THEME 2

Forests in an expanding economy

2.1 – Managing the forests: old and new paradigm

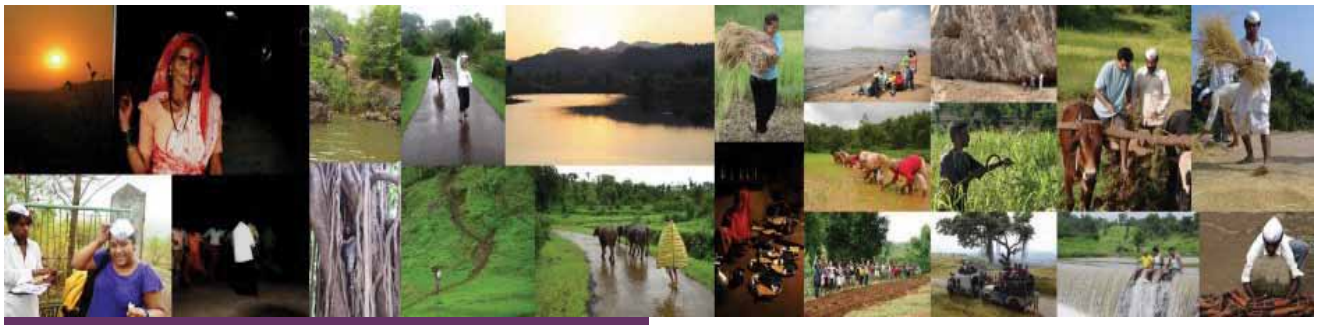
2.2 – Reconciling growth with conservation towards sustainable development

2.3 – Agroforestry: production, opportunities and institutional framework

2.4 – Forest Products: Management for livelihoods

2.5 – Forest Products in industry

<< Back to contents



Role of Youth in Sustainable Forest Management

Akash Boaz,
MBA-ITBM (Student),
Symbiosis Centre for Information Technology

A little bit of Statistics

- India has more than 50% of its population below the age of 25 *
- Current median age : 26.2 years **
- It is expected that, in 2020, the average age of an Indian will be 29 years *

* Source : Wikipedia
** Source: CIA World Factbook

Introduction

- **India's Young population** is its **biggest asset**
- Educating them would mean educating half the population
- If half the population is young now, imagine the impact it can have on the future generations a couple of decades from now

<< Back to contents

Education and Awareness

- Catch them Young-Pay attention to the development of interest in forestry conservation and development at kindergartens and schools for young children
- The youth should be encouraged to complete compulsory primary forest education that should be introduced at all levels in the education system.
- Make the youth aware of the forests and its current conditions in and around their cities and states.

Expand and Link

- Expand basic forestry education facilities to reach the whole population through means like the internet
- Provide vocational training to all rural youth to serve in rural forest based cottage industries
- Link the educational development to socio-economic development
- Link training programs with local forest conservation and protection needs
- Incorporate local cultural systems for forest conservation and development

Create Opportunities…

- Opportunities for marginalized groups and people with disabilities to access such education opportunities
- Support talented students in becoming highly qualified forestry professionals especially rural youth who have ethnic forestry knowledge of folk-lore medicines and other rare knowledge of forestry conservation and development practices of tribal communities
- Ensure cooperation and search for foreign assistance in terms of providing opportunities for students to establish local forest based enterprizes.
- Create a incentive based reward system for students excelling at various levels-schools, college, vocational education etc

Youth at Corporates

- Large number of Youth (especially in IT sector)
- Corporates have CSR(Corporate Social Responsibility) programs
- Incorporate environmental and forest education at organizations through CSR
- Start dedicated programs such as tree plantation etc.

Youth at Colleges

- Highly energetic individuals
- Just like CSR, Start SSR programs (Student Social Responsibility)
- Educate them through competitions and symposiums about the importance of forests and environment.
- Take Students to rural camps and villages so that they can learn about the forests while staying in the forests
- Organize street plays to make others aware as well

Market Access Problem

- Currently we face market access problem
- Youth is too busy to care about the environment.
- Young Indian population is extremely large with immense opportunities
- Target the Youth, market the forests and environment
- Showcase the dangers of depleting forests
- The classic 'Now-or-Never'

<< Back to contents

Attracting Youth through Rural Tourism

- Have tie ups with startups and social organizations providing responsible rural tourism
- An Example: Grassroutes
  - Live like a villager for a couple of days
  - Harvest crops, Plough Fields, Climb Trees etc.
  - Highly activity oriented tourism
- Another Example: Jungle Resorts
  - Adventurous Camps – living inside forests in tents
  - Direct interaction with nature
  - Trekking, Rafting etc.
  - Know why forests are important.

Brand Ambassadors for Forests and Environment

- Create brand ambassadors
- Have a Youth icon to motivate the young
- MS Dhoni is the brand ambassador for Jharkhand's forest dept.

Conclusion…

- Awareness is the key
  - Early Education
  - Youth Programs –SSR CSR
  - Create opportunities for youth in urban as well as rural areas
- Market the forests and environment
  - Minimize market access problem
  - Rural tourism can be of help
  - Brand Ambassadors is another good option

One more thing…

"We must take personal responsibility. Even if we cannot change the circumstances, the seasons, or the wind,

we can definitely change ourselves."

- Jim Rohn

<< Back to contents

EFFICACY OF ALUMINIUM PHOSPHIDE AGAINST WOOD DECAYING FUNGI

Himani Pant* & Sadhna Tripathi
Wood Preservation Discipline
Forest Products Division
Forest Research Institute, Dehradun

Introduction
Objective
Methodology
Results
Conclusion
Thanks

INTRODUCTION

- Non-availability of durable wood species.
- Thrust on plantation grown species.
- Improvement in service life of plantation grown species through preservation.
- All timber prior to export is fumigated to kill the existing pathogens and insects.

Introduction
Objective
Methodology
Results
Conclusion
Thanks

- Fumigation is the process of releasing and dispersing a chemical in gaseous state at required temperature and pressure, for the control of pathogens and insects.
- Most of the fumigants are either used for grain protection or used as soil fumigants but very few are known for wood protection. Thus, there is a need to study the activity of common fumigants in wood.

<< Back to contents

Introduction
Objective
Methodology
Results
Conclusion
Thanks

- Aluminum phosphide, a well known stored grain fumigant, available in solid formulation has shown promise as wood fumigant.
- Aluminium phosphide was tested as wood fumigant against wood decaying brown rot and white rot through malt agar bioassay (Pant, 2010). Alp- malt agar.ppt

Introduction
Objective
Methodology
Results
Conclusion
Thanks

OBJECTIVE

To evaluate the potential of aluminium phosphide against wood decaying fungi.

Introduction
Objective
Methodology
Results
Conclusion
Thanks

METHODOLOGY

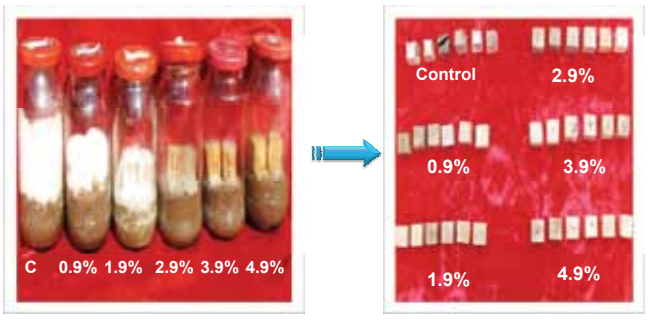
1. Preparation of test blocks
2. Preparation of soil culture bottles. Preparation of soil culture bottles.ppt
3. Fumigation of test blocks. Fumigation of test blocks.ppt
4. Determination of threshold concentration of fumigants against white and brown rot by soil block bioassay (IS: 4873, 2008).

