ESTABLISHMENT OF A GREEN-BELT AND MOSAIC PLANTING FOR PHYTOREMEDIATION AT CAMPUS OF NITTA GELATIN, KORATTY

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(An Institute of Kerala State Council for Scinece, Technology & Environment)

Peechi 680 653, Thrissur, Kerala

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KERALA FOREST RESEARCH INSTITUTE

No.: KFRI RP-641/2012

Date: 26-04-2012

NOTE

Sub : New Research Project - Allotment of Project Number

Project Number	:	**KFRI RP-641/2012**
Title	:	Establishment of a green-belt and mosaic planting for phytoremediation at the campus of Nitta GelatinIndiaLtd, Koratty
Principal Investigator	:	Dr. KK Seethalakshmi
Associate Investigators	:	VP Raveendran Dr. M Balagopalan
Human Resources	:	Casual Labour as and when required
Duration	:	2 Years (May 2012-April 2014)
Budget	:	Rs. 7.15 lakhs*
Funded by	:	Nitta Gelatin India Limited, Koratty
Contacts	:	Sri. G Suseelan Managing Director, Nitta Gelatin India Limited
Reference	:	Letter from KK Seethalakshmi dated 24-04-2012
Project Proposal	:	PP-784/2012

* Budget details given overleaf

Dr. KV Sankaran
Director

To: Dr. KK Seethalakshmi/ VP Raveendran/ Dr. M Balagopalan

cc: All Scientists/ Convener, IRG/ Registrar/ Dy. Registrar (Admn.)
Dy. Registrar (Acct.)/ PA to Director/ Office Assistant (Acct.)

Documentation:
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Contents

Project Particulars

1.Title of the project	:	Establishment of a green-belt and mosaic planting for phytoremediation at campus of Nitta gelatin, Koratty (KFRI RP-641/2012)
2.Department/ organization implementing the project	:	Kerala Forest Research Institute, Peechi.
3. Principal Investigator	:	Raveendran V P Scientist-in-Charge Extension and Training Division Kerala Forest Research Institute
4. Co – investigators	:	Dr. K. K. Seethalakshmi Scientist- F Sustainable Forest Management Division Kerala Forest Research Institute Dr. M. Balagopalan Scientist- F Sustainable Forest Management Division Kerala Forest Research Institute
6. Name of the funding agency	:	Nita Gelatin India Limited, Koratty.
7. Duration of the Project	:	May 2012 - April 2014

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Abstract

Nitta Gelatin India Limited (NGIL), one of the most successful Indo-Japanese industrial ventures, was incorporated in 1975 and started commercial production in 1979. As per recommendations of the Expert committee meeting, convened by the Hon'ble Minister of Industries on 3rd November 2011, Kerala Forest Research Institute established green-belt and mosaic plantation around the factory premises. Bamboos and other tree species were used in establishment of green cover around the factory to address environmental problems associated with the production of ocean and gelatin. *Four* bamboo species *viz. Bambusa balcooa, Dendrocalamus sikkimensis, Gigantochloa rostrata* and *Schizostachyum (Teinostachyum) dullooa* were planted along the border. Seedlings of 26 tree species were planted as mosaic plantation and majority of them planted were found well adapted to the location. Further study is needed to find out the extend of pollution and its impact on the ecosystems around the NGIL factory premises.

