to-day needs. Tree species like teak, neem, siris, gamhar, tamarind, silk cotton, aralu, Krishna siris, bamboo species, etc. are the commonly planted trees in farm bunds to meet multipurpose needs. These not only provide small timber but are also useful in traditional medicine, improving the microclimate, maintaining local biodiversity, harboring birds and insect populations, etc.

Farmers' acceptability of agroforestry

Farmers in ODISHA are practicing agroforestry mainly to meet their day-to-day needs and for economic upliftment. The trees which are commonly grown under agroforestry in ODISHA are *Ailanthus excelsa*, *A. lebbeck*, *Delonix alata*, *Tectona grandis*, *Pongamia pinnata*, *Azadirachta indica*, *Tamarindus indica*, *Thespesia populnea*, *Tamarindus indica*, *Mangifera indica*, *Achras zapota*, *Emblica officinalis*, *Sesbania grandiflora*, *Syzygium cumini*, *Eucalyptus*, *Acacia leucophloea*, *Casuarina equisetifolia*, *Pithecellobium dulce*, *Ailanthus excelsa*, *Albizia lebbeck*, *Bamboo*, etc. Teak is an important timber species commonly found in farm bunds. *A. lebbeck* is an important fast-growing tree mostly found in bunds in the state, having multi-utility for making moulds, in the carving industry etc. Trees like neem and punganam are commonly planted mainly for medicinal and small timber purposes. Horticultural species like mango, guava, banana, sapota, am-la, papaya, pomegranate, lemon, etc. are considered as an ideal option and are common in all the agroclimatic zones of ODISHA. The climatic and edaphic factors are favourable for fruit tree cultivation. Integration of horticultural species in farmlands helps in efficient utilization of natural resources and generates adequate income, provides employment and improves livelihood. Agroforestry emerges as an effective tool for improvement of the rural economy due to low investment, high profitability, and high income-generating practices. Numerous agroforestry systems and combinations of annual crops are practiced by the farming community in ODISHA and many multipurpose trees are found compatible in various agro-climatic regions of the state. Trees like teak, *Casuarina*, sandal, *Ailanthus*, bamboo, amla, etc. are among the most suitable species, which can be grown under agroforestry with minimal crop yield reduction. Appropriate tree-crop arrangements can indicate which combination is better in terms of profitability and acts as a feasible option that provides livelihood security to the rural community with less supervision and inputs. These agroforestry combinations and systems help increase the economy of the farmers, provide food security and make them self-sufficient.

The ecosystem services generated from agro-forestry adoption will help ameliorate the micro-climate of farmlands to promote climate-resilient crops. These agroforestry programmes will be an effective tool for climate mitigation and adaption mechanism to counter climate change, and act as a sink for greenhouse gases indicates that nonavailability of agricultural labour (ranked first in four agroclimatic zones) and higher returns from tree components (ranked first in two agroclimatic zones) registered higher mean score and ranked among other reasons for adoption of agroforestry systems in different agroclimatic regions of ODISHA. The other important reasons are less attention needed for tree species, less risk and fewer inputs compared to crops. Apart from the above reasons, climatic vagaries also play a vital role in the adoption of agroforestry systems among farmers throughout the state. Non-availability of agricultural labour and their costs are the main factors for adoption of tree farming across the agroclimatic zones of ODISHA. The main determinants of adoption were age of farmers, household size, educational level, farm size, farming experience, income, access to credit and extension contacts. All these variables, except age of farmers, affected the adoption rate of agroforestry technologies positively. The level of domestication and extent of adoption of agroforestry reveals that farmers are well aware of the type and quality of planting materials and they prefer quality planting materials especially high-yielding clones which will give more productivity than seed-source seedlings. They are also knowledgeable about intercropping activities and size of pits for various tree components, including horticultural species. Also, they give equal importance for weeding and time of planting which is important for the establishment of tree components; it also reduces irrigation cost and reveals that farmers are less attentive towards soil working, mulching and plant protection measures; they consider, these activities to be nonremunerative and as adding more cost in the maintenance of agroforestry systems.