Introduction
Objective
Methodology
Results
Conclusion
Thanks

RESULTS

Efficacy of aluminium phosphide against wood decaying fungi through soil block bioassay

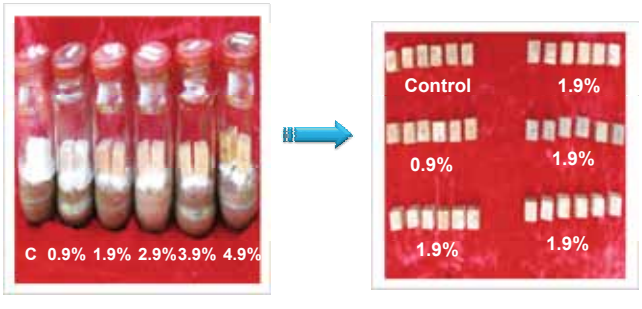
Pinus roxburghii: *Oligoporus placentus*



8% weight loss at 4.9% compared to 51% in control

8

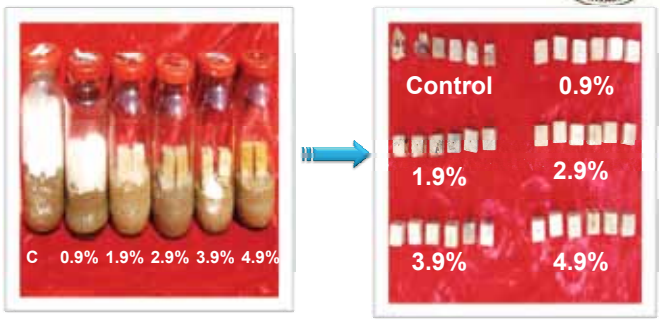
Pinus roxburghii: *Trametes versicolor*



7% weight loss at 4.9% compared to 51% in control

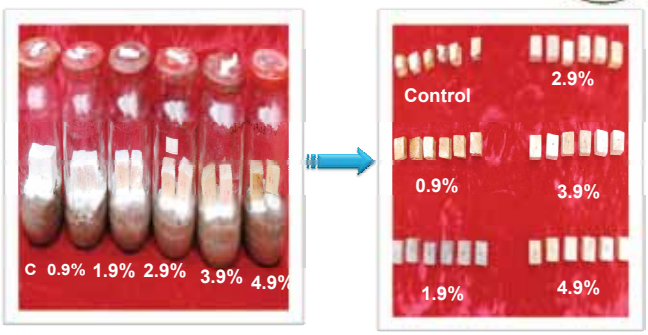
<< Back to contents

Populus deltoides: Oligoporus placentus



10% weight loss at 4.9% compared to 55% in control

Populus deltoides: Trametes versicolor



7% weight loss at 4.9% compared to 53% in control

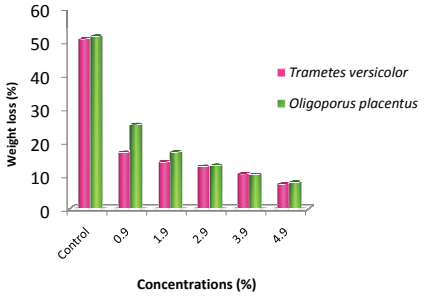
Mean weight loss (%) of wood fumigated with aluminium phosphide due to decay fungi

Conc. (%)	Reten. (gm/m³)	Wood			
		P. roxburghii		*P. deltoides*	
		T. versicolor	*O. placentus*	*T. versicolor*	*O. placentus*
Control	0.00	50.69 (45.38)	51.44 (45.80)	53.42 (46.94)	54.80 (47.73)
0.9	16.85	16.86 (24.23)	25.14 (30.08)	20.04 (26.58)	28.82 (32.45)
1.9	35.58	14.00 (21.96)	16.95 (24.30)	16.50 (23.96)	20.22 (26.70)
2.9	54.31	12.70 (20.87)	12.91 (21.04)	14.15 (22.08)	16.61 (24.04)
3.9	73.04	10.36 (18.77)	10.17 (18.58)	12.14 (20.38)	13.82 (21.81)
4.9	91.76	7.35 (15.72)	7.88 (16.28)	7.46 (15.83)	9.53 (17.97)
Mean (Wood)		19.70 (25.25)		22.29 (27.21)	
Mean (fungi)		19.64 (25.22) – T.v.		22.36 (27.23) –O.p.	

C.D.$_{(0.05)}$ Wood=0.15, Fungi= 0.15, Concentrations=0.26

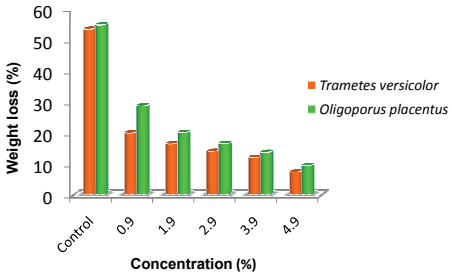
Introduction
Objective
Methodology
Results
Conclusion
Thanks

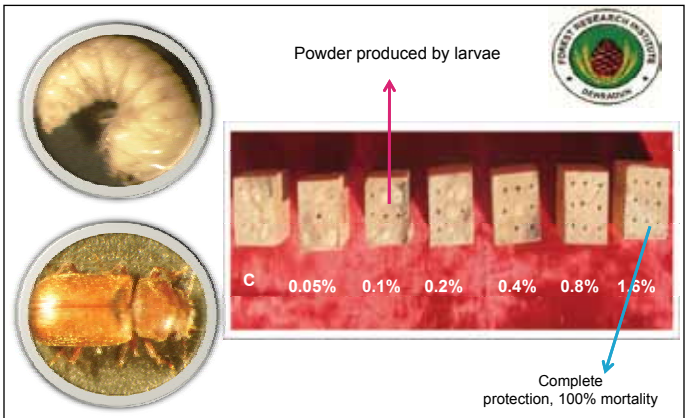
Efficacy of aluminium phosphide against wood decaying fungi in chir pine blocks



Introduction
Objective
Methodology
Results
Conclusion
Thanks

Efficacy of aluminium phosphide against wood decaying fungi in poplar blocks





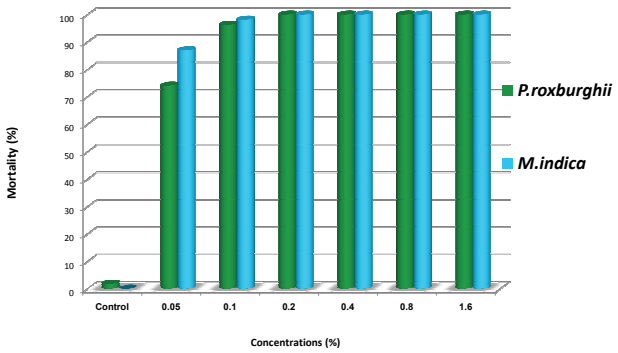
Efficacy of aluminum phosphide in mango blocks against *L. africanus* through larval transfer method

<< Back to contents

Mean mortality (%) of *Lyctus* larvae in wood due to different concentrations of aluminium phosphide

Concentration	Retenion (gm/m³)	Wood	
		P. roxburghii	*M. indica*
Control	-	1.85	0
0.05%	0.93	74.07	87.03
0.1%	1.87	96.29	98.14
0.2%	3.74	100	100
0.4%	7.49	100	100
0.8%	14.98	100	100
1.6%	29.96	100	100

Efficacy of aluminium phosphide against *L. africanus*



Introduction
Objective
Methodology
Results
Conclusion
Thanks

CONCLUSION

* Alp at 91.76 gm/m³ retention caused only 7-10% weight loss in both woods.

* Further study on the residual effect of fumigants can also be taken up to see the effect of fumigants for longer duration.

Introduction
Objective
Methodology
Results
Conclusion
Acknowledgement

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* Dr. Sadhna Tripathi
* Director, F.R.I., Dehradun
* Head, Forest Products Division
* Staff of Wood Preservation Discipline
* Organizers of IFC 2011

[<< Back to contents]

Managing degraded arid sandy salt affected soils with Atriplex spp for improved productivity



Dr Ranjana Arya

Arid Forest Research Institute, Jodhpur

Introduction

Salt-affected soils occur in all continents and under almost all climatic conditions. Their distribution, however, is relatively more extensive in the arid and semi-arid regions compared to the humid regions

Normally these soils are unable to support vegetation due to their inhospitable conditions. Increasing population necessitated utilization of salty soils to fulfill the scarcity of fodder and fuel wood.

Plant growth on these barren lands would also contribute towards better environment.

Distribution of salt affected soils in arid India

State	Area (in lakh ha)
Rajasthan	3.75
Gujarat	22.22
Total	25.97
Total(India)	67.27

In Rajasthan, salt affected soils are spread in Bikaner, Jodhpur, Jaisalmer, Barmer, Pali, Jalore, Nagaur, Sikar, Churu, Jhunjunu, Sriganganagar & Hanumangarh districts
***In Gujarat** these are mainly distributed in **Kachchh, Patan Surendranagar, Banaskantha, Ahemdabad, Bhavnagar, Junagarh, Bharuch and Surat** districts*

Source: Sharma et al, 2004, Salt affected soils in India – Current Assessment in Advances in Sodic Land Reclamation (Proc. Int. Conf. - Sustainable Management of Sodic Lands)

<< Back to contents

Potentials of growing Atriplex on salt affected lands

Atriplex **shrubs with considerable forage potential shrubs in arid and semi-arid rangelands of the world (Le Houerou, 1992, 1995) have adaptations enabling them to tolerate the adverse effect of salts internally,or excrete salt from cells and tissues (McKell, 1994).**

As a result they have an advantage over plant species that lack strategies to deal with salt in the soil and are thus excellent competitors in saline environments. Atriplex spp. have been planted on more than 1,000,000 ha in Middle East (Nefzoui, 1997).

Performance of *Atriplex spp (A.lentiformis A.amnicola and A.stocksii)* was studied with different management practices in arid conditions of Rajasthan to optimise productivity.

***Atriplex lentiformis* (Torr.) S. Watson - excretory halophyte**

Family Chenopodiaceae Big saltbrush occurs from central California,southern Nevada, southwestern Utah, Arizona, California and Sonora, Mexico. Its value as livestock forage led to its introduction into Australia, Middle east & Asia

A.lentiformis (exotic)

Shrubs of genus Atriplex, are salt excluders; the leaves accumulate salt in the cell vacuoles and in bladder cells. The bladder cell release their salts.