Introduction

Biodiversity conservation and sustainable use of natural resources is of prime importance for the sustenance of mankind in this universe. Rapid alteration of the earth's environment may lead to loss of stability of the ecosystems, which will be detrimental to the mankind. Humans have been transforming natural landscapes worldwide, both terrestrial and aquatic for various developmental activities. Until recently, humanity has proceeded on the assumption that the resources in this planet were almost unlimited. The economic and demographic growth experienced by the world in the last two centuries, but especially in the last fifty years, has exploded this myth. Resources in this planet are finite and that they must be managed in a sustainable way if they are to continue to serve as our principal source of sustenance. The loss of biodiversity is only one manifestation of the poor management of natural resources. Although the impact of transformation of environment was not originally known, recently, the ill effects have started showing up in the form of climate change, tsunami, poor crop productivity, emergence of epidemics and so on. It is now well appreciated that better management of natural and manmade landscapes is inescapable for human survival. Global human concern has recently been codified in the Convention on Biological Diversity signed at **United Nations Conference on Environment and Development** (UNCED), in Rio, during June, 1992 to which India is also a signatory. Water, soil, plants, animals and human beings in nearby ecosystem are being badly affected by massive atmospheric pollution. Harmful effects of air pollution on vegetation have already been studied. Survey of vegetation in the industrial area of Banagar, Hyderabad by Madhavavendra *et al.* (1990) revealed 34 plants as resistant, 12 as susceptible and 3 as very susceptible to pollution in terms of defoliation, leaf chlorosis, necrosis, bronzing and withering. The National Botanical Research Institute, Lucknow, in collaboration with Indian Toxicological

Research Institute, Lucknow, has extensively surveyed seven industrially polluted areas in the Uttar Pradesh and identified a number of pollution tolerant species in air-polluted areas (Pokhriyal and Nautiyal, 1991). Bhattacharya (1994) also listed out a number of tree species tolerant to different air pollutants. Tree acts as a sink of air pollutants and thus reduces their concentration in the air (Prajapati and Tripathi, 2008). However, this function of pollution abatement is best performed by the pollution- tolerant species. It appears that tree plantation in industrial areas is a site- specific activity and knowledge of tolerance level of plant species to air pollution is necessary.

It is possible to estimate the overall effect of a large number of pollutants as total pollution by measuring changes in the plants (Lakshmi *et al.*, 2009). In the current study, attempts were made to adopt appropriate site amelioration programmes in order to minimize the ill effects of pollution through greening up in the area.

Nitta Gelatin India Limited (NGIL), one of the most successful Indo-Japanese industrial ventures, was incorporated in 1975 and started commercial production in 1979. To address the environmental problems associated with manufacture of products a meeting of an Expert committee was convened by the Hon'ble Minister of Industries on 3rd November 2011. One of the recommendations of the committee was to establish a green - belt around the factory premises.

Prior to this, during 2004, attempts were already made by KFRI to establish a bio-shied using bamboos on one side of boundary of the campus at Koratty. Extraordinary growth performance was observed in this site for bamboos as compared to other locations. The present project was undertaken to establish a bio-shield in the boundary with bamboos in the entire campus and carry out mosaic planting and landscaping of the area with other species having different growth forms

to make the campus eco-friendly. The project was implemented with the following objectives: You have given acknowledgement to George Mathew for butterfly park. It is not there in objective or introduction????

OBJECTIVES

1. To develop a green-belt around the factory to minimize pollution, to promote conservation of natural ecosystems.
2. To promote public awareness on nature conservation.
3. To provide training to artisans in the Panchayath on value addition of bamboo to use the raw material produced from the campus.

Materials and Methods

The study area is approximately 10 h located in Kathikudam village is surrounded by farm lands and paddy fields. The gelatin factory has been operating in the area since 1979. Waste water before releasing into the river was treated for removing the effluents. The factory site has large areas that do not have proper green cover.

Fig-1. Inspection of the area

Development of Green-belt

The green-belt planting was done during 2012- 2013 using poly-potted seedlings raised in the nursery specially established for the purpose inside the NGIL campus. Four bamboo species viz. *Bambusa balcooa, Dendrocalamus sikkimensis, Gigantochloa rostrata* and *Schizostachyum (Teinostachyum) dullooa* were planted along the border (Table 1). . Planting was done at a spacing of 4 x 4 m and pit size was 45 x 45 x 45 cm. Bone meal @ 200g/pit was added as starter fertilizer. The entire green-belt area was maintained by casualty

replacements, regular weeding, soil working, mulching and fertilisation using farmyard manure

Mosaic Planting

The proposed area was fully covered with weeds hence through weeding along with the planting lines was carried out (Fig.2). Seedlings were procured from the Forest Nursery of KFRI and other places and brought to the campus of Nitta Gelatine in June 2012 (Fig.3). They were transported manually to planting sites which are not motorable (Fig.4). Mosaic planting in different patches was carried out using 26 different species (Table 2). Planting was done at a spacing of 2 x 2 m in 30 x 30 x 30 cm pits size (Fig.5). The planted area was demarcated and surveyed to ascertain the area of plantation established. The entire area was maintained by casualty replacements, regular weeding, soil working, mulching and fertilisation. Branches of trees up to about two metre height were pruned to facilitate distant vision as per security guidelines. The plants susceptible to wind were provided with support.