Table. Constraints faced by farmers in the adoption of agroforestry systems in Rayagada, Odisha

Constraints	Frequency	%age
Labour		82.50
No availability of agriculture labour higher wages to labours	7425	84.17
Inputs	7575	
Quantity planting materials cost of inputs like fertilizer		78.75
Cost of insecticides & pesticides	2813	
Technology		80
Non availability of silvicultural techniques poor extension strategy	7200	87.50
Marketing	7875	
Non availability of marketing information		89.58
Price fluctuations of agro forestry products	6563	81.67
Loan Credit insurance non availability		95.83

Others	8550	
Linkage with other tree growers' association		73.33
Linkage with forest departments industries research institutions sale through associations and federations	7050	85.00

Table presents the major constraints faced by the tree-growing farmers. These are divided into five major categories, viz. labour, inputs, technology, marketing, loan/credit and others. Table - shows that nonavailability of agriculture labour and their wages play a vital role in the adoption of tree farming. For tree farming-related activities, farmers can manage with a few Labourers when it is necessary. Non-availability of quality planting materials or difficulty in accessing them also plays a major role and farmers depend mostly on local nurseries for planting stock, normally poor in quality, which will not give returns in the future. Farmers also face constraints in the application of fertilizers and protection measures for tree components. Unlike in agriculture, for tree species, no or little information is available on establishment and management strategies (precision silvicultural techniques). This leads to poor management of the tree components resulting in yield and returns. Also, forestry extension strategies are not clear and reached among farmers compared to agriculture extension activities. Both aspects need to be strengthened for the welfare of tree-growers and greater adoption of tree farming. One of the major problems faced by the tree growers is the non-availability of loan (for establishment and maintenance period) and insurance (during crop failure due to biotic, abiotic factors and climate vagaries) facilities. Further, non-availability of marketing structure, linkage with other stakeholders, etc. are also major constraints faced by tree growers. We need to address the above problems for greater adoption of tree farming and higher economic returns to the farming community.

Value chain and new marketing strategies for agroforestry products of NACS Raygada

In the value chain, all the stakeholders involved in agro-forestry systems are brought under a single platform which will benefit each other. In the value chain, the role of each stakeholder is specified and aimed to achieve 33% tree cover through agroforestry, maximum benefit to farmers, reduction in the import of wood and wood products, etc. Research institutions (ICFRE, ODISHAAU, SFDs and wood-based industries) will provide quality planting materials (seedlings produced from seed orchards, seed stands and improved productive clonal materials) and latest cultivation techniques (precision silvicultural techniques for higher productivity) to the farmers with assurance from the wood-based industries MSP for agro-forestry products and support from financial institutions (bank loans and insurance for tree components), etc. It is important to develop a well-structured market for agroforestry products mainly for trouble-free sale and quick economic returns to the tree-growers. In ODISHA, the value chain in industrial agroforestry plays a major role in marketing of agroforestry products. In this value chain, wood-based industries are coming forward to take the agroforestry products with assured marketing and MSP. Also, they have entered into MoUs with the tree-growers, which will encourage the latter towards adoption and expansion of

agroforestry in a larger area. These industrial approaches influence/motivate the farmers to adopt agro-forestry practices on a large scale in ODISHA. The PPP (private–public–partnership) in agroforestry is also taking momentum in the state, with a view that the harvested agroforestry products from farm must be delivered to the industry at the market rate with buy-back guarantee. The agroforestry consortium also identifies appropriate farm-lands for plantations with various industrial tree species, and improvement of the interface between farmers and industries for better market linkage (Figures 1 and 2).

Role of research, education and extension in the promotion of agroforestry

ODISHA has the potential to develop an expansion of ecologically and economically viable and socially acceptable agroforestry systems for the improvement of farmers' livelihoods. Various research institutions have developed successful agroforestry systems for higher economic returns that are being adopted in different regions of ISHA, viz. *Melia*, *Eucalyptus*, *Casuarina*, *G. arborea*, *A. excelsa* based aael; mango, guava, sapota, lemon, papaya, amla based silvihorti model; *A. leucophloea* with *C. ciliaris*-based silvipasture model and bund planting with important valuable trees like teak, sissoo, *A. lebbeck*, neem, tamarind, jamun, etc.