Site Conditions (Saline-Alkali)

Location Gangani site, 50 Km from Jodhpur on Jodhpur-Nagaur road

- **pH_2 –8.5-10.2 EC_2 – 4.8-48.4 dSm^{-1}, ESP- 30-60%**
- **Soil depth – 30-90 cm ($CaCO_3$ layer underneath)**

Texture – Sandy to loamy sand, Waterlogged in monsoon

Ex-1 Performance of *Atriplex lentiformis* with graded doses of gypsum and nitrogen (1997-2003)

Design: RBD, Spacing: 3m x 4m ; Replication: Three

Treatments: Gypsum levels

1. Control (G_0) 2. 100% soil GR (G_1) 3. 150% soil GR (G_2)

Nitrogen levels

1. 0 (N_0), 2. 20 (N_1), 3. 40 (N_2), 4.60 (N_3), 5. 80 (N_4), 6. 100 (N_5) g of urea

Method of planting

Pits of 50 x 50 x 50 cm were dug and 3 kg Farmyard manure (FYM), 15 g Single super phosphate (SSP) and gypsum as per treatment) were mixed with pit soil at the time of planting

Crescent shaped drainage trenches of the size 6'x1'x1' were made around individual plant along the slope to facilitate the leaching of salts.

Results

Periodic Percent survival with different treatments

Treatment	N0		N1		N2		N3		N4		N5	
	A	B	A	B	A	B	A	B	A	B	A	B
G0	83.3	83.3	83.3	77.7	100	83.3	83.3	83.3	77.8	66.6	49.5	49.5
G1	100	100	77.7	77.7	83.3	83.3	77.7	73.3	100	77.7	72.2	72.2
G2	88.8	88.8	66.6	55.5	72.2	72.2	83.3	72.2	66.6	66.2	55.5	55.5
Mean	90.7	90.7	75.9	71.8	85.2	79.6	81.4	76.2	81.5	70.2	59.1	59.1

A-May 1999(22 months); B-Nov 2000 (40 months)

➢At months of age maximum 100 % survival was recorded in T_7 (100 % soil GR) where as minimum 55% in nitrogen treated bushes with or without gypsum application. Overall there was no appreciable decrease in survival of bushes as compared to survival in May 1999 despite two-failed monsoon.

➢Survival ranged from 45 to 83 % in different treatments in March 03 (drought year). Less decrease was observed in gyp. treated bushes.

Growth : The results showed that height attained by the bushes in different treatment was statistically not different from each other.

While in the case of crown diameter treatment effect was significant, and CD value indicate that different treatments (T_4, T_5, T_7, T_{10}, T_{13} and T_{15}) attained significantly higher growth as compared to Control (T_1) at 14 months of age.

	N0	N1	N2	N3	N4	N5	M
	Mean height (cm)						
G0	101	116	112	118	121	107	113
G1	110	108	106	114	126	106	112
G2	106	106	128	111	114	106	112
M	106	110	115.3	114.3	120.0	106.3	CD: NS
	Mean Crown dia. (cm)						
G0	129	150	153	174	178	139	154
G1	166	133	138	166	131	149	147
G2	171	131	149	180	144	160	156
	155	138	147	173	151	149	CD36.4

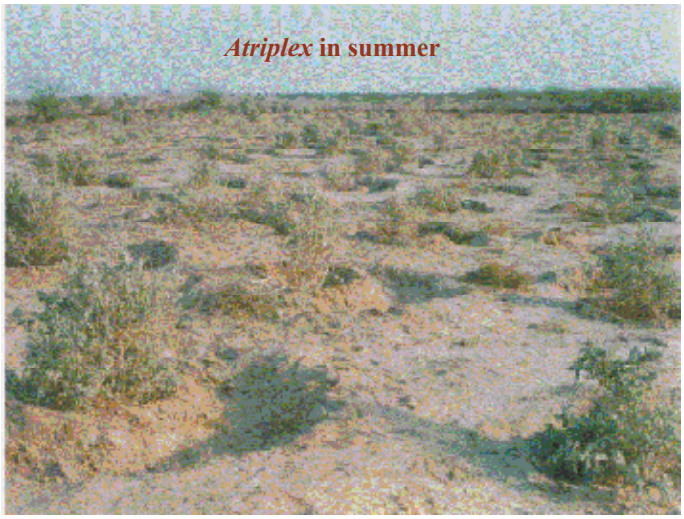
<< Back to contents

Biomass of *Atriplex lentiformis* (g/ bush) with different levels of gypsum and nitrogen at 14 months of age

	N0	N1	N2	N3	N4	N5	M
	Fresh weight						
G0	742	1706	1454	1845	1377	1246	1395
G1	2150	1901	1730	2166	1266	1476	1781.5
G2	1315	1275	1325	1827	1210	1344	1383
M	1402	1627	1503	1946	1284	1355	

***A.lentiformis* responded to nitrogen application and maximum growth and biomass was recorded in T_4, T_{10} and T_{16} treatments where 60 g of urea was applied with different levels of gypsum at 14 months of age.**

Application of nitrogen doses increased the leaf component in different treatments. Mean percent allocation showed that percent leaf component was minimum in N_0 nitrogen level.



Ex-5 Performance of *A. amnicola* with or without gypsum on dfferent modes of planting (2000)

Planting year: 2000

Design: Randomised Block Design

Spacing : 3m x 3m

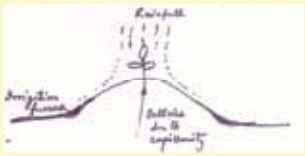
Treatments: Gypsum levels

1. Control (G_0) 2. 100 % soil GR (G_1)

Planting structures

1. Bund, 2. Single ridge mound(SRM)
3. Double ridge mound

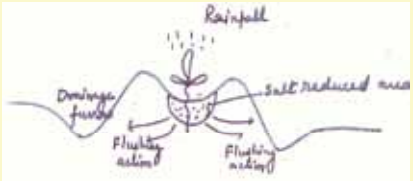
Method of planting: For making Double ridge mounds, bunds (0.50m broad and 0.45 m high) were constructed with the help of tractor. Ridges (20 cm high) were made manually. Distance between two ridges (planting space) was 1.2 m.



Single Mound – Shed rainfall and wet up from saline water

Double ridge mound –

a. Site drainage
b. elevation of seedling above the water tank
c. salt leaching (seedling root zone)



Salient findings:

Survival - through out the study DRM recorded maximum survival followed by Bund and SRM . At 72 months % survival was 72.2 (DRM), 66.5 on bund and 65.2 on SRM , gypsum treated bushes recorded higher mean survival

Growth Maximum height and crown diameter was attained on DRM very closely followed by Bund. Bushes regained growth after periodic cutting (at 48 & 70 month age) showing good regrowth potential.

Biomass Produced 2.2t/ha fresh biomass on DRM and simple bund structures on sandy soil at 36 months of age. Woodiness (less leaf component) increased with age, application of nitrogen decreased woodiness.

<< Back to contents


Atriplex amnicola in summer


after rains (03)


indigenous vegetation after rains


Sheep grazing in *A. amnicola*

Atriplex stocksii Boiss.,
is a short, robust perennial shrub distributed in both inland and coastal marshes. Seeds germinate after monsoon rains and survival is high. Dormant plants become active and produce vegetative part immediately, flowers and fruits after about 30 days and seeds after 60 days and become dormant again.

Treatments: Design: RBD, Spacing: 3m x 3m , Replication: 4,
Plants/Replication: 6

Mode of Planting

1. **Control,**
2. **Circular Dish Mound**
3. **Double ridge mound**

Double Ridge Mound

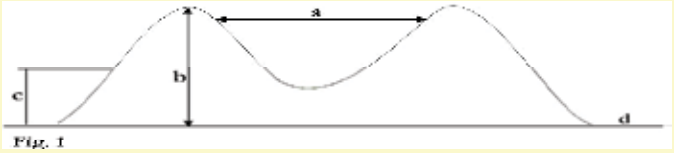


Fig. 1

a - 120cm; b - 65 cm; c - 40 cm; d - ground soil level

CDM in preparation

CDM under water logged condition

Periodic percent survival and growth of *A. stocksii* on various soil structures

Species	DRM			CDM			Control		
	12*	24	36	12	24	36	12	24	36
% survival	87.5	87.5	87.5	95.8	50.0	50.0	21.0	21.0	21.0
Height(cm)	41.8	36.5	45.7	37.8	34.0	47.3	34.2	31.7	40.8
Crown diameter (cm)	89.3	76.8	89.6	83.9	81.5	91.0	52.5	41.0	68.0

It registered very high mean survival on DRM (87.5%) and CDM (95.8%), respectively, as compared to control (21.0 % only), after 12 months of establishment. Structures continued to influence the survival and after 72 months, the percent survival was 75% on DRM, 41.7% on CDM and 12.5% on control indicating DRM was best structure.