Fig-2. Proposed site before planting

Fig-3. Seedling for planting

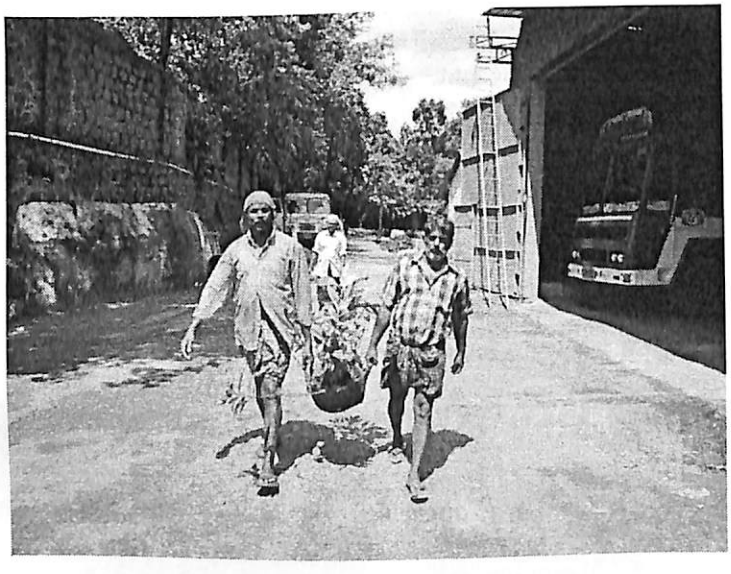

Fig-4. Planting operation

Fig-5. View of planted Seedling

Weeding, Fertilizer application and Soil sampling and analysis

The area is highly infested with alien weeds like *Mikania* and hence weeding was carried out for three times within a period of six months. Bone meal @ 200g/pit was added as starter fertilizer. Surface soil samples were collected from different locations from where planting envisaged (Fig 6 & Fig 7). The soil samples were tested at KFRI laboratory at Peechi and analysis is in progress .

Fig-6. Soil Collection

Fig-7. Soil Collection

RESULTS AND DISCUSSION

The area of 2 h available for the project included open garden, hilly boundary areas, water logged areas, lateritic areas, etc. Site specific plant species were introduced in such a way that the aesthetic as well as ecosystem values were considered. Scrubby patches as well as hilly areas contained several species of insects, reptiles and birds. Similarly, the water logged area supports a rich population of water birds. By adopting suitable restoration programmes mainly through plant introduction, survival of these organisms can be ensured and the area can be developed into a natural reserve.

Bamboos were used for green-belt since they have faster growth and shown the ability to grow in difficult areas. The Bamboo species planted viz. *Bambusa balcooa, Dendrocalamus sikkimensis, Gigantochloa rostrata* and *Schizostachyum (Teinostachyum) dullooa* were established well in the factory premises. A better growth performance was observed in the site for bamboos when compared to other locations.

Most of the 26 tree species were found well adapted to the location. The plants which recorded slow growth were the characteristics of slow growth and hence it may not be attributed to pollution in the area. Some of the plants, which normally grow at slow to moderate rate, recorded remarkably good growth and it is not easy to determine whether site, management or pollution contributed to this. Further study is needed to find out the factors influencing the growth of the species. An area of 27 m x 45 m has been set aside for setting up a butterfly garden as conservation cum environmental education programme. Preparation of the design has been completed and the planting of various butterfly host plants is in progress.