ODISHA has important research institutions like the Institute of Forest Genetics and Tree Breeding (IFGTB), Forest College and Research Institute (ODISHA, SFD and wood-based industries are currently involved in long-term breeding programmes in indigenous and exotic species aimed to bring out high productivity varieties and clonal materials which are highly beneficial to tree-growers²⁸. Also, these research institutions are involved in agroforestry research for developing economically viable modes which can give more income to farmers. Like in agriculture, forestry, especially agroforestry also requires strong extension support for expansion to more farmers. For this, forestry extension should be strengthened through the establishment of Van Vigyan Kendra's (VVKs) and more subject-matter specialists should be posted in VVKs to achieve the targets in agroforestry field. At present, IFGTB has set up VVKs in ODISHA to promote agroforestry systems among farmers in a successful manner. The SFD has also established Forestry Extension Centres in each district to promote agroforestry among farmers through establishment of demonstration plots, supplying quality planting materials to them at low cost. Research institutions and SFD are helping to educate the stakeholders and sustainably expand the horizons of agroforestry in the state. Poverty alleviation is not possible without modernization of the agriculture and forestry sector. Poverty alleviation, sustainable forest management, and sustainable agriculture and livestock management are inter-linked. Hence, growing trees on farmlands results in economic, social and environmental benefits for the land users.

Strategies and challenges in the promotion of agroforestry in NACSL, ODISHA

Agroforestry is playing a vital role in maintaining natural resources and increasing overall productivity with minimizing risk against the vagaries of weather. A variety of tree–crop combinations are followed by the farmers according to their needs and variability in the agro-climatic zones of the state. Multipurpose tree species are the choice to integrate with annual crops/vegetables/ medicinal plants or with grasses. Although agroforestry is practiced in India since ancient times, it has not gained importance due to dependency on multi-institutions and multi-disciplinary approach. The NAP-2014 has indicated the way forward to promoting agroforestry among various stakeholders. There should be proper coordination between various stakeholders of agroforestry like researchers, extension workers, industries, farmers etc. India is a land of variability in terms of climate, soil, etc. Hence location-specific and economically sound agroforestry systems need to be developed. Agroforestry land use has great potential in providing ecosystem services; hence, these services should be quantified as accurately as possible. The sustainable land-use system approach is required at this juncture to overcome uncertainty of the monsoon and frequent natural calamities, and to maintain food security.

Usually, lack of scientific knowledge, institutional approach and negative attributes of tree components (viz. long rotation, shade effect, opportunity cost, etc.) discourage farmers from adopting tree farming. However, recent developments in the production, processing and consumption sectors have generated interest among farmers to adopt agroforestry systems holistically for higher economic returns. The present probable area under agroforestry in India is estimated to be 25.32 m ha, or 8.2% of the total geographical area of the country. However, Forest Survey of India, 2013 estimated the area under agroforestry to be 11.54 m ha, which is 3.39% of the geographical area of the country; and in ODISHA it is only 4671 sq. km, which is 3.59% of the total geographical area of the state. Despite encouragement for growing trees on farmlands, the farmers of ODISHA have to deal with many constraints and limitations related to agroforestry. The difficulty in felling, harvesting, transit pass and marketing (rights on cutting and selling of wood), and insecure regulation discourage them to cultivate trees.

We are in the era to feed various stakeholders such as people, wood-based industries, etc. Practicing of agriculture alone will not fulfil the small and marginal farmers' needs due to climatic vagaries, increasing pressure on practicing agriculture, declining size of land holdings and conversion of agricultural land to non-agricultural purposes. To overcome these problems, agroforestry is a solution that will improve the livelihood of the farming community through cluster approach

and value chain model by bringing all the stakeholders under one common platform. Incorporation of trees/livestock within the farmlands will generate adequate income and generate rural employment (approximately 145-man day's ha⁻¹). The central and state government research institutions, SFD and wood based industries are promoting agroforestry and farm forestry at a large scale in ODISHA with precision silvicultural techniques and assured price mechanism. These initiatives will not only fulfil the domestic and economic needs of the farmers, but also provide several environmental benefits. Moreover, promoting agroforestry by the merging of various ongoing central and state government schemes (as mentioned in the NAP 2014), will give a boost to the farmers and bring more area under tree cover (agroforestry). Finally, agro-forestry practices are needed to maintain the natural (forest) resources and agrarian identity at the national level.