Component wise Green and Dry Biomass (mean ± SE) yield g bush

Green				Dry			
DRM	CDM	Control	Mean	DRM	CDM	Control	Mean
Leaves							
1366.7 (223.8)	956.7 (411.6)	475.0 (95.7)	**932.8**	381.0 (62.4)	290.0 (124.6)	121.0 (24.3)	**264.0**
Branches							
991.7 (197.0)	591.7 (216.7)	263.3 (83.9)	**615.6**	631.4 (125.4)	361.0 (132.4)	110.0 (34.9)	**368.3**
Total biomass							
2358.3 (401.1)	**1548.3 (623.1)**	**738.3 (178.9)**	**1548.3**	**1012.5 (180.0)**	**650.9 (254.5)**	**231.0 (180.0)**	**631.3**

<< Back to contents

Leaf Yield : Structure wise DRM recorded maximum green and dry leaf yield (1366.7& 381.0 g) followed by CDM (956.8 & 290.0 g) and control (475.0 & 121.0 g).

Branch yield: DRM recorded maximum branch yield (991.7 & 631.0 g) which is 3.8 to 5.7 times more than control (263.3 & 110.0 g). While CDM (591.7 & 361.0 g) recorded 2.2 & 3.2 times more branch yield

Total yield

Overall DRM produced maximum green and dry biomass. Species wise DRM accumulate maximum green biomass for *A. stocksii* which was 1.5 and 3.0 times more than CDM and control. Total dry biomass on all the three structures was, 1.13 tha^{-1} on DRM, 0.72 tha^{-1} on CDM and 0.26 tha^{-1} on control for *A. stocksii* .

Phenological observations

A. lentiformis* and *A.amnicola* flowered within a year in the month of October, seed setting and maturing took place (December- February). The species are dioecious, have separate male and female shrubs. Seeds were viable, producing healthy seedlings, however, no natural germination was observed. . *Shrubs become woody with age

***A. stocksii* flowered in September (two months after establishment), seed matures by December. No of seed (with seed coat) were 262. It is a monoecious species. It shed leaves in summer months (March onwards) and become dormant becoming active again after receiving rain in monsoon**

Soil improvement

- **Improvement in soil status -reduction in soil pH and electrical conductivity and improvement in percent organic carbon content.**
- **Protection and plantation activities promoted the natural regeneration and the number of plant species increased gradually**
- **Weed evalutation in September 2000 recorded an average yield of grass of 762 $g.m^{-2}$. The dominant species was *Sporobolus helvolus*(1217 $g.m^{-2}$) followed by *Dactyloctenium sindicum* (800 $g.m^{-2}$), *Sueda fruiticosa* (600 $g.m^{-2}$), *Trienthema triquetra.***

Conclusions

***Atriplex spp* have potential to produce nitogen rich fodder from highly degraded arid salt affected soils.** High ash content (~40%) requires its mixing with cereal residues

They performed well on medium depth soil planted in normal pits with crescent drainage trenches. Double ridge mound, (DRM, adapted from Australia) technique was successful in enhancing the survival of shrubs on shallow water logged saline soil. However, root development was in two directions along the ridges.

They responded to gypsum and nitrogen application

Growth of native vegetation in successive years indicates that bushes did not suppress the growth of indigenous flora

Thus all the three *A. stocksii* , *A.amnicola* and *A. lentiformis* can be successfully included in the afforestation programmes for salt affected soils.

Thanks

What Are Halophytes?

Halophytes are generally defined as plants (i.e. grasses, succulents, herbs, shrubs and trees) that grow in a wide variety of saline habitats from coastal sand dunes, salt marshes and mudflats to inland deserts, salt flats and steppes

Halophytes are often classified as **excretives** and **succulents**. (Another classification recognizes **excluders** versus **includers)**.

Excretives have glandular cells capable of secreting excess salts from plant organs.

Succulents use increase in water content within large vacuoles to minimize salt toxicity.

<< Back to contents

ECONOMIC VALUE OF FOREST ECOSYSTEM (DUDHWA NATIONAL PARK , LAKHIMPURKHERI)

Dr. J.V. SHARMA

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SERVICES NOT ACCOUNTED BY CSO FOR THE PURPOSE OF GDP

1. Provisioning of medicinal plants
2. Provisioning of livelihood factors such as Kosa silk, kendu/tendu leaves, Sal seed and even salt and minerals
3. Provisioning of fish and other aquatic resources and safe havens for propagation of such resources
4. Microclimatic functions
5. Carbon store and carbon sequestration
6. Nitrogen fixing
7. Biodiversity
8. Recreational, cultural and aesthetic services

SERVICES NOT ACCOUNTED BY CSO FOR THE PURPOSE OF GDP

9. Provisioning of water and its recharge and purification
10. Prevention of soil erosion,
11. Regulation of flood control
12. Provisioning of nutrients through rivers and streams to enhance agriculture productivity
13. Storm protection services, particularly by mangroves
14. Safeguards against natural disasters
15. Provisioning of oxygen
16. Provisioning of grass and fodder
17. Provisioning of fruits, tubers and honey

<< Back to contents

TOTAL ECONOMIC VALUE

USE VALUE	• DIRECT USE VALUE • INDIRECT USE VALUE • OPTION VALUE
NON –USE VALUE	• BEQUEST VALUE • EXISTENCE VALUE
TEV	• USE VALUE + NON-USE VALUE

GOODS AND SERVICES PROVIDED BY DNP

DIRECT USE VALUE	• Fuel Wood ,Fodder, MFP , Ecotourism and Recreation
INDIRECT USE VALUE	• Carbon- Sequestration, Ecological Function , Enhancing Agriculture Productivity
BEQUEST VALUE	• Preservation and Conservation of Biodiversity of DNP for future generations

AREA STATEMENT OF DNP

Dudhwa National Park	District	Tehsil	Area (Ha.)
Dudhwa National Park	Lakhimpur-Kheri	Nighasan	49029.19
Buffer Area of National Park	Lakhimpur-Kheri	Nighasan	19003.71
Kishan Pur Sanctuary	Lakhimpur-Kheri	Gola	18617.70
Kishan Pur Sanctuary	Shahjanpur	Powayan	1723.30
Total			88373.90

BIODIVERSITY IN DNP

- Mammals ; 47 species
- Birds:449 Species
- Reptiles : 35
- Fish: 79
- Amphibians: 5
- Invertibrates:114
- Plant: 276 including 91 tree, 77 Shrubs, 31 Herbs, 30 Grasses, 28 Hydrophytes, 6 Pteridophytes, 16 Algae, 12 Fungi and 5 Bryophytes

TECHNIQUES USED FOR VALUATION OF ECOSYSTEM SERVICES

- Market Price Method
- Travel Cost Method
- Cost-Based Valuation Method
- Opportunity Cost Valuation Method

TOTAL ECONOMIC VALUE OF DUDHWA NATIONAL PARK

Goods/Services	Annual Monetary Cost (Rs.)	%
Fuel wood extracted from DNP	155989920 or 155.98 million	12.52
Fodder and Grazing from DNP	228169028 or 228.16 million	18.32
Minor Forest Produce extracted from DNP	52411633 or 52.41 million	4.20
Carbon Sequestration from DNP	363323160 or 363.32 million	29.23
Ecotourism/Recreation from DNP	49981000 or 49.98 million	4.01
Ecological Functions from DNP	55145251 or 55.14 million	4.43
Bequest Value of DNP	339918931 or 339.91 million	27.30
Monetary Value of Agricultural Productivity	0	0
Total Economic Value (TEV)	1244938923 or 1244.94 million	100

<< Back to contents

CONCLUSION

- DNP provides goods and services to the society equivalent to Rs. 1244.93 million per annum. (Assessment Year 2006)
- DNP contributes largely towards carbon sequestration(29.18%) followed by bequest value (27.31%) and other direct and indirect use value such as fodder & grazing (18.33%), fuel wood (12.53%), MFP (4.21%), recreation (4.01%) and ecological function(4.43%) of Total Economic Value.
- Direct Use value (Fuel Wood, MFP, Fodder & Recreation contributes around 39%
- Carbon Sequestration contributes around one third Value (29.23%).
- Bequest Value also contributes around one fourth (27.30%).

CONCLUSION

- DNP contributes very little (2.78%) towards enhancing the agriculture productivity in adjoining fields to DNP that is counter mounded due to damage by wild animals
- DNP Contributes one third for direct value, one third for indirect value and one third for non-use value.
- HP Forest contributes around 61% monetary value for Soil and Water Conservation. It indicates that mountain ecosystem contributes largely towards soil and water conservation. (Verma 2000)

CONCLUSION

- Gir Forests contributes around 30% towards enhancing agriculture productivity in the adjoining agriculture fields. The contribution of dry deciduous forests is maximum for enhancing agriculture productivity in the adjoining agriculture fields. (Pandya 2001)
- The Economic Value of Forest Ecosystem depends upon type of flora and fauna , and geography of the area. The economic value of Forest Ecosystem may be apply in same kind of areas.
- DNP contributes Rs. 1244.93 million per annum to the society. The managers of DNP may project this contribution while submitting budgetary demand so that policy makers could be convinced to provide adequate financial allocation and other resources such as HR for the protection and preservation of this ecosystem.