Fig-8.Green - belt established in the factory premises

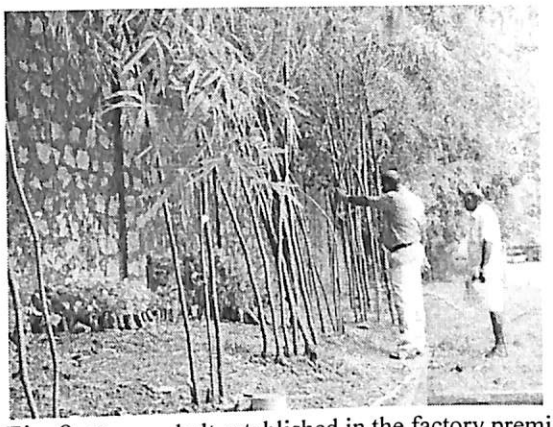

Fig-9. Green - belt established in the factory premises

Fig-10. Green - belt established in the factory premises

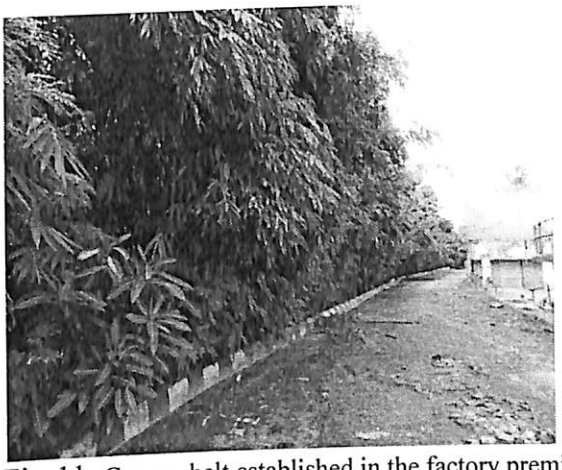

Fig-11. Green - belt established in the factory premises

Table 1. Details of bamboo species planted for the green belt.

Sl. No.	Species Name	Numbers
1.	*Bambusa balcooa*	50
2.	*Dendrocalamus sikkimensis*	50
3.	*Teinostachym dullooa*	50
4.	*Gigantochloa rostrata*	50
Total		200

Table -2. Details of tree species planted during first year.

Sl No.	Local Name	Botanical Name	Numbers
1	Chenkurunji	*Gluta travancorica*	200
2	Chooral	*Calamus thwaitesii*	100
3	Garden palm	*Areca triandra*	100
4	Karinjotta	*Quassia indica*	100
5	Njaval	*Syzygium cumini*	100
6	Thanni	*Terminalia bellirica*	100
7	Palakapayyani	*Oroxylum indicum*	100
8	Attuthekku	*Neolamarckia cadamba*	100
9	Karimaruthu	*Terminalia elliptica*	100
10	Kattunjaval	*Syzygium gardneri*	50
11	Badam	*Terminalia catappa*	50
12	Kanikonna	*Cassia fistula*	50
13	Mahogani	*Swietenia macrophylla*	150
14	Kurangumanjal	*Bixa orellana*	50
15	Karukapatta	*Cinnamomum verum*	50
16	Kumizhu	*Gmelina arborea*	100
17	Manjadi	*Adenanthera pavonina*	50
18	Kudambuli	*Garcinia gummigutta*	50
19	Venga	*Pterocarpus marsupium*	20
20	Saimaruba	*Simarauba glauca*	20
21	Chestnut	*Castanospermum australe*	20

22	Asokam	*Saraca asoca*	20
23	Mandaram	*Bauhinia racemoss*	50
24	Kattadi	*Casuarina equisetifolia*	50
25	Bird of paradise	*Heliconia* spp.	100
26	Teak	*Tectona grandis*	100
Total			1980