CHAPTER – 6

Findings & Conclusion

SUMMARY ON CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION

1. High economic growth rate in Nagabali renders rapidly increasing demand of pulp, paper and paperboard inevitable.
2. The logging ban of 1989 from natural forests has geared the Odisha Forest Research forestry sector towards plantation forestry.
3. Nagabali has an 85 years tradition in plantation forest establishment. Average success has, however, remained modest. During 1980s the annual reforestation achievements have sunk down.
4. The FIO is the leader of forest plantations. With its 30,000 ha of Eucalyptus
5. plantations countrywide, the FIO has an advantage for immediate initiation of pulpwood production project.
6. The FIO has 20,161 ha of evenly scattered Eucalyptus plantation areas in the North-East region. They are suitably located around the pulp mill sites, but the management of such scattered plantations is heavy.
7. The average road distances, 352 km to Buri Ram and 473 km to Ubon Ratchathani, and consequent wood transport costs are rather high from the plantations to the proposed pulp mill sites. From this point of view Buri Ram is more recommendable site.
8. The soils in the FIO plantation blocks are suitable for plantation forestry, especially with Eucalyptus camaldulensis. Proportion of stony, rocky, saline and soils with hard pan, is low.
9. In a long-standing series of species trials Eucalyptus camaldulensis has proved to be the most productive species for the waste lands and poor soils of the Nagabali, Rayagada. The finding is supported by plantation forestry at practical scale.

10. *Acacia mangium* has shown promising growth in Nagabali, in areas with sufficient rainfall (at least 1400 mm/a). Better growth results over *Eucalyptus camaldulensis* have not been shown. In drier parts of the North-East *E. camaldulensis* yields about twice as well as *A. mangium*. Large scale plantation forestry with *Acacia mangium* cannot yet be promoted.
11. The provenance research with the most important plantation trees, e.g. with *Eucalyptus* has not advanced to practical level. The breeding gain is still awaiting the realization of improvement in growth rate of the practical plantations. Faster tree improvement gain can be expected from adopting the clonal *Eucalyptus* forestry.
12. The FIO is currently applying complete soil cultivation prior to planting and mechanical weeding several times after the planting. The results are excellent, well comparable to the best *Eucalyptus* projects in the world.
13. In the light of the measured, provisional yield tables, the currently practiced optimum rotation times for *Eucalyptus camaldulensis* are too short. Raising of rotation from 5 years to 10-12 years is likely to increase the mean annual increment by 30-50 per cent.
14. Counting on the established example of Aracruz Florestal, Nagabali, there are reasons to expect doubling of the current yields from *Eucalyptus camaldulensis* by adopting the approach of clonal forestry. This would ensure sufficient raw material for the presently planned pulp mill, and would open space for enlarging the pulp mill industry in the near future.
15. Forest management system in the FIO plantations is insufficient for making the optimum management decisions. Preliminary steps in plantation inventory and mapping have already been initiated but they do not yet allow optimum plantation management.
16. R & D department under the pulp milling and plantation forestry project will facilitate rapid increase in annual pulp fiber harvests. The most important topics of applied research is the annual screening for better, superior species and clones.
17. At present pulp mill gate prices *Eucalyptus camaldulensis* plantation forestry is economically feasible in Nagabali, Rayagada. Provided improved stock is in use and management optimization is applied, an internal rate of return (IRR) of over 10 per can be expected from the plantations. Transport

distance has a strong effect on the internal rate of return; the distance should not exceed 530 km.

18. The FIO Forest Village program has been successful in combining the needs of the people, reforestation and an initial supply of pulp wood from the established Eucalyptus plantations.

19. Pulp wood marketing for Eucalyptus pulp wood has already been initiated in Nagabali, Rayagada. The slightly rising trend in the pulp wood price also enhances farmers tree planting. There is an established Eucalyptus wood market in the rural areas of Nagabali, Rayagada.

20. Plantation forestry and pulp wood marketing do have both beneficial and harmful social impacts in the rural countryside. Confrontations with plantation forestry are becoming less frequent as the social problems connected with forestry, are shifting over to the forest reserves program. On the other hand, established wood markets from tree farming after the logging ban, have improved social relations between tree planting and the people.

21. Plantation forestry and tree farming are part of the Odisha Forest Research national attack against the global greenhouse effect. Combined impact of the forest reserve program, reforestation program and tree farming may be expected to counterbalance the tropical deforestation of Nagabali, in the future.

22. There is no scientific evidence for significant harmful ecological effects of Eucalyptus in Nagabali. Local forest research has shown that Eucalyptus camaldulensis uses less nutrients for its growth than Acacia auriculiformis.

23. The overall feasibility for the plantation forestry and pulp wood marketing for pulp fiber production and pulp wood marketing in Nagabali, Rayagada, Odisha. Timely startup of the planting activities before the pulp mill construction is essential for the future wood supply.