CONCLUSION

- India has 16 types of forest ecosystem. Study for each ecosystem may provide basis for contribution of forest ecosystem towards GDP.
- Policy makers may use the total economic value of forest ecosystem for taking administrative, legal and financial decisions for the improvement in the management, protection and conservation of biodiversity exists in DNP considering its economic benefit to the society.

LIMITATIONS

- Data collected in 2006 and presented value is for 2006
- DNP contributes more ecosystem services but for the purpose of estimation of TEV, only 8 services are taken into consideration.
- Royalty of Timber from FC has been taken instead of open market rates

<< Back to contents

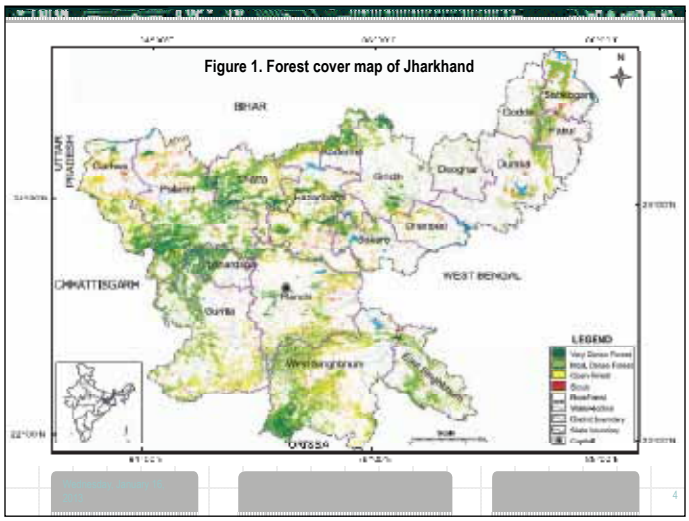
INTRODUCTION

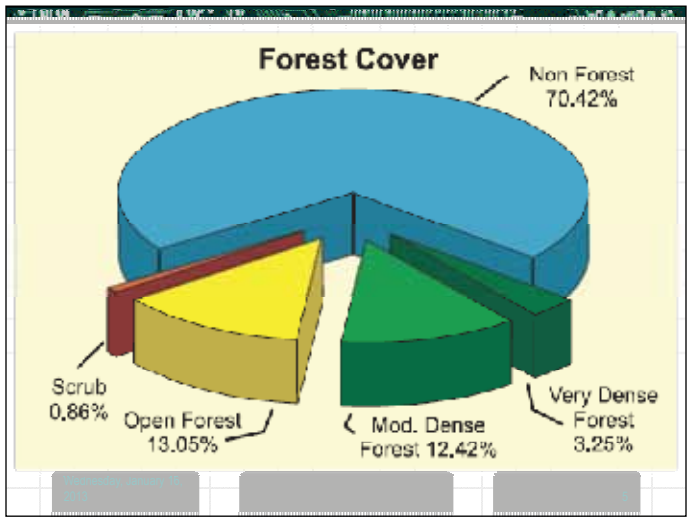
- After the moratorium imposed by the Supreme Court of India on green felling of timber, non-timber forest products of commercial importance such as leaves of *Diospyros melanoxylon* Roxb. have gained prominence as source of revenue from forests.
- Variously referred as kendu or tendu leaves used for wrapping bidis, popular as country cigarettes is one of the most important nationalized non-wood forest products constituting not only a large domestic market within the country but export material to Pakistan, Sri Lanka, Nepal and UAE.
- The wide-scale use of Diospyros melanoxylon leaves in bidi industry is mainly based on their enormous production, agreeable flavour, texture, workability, flexibility, resistance to decay and capacity to retain fires.

VARIATION IN LEAVES

- Large-scale variation is encountered in the morphological characters on which leaves, are selected and categorized for bidi making i.e., size, thickness of leaves, texture, relative thickness of midrib and lateral veins.
- Production of leaves and the length of collection season also vary in different localities.
- The variability in the leaf quality and productivity may be due to genetical and/or environmental factors while management especially pruning of trees also plays an important role.
- Quality and productivity of kendu leaves in 135 permanent plots laid in four agro-climatic zones in Jharkhand to record significant influence of climate, soil characteristics and management practices.

<< Back to contents





Items	Jharkhand	India	Jharkhand as % of India
Geographical Area	79714	3287263	2.42
Reserved Forest	4387.2	399919	1.10
Protected Forest	19184.78	238434	8.05
Un-Classified Forest	33.49	136387	0.02
Recorded Forest Cover (Total of item 2 to 4)	23605.47	774740	3.05
% of Forest Area to Goegraphical Area	29.61	23.57	

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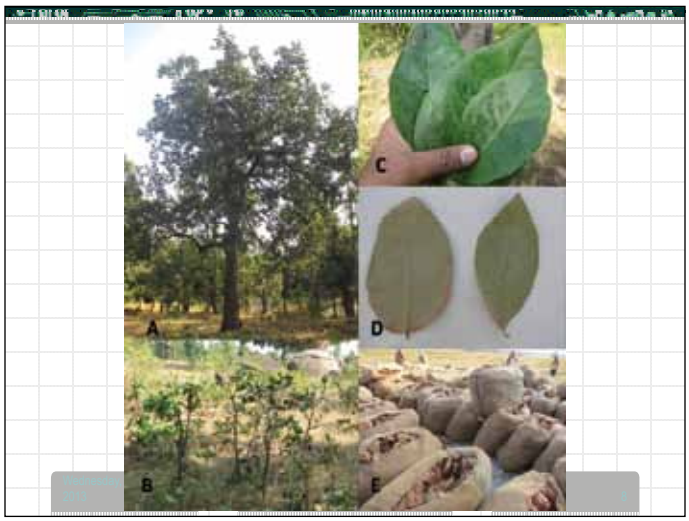
THE SPECIES

- The leaves are obtained from kendu tree (Diospyros melanoxylon Roxb.)
- Family Ebenaceae
- endemic to Indian sub-continent.
- *D. melanoxylon* (inclusive of *D. tomentosa* and *D. tupru*) is one of the most characteristic trees of the dry deciduous forests throughout India, covering the entire Indian peninsula (Troup, 1921).
- the area of distribution extends upto Nepal in sub-Himalayan tracts including the Indian plain, Gangetic plain, Madhya Pradesh, Maharashtra, western coast upto Malabar and Eastern coast upto Coromandel.
- The plant is also met with on the Nilgiris and Serawalli hills in the south.



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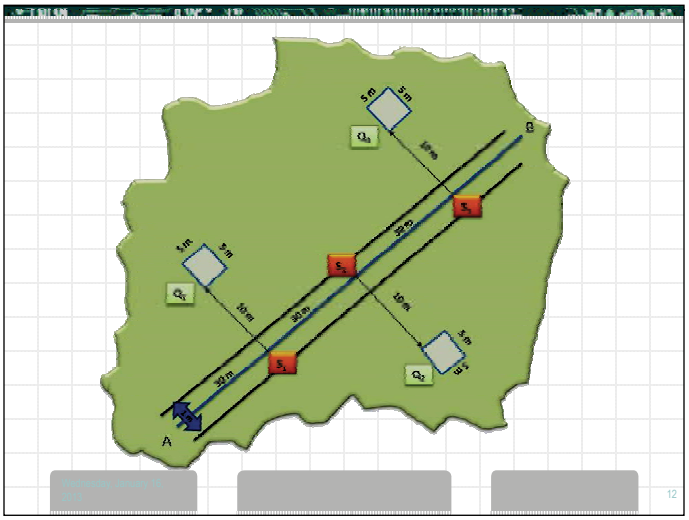
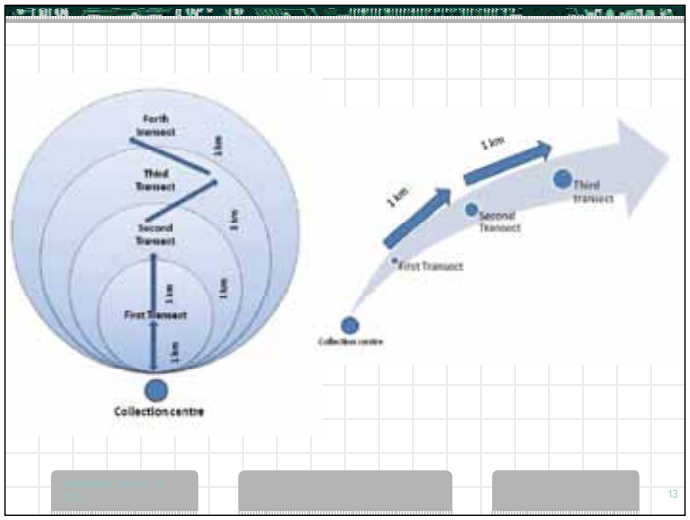
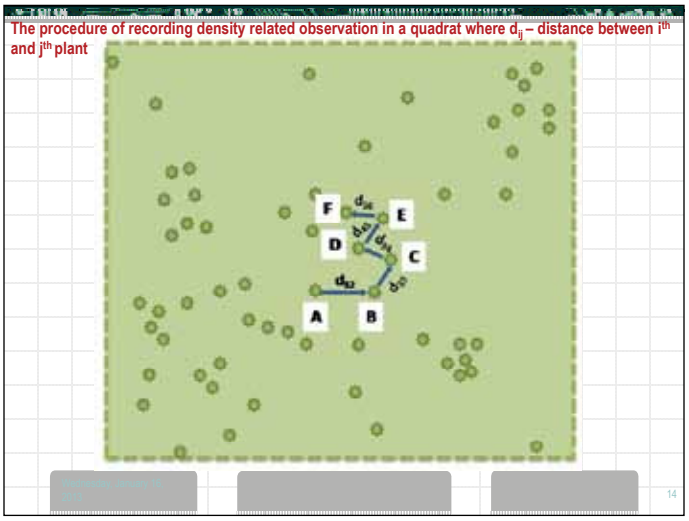
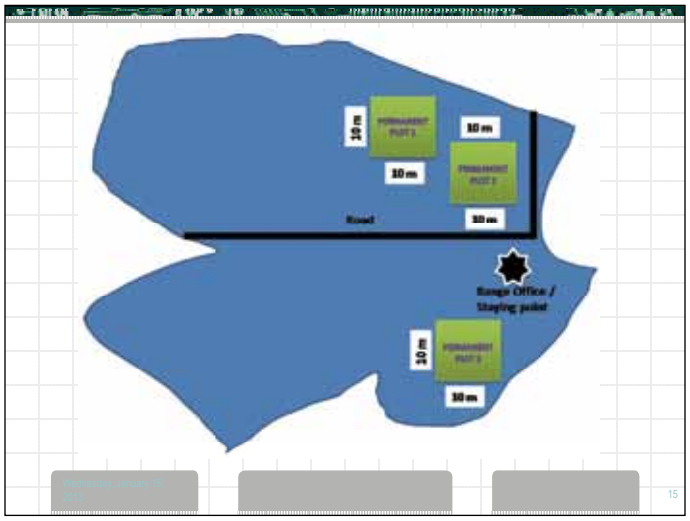