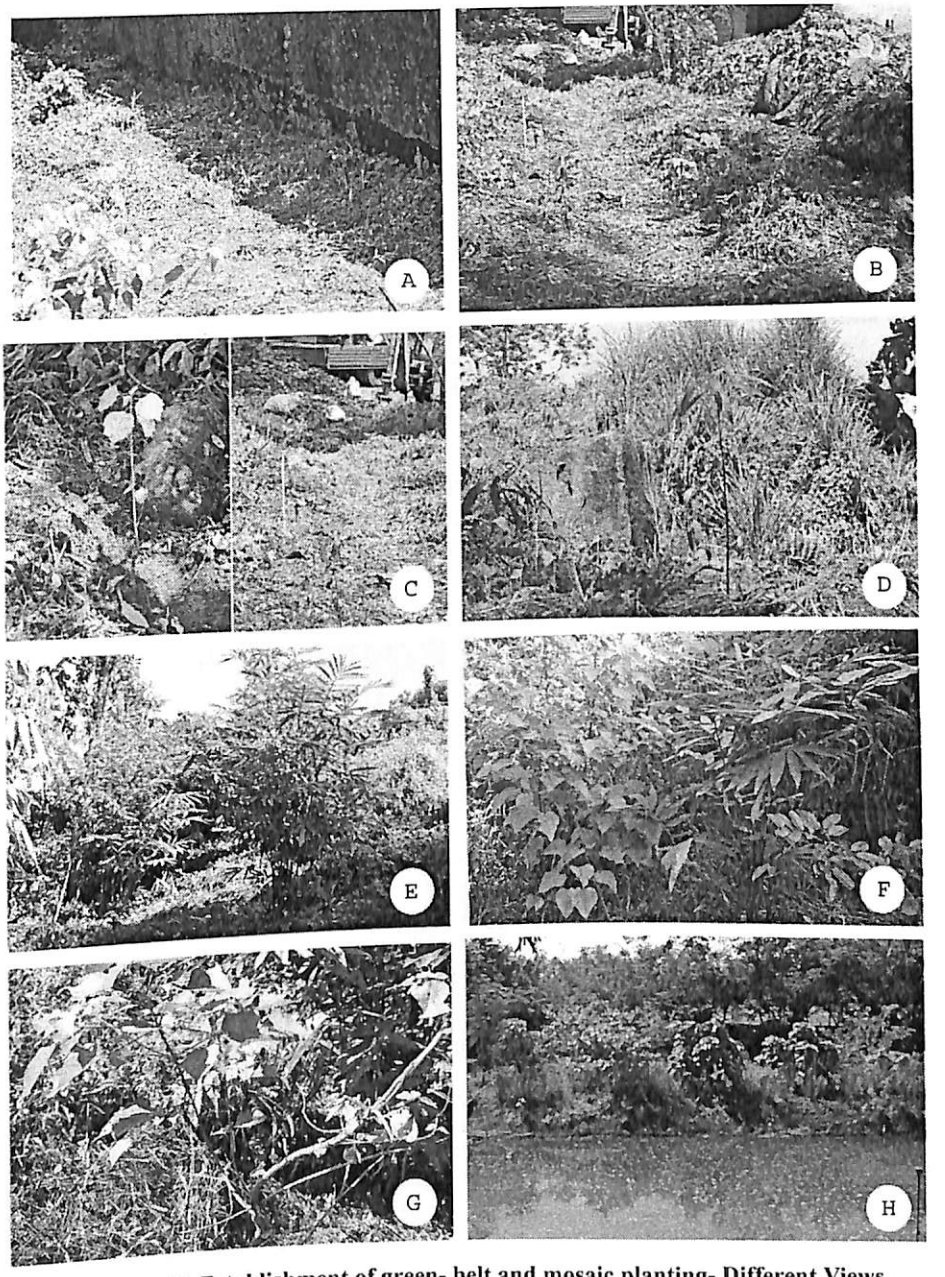

Plate I- (A-H) Establishment of green- belt and mosaic planting- Different Views

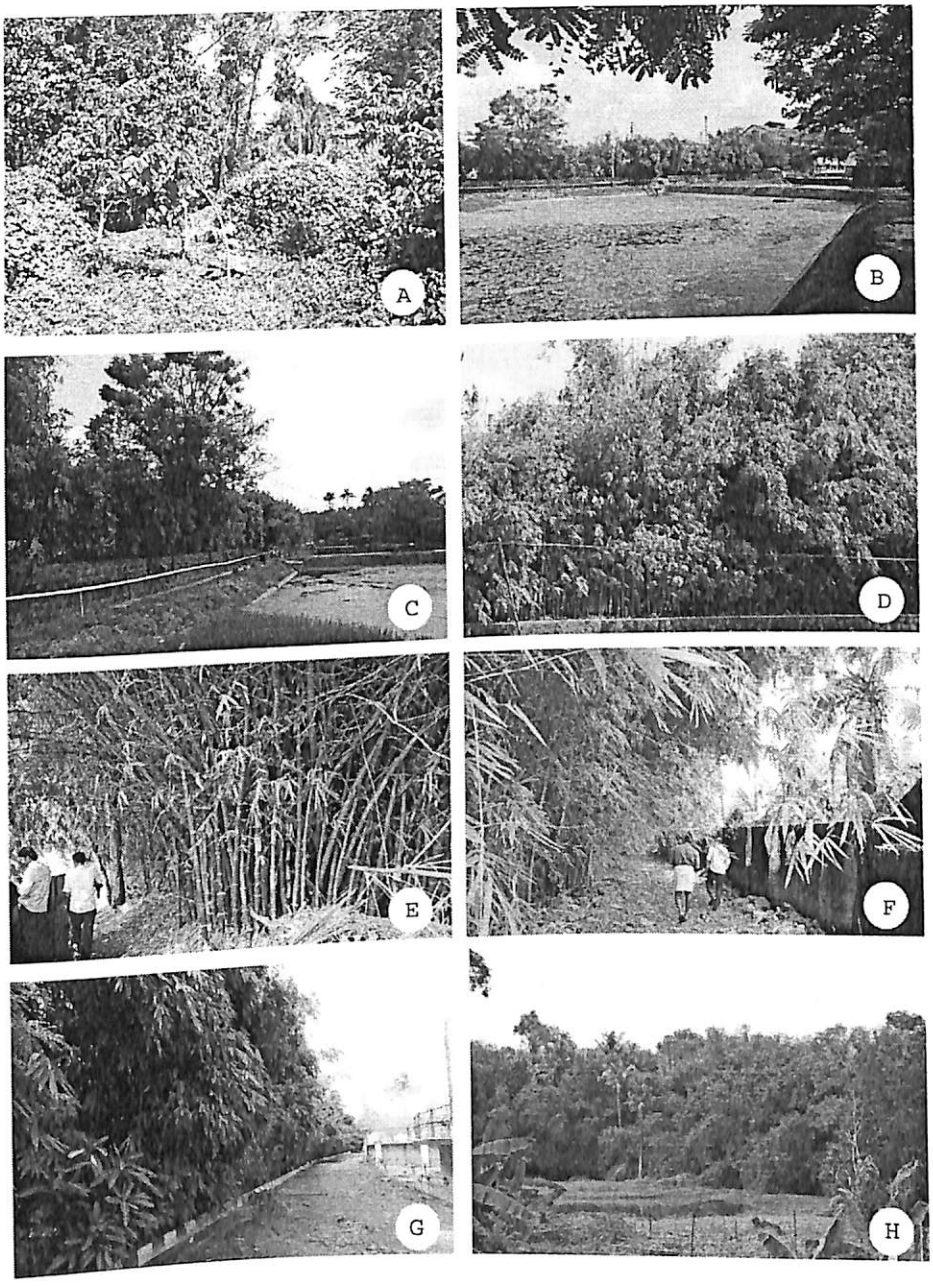

Plate II- (A-H) Establishment of green- belt and mosaic planting- Different Views

Conclusion

Clean air and water the vital part of healthy life. It must be protected from bad effects of pollution at any cost. Establishing green-belt and mosaic planting are some of the effective tools to mitigate the problem of atmospheric pollution. The green-belt established in NGIL campus is successfully established and survival of the tree species as well as bamboos was very good. The pollutants produce various kinds of morphological, physiological and biochemical changes in plants. Further studies are needed to explore the impact of pollutants on the ecosystems around the NGIL factory premises.

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