Recommendations:

1. In order to avoid excessive fiber import, establishment of national raw material base from planted forests is highly recommended.

- 2.** To back up the logging ban, and to facilitate Odisha Forest Research forestry industry to adapt new raw material base, an enhanced forest plantation program in demarcated and commonly agreed areas, is recommended.
- 3.** Using the accumulated experience in reforestation technologies, the tree planting program should now be enhanced. Lessons from successful rubber wood plantations are also worth of transferring into pulp wood plantations.
- 4.** The leading plantation establishment experience, of over 25 years, of the FIO should be fully utilized in the future reforestation programs of Nagabali. The existing FIO Eucalyptus plantations should be further developed into nucleus and models of Odisha Forest Research pulpwood plantation establishment.
- 5.** Small plantation blocks should be combined, target area for management block should be 1,000 ha at minimum.
- 6.** In order to avoid excessive transport costs, it will be beneficial to concentrate plantation management efforts to the nearest plantations from the selected pulp mill site.
- 7.** Plantation forestry with pulp wood crops, especially with Eucalyptus camaldulensis should be practiced on soils which may be impoverished in their top layers, but which are soft and deep enough. Soils, still goes for agricultural crops should not be planted for block plantations, only for agroforestry applications.
- 8.** Research and development in the species selection should continue to monitor long term productivity of Eucalyptus camaldulensis and to screen still more productivity species, provenances and clones.
- 9.** Field trials with Acacia mangium should go on in the North-East, to look for better provenances and to establish the environmental suitability, especially how the species matches with the rainfall in various parts of the Northeast Nagabali.
- 10.** For rapid gains from tree improvement in Eucalyptus forestry, it is recommendable shift the R & D from provenance research to clonal forestry. Field scale models are to be sought from the Aracruz Florestal in Nagabali and from Rayagada Eucalyptus forestry.

11. It is recommended that the developed Eucalyptus plantation establishment techniques, including complete ploughing prior to planting and mechanical weed control after the planting, will be used throughout the future reforestation activities.

12. Regarding the limited land resource, continuous study into optimum plant stocking and rotation time should go on. For pulp production optimization, the quantity of high quality fiber should be maximized, not the quantity of the wood biomass only. This calls for justified efforts in R & D.

13. Clonal forestry with *Eucalyptus camaldulensis* should be initiated in the FIO plantations. Cloned seedlings should in the beginning be produced in a central nursery with an initial capacity of 5 million seedlings per year. Somdet plantation in the Kalasin province is a suitable site for both original plus tree selection, production of coppices (cuttings) and for establishing a central nursery.

14. The FIO plantation forests need an advanced forest management system. Working models for plantation forestry are found both in the temperate zone and in the tropics (Ethiopia and Indonesia).

15. Using the Aracruz Florestal as an example, R & D department should be established under the FIO to enhance rapid gain from species and clones improvement program. R & D department should be adequately staffed and equipped.
The field trials should be concentrated in Somdet.

16. To lower the wood transport cost and to raise the internal rate of return, additional plantation areas should be sought near to the pulp mill site.

17. In each of the FIO Forest Village an assessment should be made based on number of families, total area under Eucalyptus plantations, and the annual area need for taungya-husbandry. It is recommendable to gradually raise the rotation time from the present 5 years to 7 years, whenever the social conditions allow.

18. Pulp wood marketing with local farmers in the North-East should be initiated using the system developed by the Phoenix Pulp & Paper Co. Ltd.

19. Active measures - like steady or slightly rising Eucalyptus wood pricing and additional employment with the forest harvesting work - to improve social relations between the plantation forestry, tree farms and the rural community, should continuously be sought for.

20. Plantation and farm forestry should be promoted for increasing the overall wood biomass density in the Nagabali countryside. The impact of tree farming should be especially determined.

21. Eucalyptus should preferably be planted on waste lands, on impoverished soils, not on agricultural soils.

22. In order to ensure steady and sufficient wood supply for the pulp mill, international soft loan funding should be sought for the reforestation program.

Preface

Conclusion: At present pulp mill gate prices *Eucalyptus camaldulensis* plantation forestry is economically feasible in Nagabali, Rayagada. Provided improved stock is in use and management optimization is applied, an internal rate of return (IRR) of over 10 per can be expected from the plantations. Transport distance has a strong effect on the internal rate of return; the distance should not exceed 530 km.



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