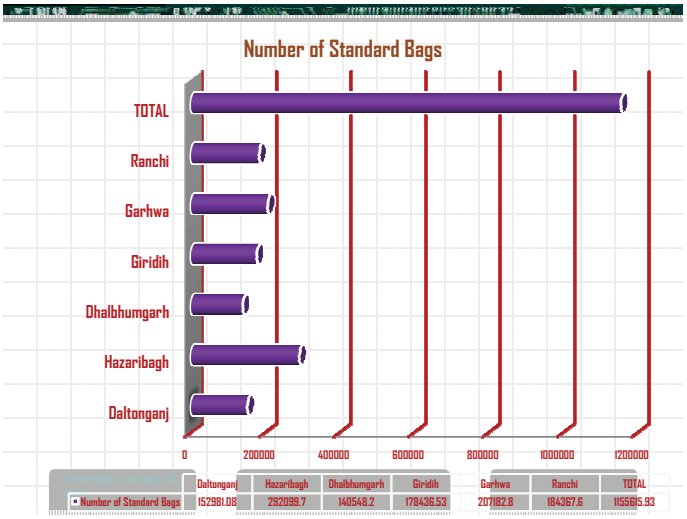


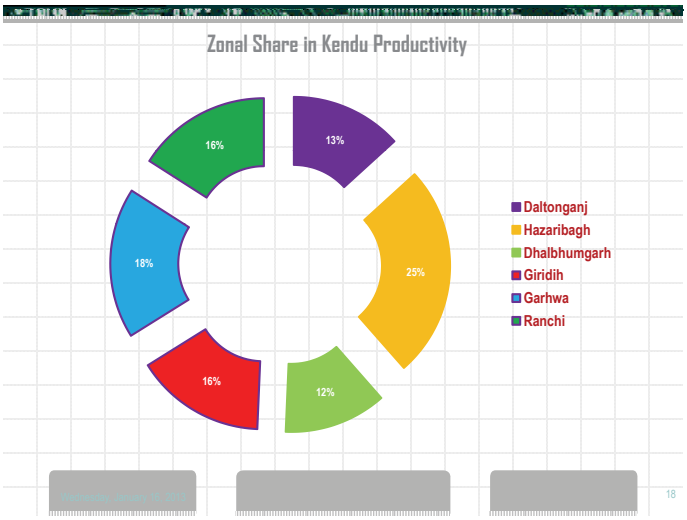


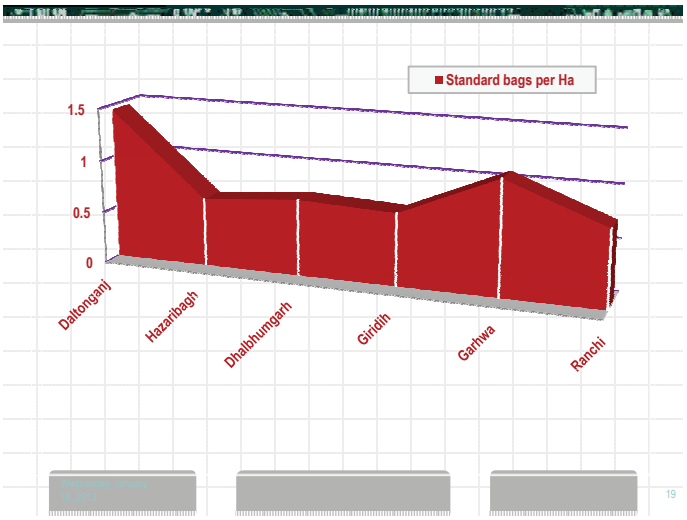


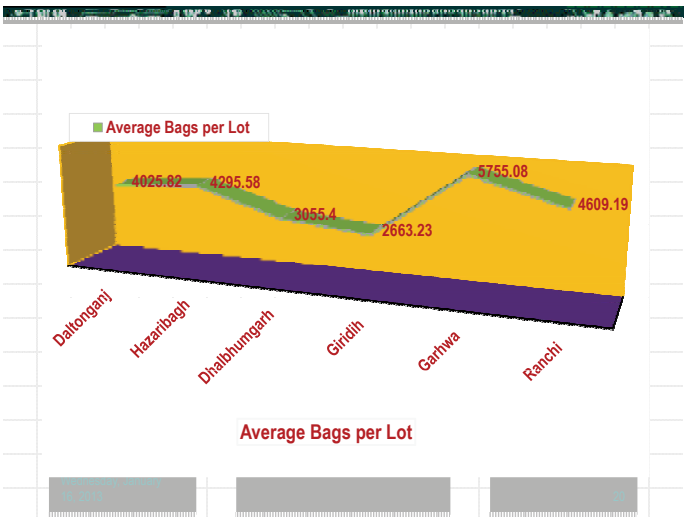
<< Back to contents

ZONE	Number of Standard Bags	Area under Kendu	Standard bags per Ha
Daltonganj	152981.08	105718.90	1.45
Hazaribagh	292099.70	451450.45	0.65
Dhalbhumgarh	140548.20	192104.00	0.73
Giridih	178436.53	259330.80	0.69
Garhwa	207182.80	188650.45	1.09
Ranchi	184367.60	252428.98	0.73
Total	11,55,615.93	1449683.58	









<< Back to contents

CONCLUSIONS

- Wide variation in kendu leaves productivity in 5 administrative zone in Jharkhand.
- Climatic conditions score over edaphic factors in qualitative characteristics of The leaves.
- Management especially pruning of plants enhances leaf quality.
- Genetic Improvement for qualitative characteristics is essential.

<< Back to contents

Effect of Growth Retardant on Mulberry (*Morus alba* L. S_{146} Genotype) Foliage for Improvement

By

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Botany Division

Forest Research Institute, Dehradun

Mulberry (*Morus alba*)

Mulberry leaves are the sole feed of domesticated silkworm known as *Bombyx mori.* The leaves that are fed must be rich in protein and moisture content for high quality silk production.

Mulberry genotype S_{146}

Variety evolved by CSR&TI Berhampore and is suitable for sub-tropical areas of hills. Leaf yield per ha per year is around 25 mt.

Need of the Study

The study was mainly focused on

1. how to improve moisture retention capacity of leaves? and
2. how to improve protein, chlorophyll and mineral content of leaves? so that shell wt. of cocoons is increased and ultimately the silk filament length.

Plant Growth Retardants (PGRs)

1.PGRs are capable in improving foliage because they suppress the elongation of stem, intensify green colour of leaves & indirectly affect flowering.

<< Back to contents

2.They retard the lengthening and division of cells in vegetative tissues & control growth without causing any damage.

3. Their use is known to reduce unwanted longitudinal shoot growth without lowering plant productivity.

4. Most PGRs act by inhibiting GA bio-synthesis.

5. They increase assimilation rate of plants and direct its movement to leaves thus increase in production and quality of foliage.

CCC (2-chloro ethyl trimethyl ammonium chloride)

1. **Easily available, simple, easy to use.**
2. **Requires in small quantity.**
3. **Cost effective.**
4. **Work done by Lee, J.W. (1980) to improve mulberry foliage by foliar spray of CCC stated that chlorophyll content was increased in all treated leaves.**

Objective

To find out the suitable dose of CCC that can bring quantitative and qualitative improvement in mulberry foliage (*Morus alba* L. Genotype S_{146})

Experimental Plot 1

Bush mulberry (*Morus alba*) experimental plot (spacing 3' x 3')

Experimental Plot 2

Tree Mulberry (*Morus alba*) experimental plot (spacing 10' x 10')

Pruned Mulberry Bushes & trees

Doses of CCC used

- 10 ppm
- 100 ppm
- 500 ppm
- 1000 ppm

Sticker used

Agrowet 101

<< Back to contents

Methodology Used

1. Foliar spray by sprayer.
2. Spray was done in both bush and tree plants.
3. Spray was done during Jan.& Feb. to get foliage for Spring crop rearing (March/April) & July to get foliage for Autumn crop (Sep./Oct.).
4. Two controls one with water & other with water and agrowet were maintained.
5. Agrowet was used in all CCC concentrations.
6. Leaves were harvested after 40-50 days of spray both for bio-chemical analysis and feeding silkworms and also morphological observations.

Growth Parameters

Data on growth parameters of randomly selected 3 plants from each replication of bush & tree plots were recorded on

- Shoot length
- Leaf area
- No. of branches per plant
- Internodal distance
- Leaves/shoot
- Leaf yield
- Fresh wt of leaves
- Moisture content in leaves
- Moisture retention capacity (%)

Bio-chemical analysis of leaves

Bio-chemical analysis was done to get values of the followings:

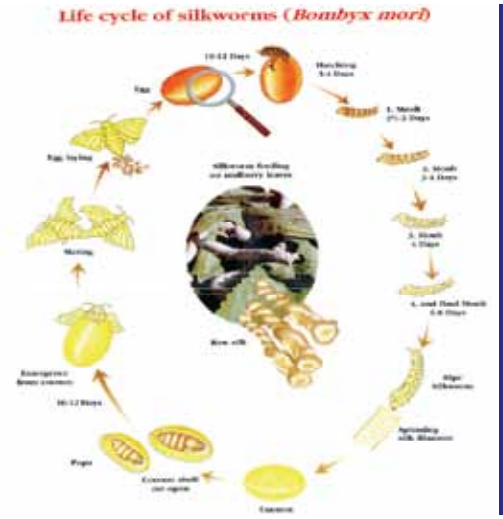
- Chlorophyll content (a, b & total)
- Sugar % (reducing, non-reducing & total)
- Crude fibre %
- Protein %
- Mineral (N,P,K, Ca, Mg)

Bioassay

Mulberry leaves of bush and tree plants of similar treatments were mixed together and fed to Silkworm larvae in both the rearing seasons i.e. Spring and Autumn.

Data on the followings were recorded:

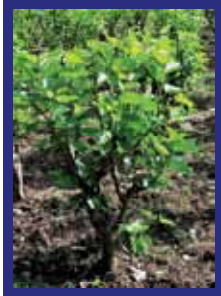
- Cocoon yield (by wt. and by number).
- Single cocoon and shell wt.
- Shell %
- Filament length (m)



[<< Back to contents](#)

Impact on Bushes

Dark green leaves, more foliage



Impact on Trees

Dark green leaves, more foliage

Dark Green Colour of Leaves:

The leaves treated with CCC were found more greener and thick than control. The dark green appearance of leaves is correlated with increased chlorophyll content. The thickness of leaves and the ratio of palisade to spongy parenchyma are found to be related to moisture conservation and net assimilation rate which contribute to the quality of leaves (Hesketh *et al.* 1985). Growth Retardants cause cells to be smaller with denser cytoplasm (Appleby *et al*. 1966). This makes the leaves thicker and darker in colour.

Reduction in Shoot Length

1. Reduction in shoot length recorded in all plants treated with CCC.
2. Growth Retardants inhibit the biosynthesis of gibberellins which may be the possible reason for retardation of shoot elongation (Kende and Lang, 1963; Dicks *et al.* 1973).
3. Reduction in shoot height may be due to inhibition of cell division and cell elongation (Sochs *et al*. 1960).
4. Reduction in shoot elongation results into reduction in inter-nodal distance which leads to more number of leaves.
5. Growth Retardants partly enhance the apical dominance which results in production of more branches and hence greater number of leaves

Reduction in Internodal Distance

1. Reduction in internodal distance was observed in all plants treated with CCC, which was the impact of reduction in shoot length.
2. Reduction in internodal distance has ultimately led to more number of leaves.
3. The change in branching habit of plant or lateral branch development by CCC may possibly be due to stimulation of breaking up of apical dominance thereby changing the auxin balance which is the controlling factor for apical dominance

Decrease in Leaf area

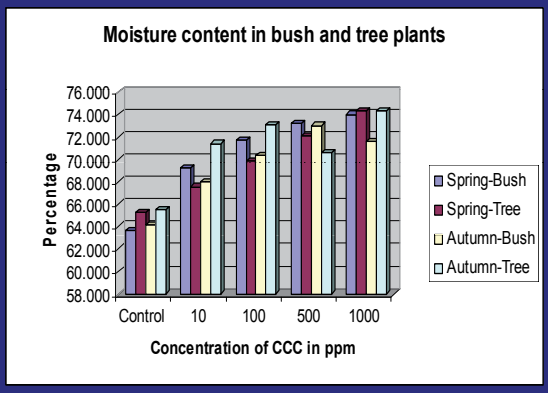
1. No increase in leaf area was recorded due to CCC treatment. It is in accordance with the findings of Lee (1980), who studied the effects of foliar spray of CCC on the growth of mulberry.

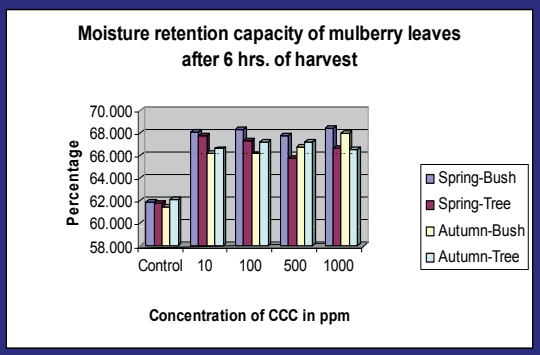
1. It is reported that the overall development of leaves is subdued initially by growth retardants which are subsequently compensated by over production.

<< Back to contents

Higher Leaf Yield

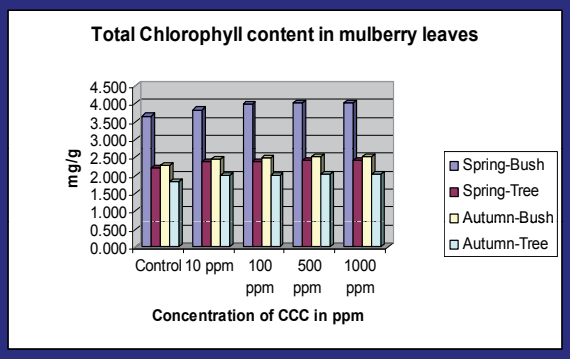
1. Increase in leaf yield can be attributed due to collective impact of decrease in shoot length, internodal distance and increase in branches caused by CCC.
2. The significant increase and improvement in number of branches by CCC treatments at different concentrations may be due to the photosynthetic active radiation penetration in crop canopy (Dyson and Humphries, 2008).
3. Moreover application of growth regulators stimulates the water uptake (Devlin and Witham, 1986 b), the protein and free aminoacid contents (Santosh Kumari *et al.* 1990) and increases the sugar and starch contents (Paleg, 1960; Devlin and Witham 1986) which ultimately contributed to the yield and other mulberry growth parameters.





Improvement in Moisture Content

1. Increased moisture & moisture retention capacity was observed in all CCC treated leaves.
2. It may be because GRs cause a favourable change in Relative Water Content and leaf water potential and maintain water status and play a role in improving the plant water status, which in turn improve its palatability for silkworm.
3. Higher moisture retention value may be due to lower number of stomata per mm^2, thick cuticle, maximum thickness of upper and lower epidermis and maximum thickness of palisade tissue as observed by Geok and Dunn (1975).



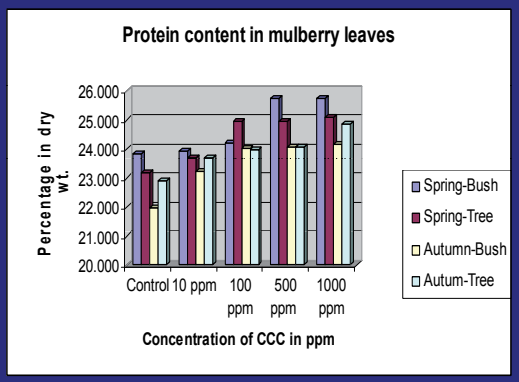
Higher Chlorophyll Content

1. Higher chlorophyll content was recorded in all mulberry leaves treated with CCC.
2. This may be due to increase in protein synthesis and biological activity. Level of chlorophyll is one of the criteria for quantifying the photosynthetic rate.
3. The increased amount of chlorophyll content in leaves indicates the photosynthetic efficiency.
4. The improvement in chlorophyll content might be due to synergistic interaction of growth retardant i.e. CCC.
5. Lee (1980) reported that foliar spray of CCC increases chlorophyll content in mulberry.

<< Back to contents

Higher Carbohydrate Content

1. Higher carbohydrate content was recorded in all mulberry leaves treated with CCC.
2. It is because CCC pronounced influence on biosynthesis of carbohydrates in the leaves.
3. Paleg (1960), Develin and Witham (1986) also reported increase in sugar and starch content, which ultimately increased the quality and yield of mulberry.
4. In mulberry leaves, carbohydrates are available in plenty and it was reported to be the chief source of energy and for synthesis of lipids and amino acids for silkworm (Hiratsuka, 1917 and Horie, 1978).

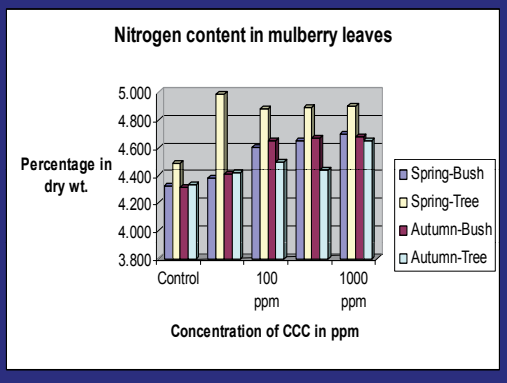


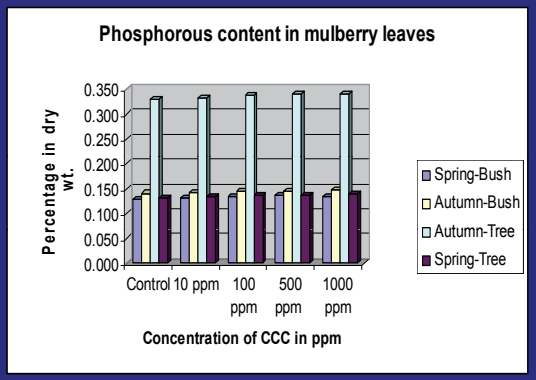
Higher Protein Content

1. It is reported that about 70% of the silk protein produced by silkworm are directly derived from the protein of mulberry leaves (Krishnaswami *et al*. 1970; Petkov and Dona, 1979).
2. Protein and amino acids are the two major components required by silkworm for synthesis of silk.
3. Increase in protein content is due to impact of CCC in enhancing photosynthetic efficiency and thereby enhanced protein synthesis & biological activity.

Higher Mineral Content

1. Significant increase was recorded in total mineral content in all leaves treated with CCC.
2. Because growth retardants influence the active metabolic state of plants, better uptake and greater accumulation.
3. Halevy, 1966 stated that greater number of palisade cells and fewer inter-cellular spaces in the leaves treated by GRs tend to decrease rapid water loss or increase the efficiency of water movement. Such an influence on water movement may extend to roots leading to reduced transpiration but increased salt accumulation.





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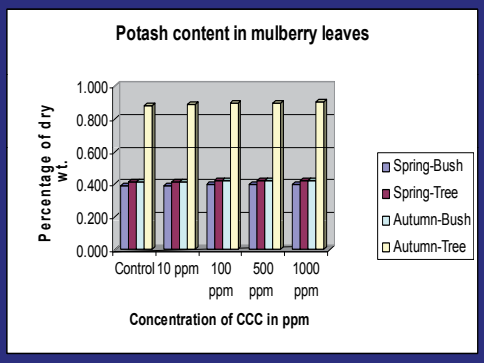

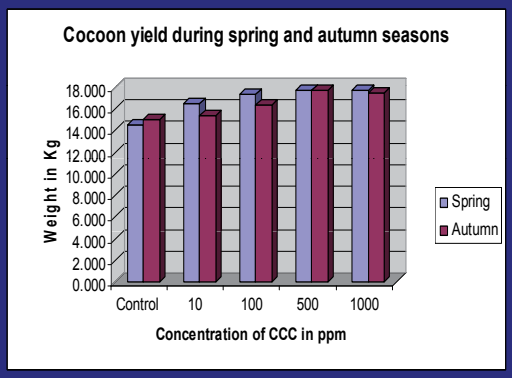

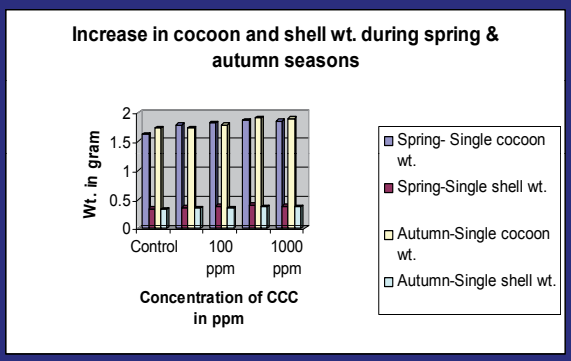

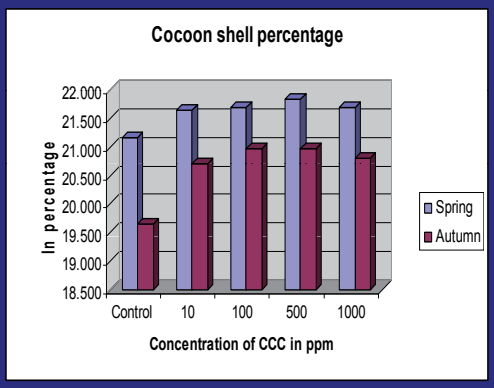

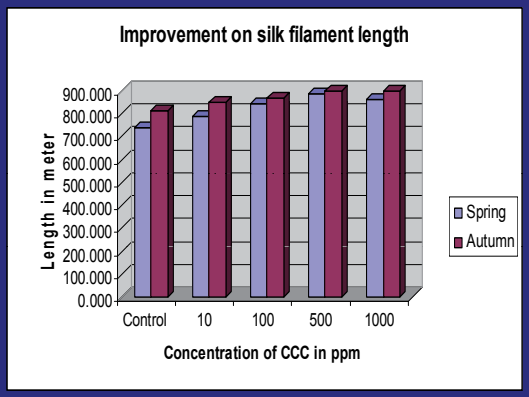

Bioassay

Improvement in Cocoon, Shell weight and Filament Length

1. The increment in cocoon yield was mainly due to the efficiency of CCC to enhance the growth, metabolism and physiological activity of the host plants, with the result leaf quality was improved and due to the reason improvement in silkworm growth and cocoon characters were observed.
2. The increased cocoon weight might be due to the influence of plant hormone on foliage nutrients, and absorption of the plant material by silkworm as suggested by Newman (1982).

<< Back to contents

3. The phagostimulatary properties of CCC might be due to β-sitosterol and its glucoside campesterol, stigmasterol, betulin, urolic acid and saponin composed of oleanolic acid, glucose and galactose.
4. The effects of CCC on the silkworm could be mediated either by a direct effect of CCC on the metamorphosis of the insect or indirectly by its influence through mulberry foliage.
5. It is reported that varieties possessing higher nitrogen and amino acid contents in leaves are nutritively superior and positively related to growth and development of silkworm (Machii and Katagiri, 1991).

Summary of the results (% increase over control)

SN	Parameters	Season			
		Spring		Autumn	
		Bush	Tree	Bush	Tree
1	Increase in leaf moisture	16.25% (1000 ppm)	13.99% (1000 ppm)	13.80% (500 ppm)	13.39% (1000 ppm)
2	Increase in leaf moisture retention capacity after 6 hrs of harvest	10.52% (1000 ppm)	9.70% (10 ppm)	10.59% (1000 ppm)	8.31% (100 ppm)
3	Increase in leaf yield/plant	5.03% (1000 ppm)	20.90% (1000 ppm)	15.24% (1000 ppm)	16.05% (1000 ppm)
4	Increase in total leaf chlorophyll	10.20% (1000 ppm)	9.41% (1000 ppm)	11.49% (1000 ppm)	11.23% (1000 ppm)
5	Increase in leaf protein	8.10% (500 ppm)	8.15% (1000 ppm)	9.94% (1000 ppm)	8.47% (1000 ppm)
6	Increase in leaf mineral content	2.31-3.85% (mixed)	2.20 - 3.85% (1000 ppm)	1.10-2.12% mixed	1.65-3.03% (1000 ppm)
7	Increase in total sugar content	5.82% (1000 ppm)	7.32% (1000 ppm)	6.81% (1000 ppm)	6.67% (1000 ppm)
8	Improvement in cocoon yield	22.08% (500 ppm)		17.28 % (500 ppm)	
9	Improvement in shell %	3.11 % (500 ppm)		6.63% (500 ppm)	
10	Improvement in filament length	20.43% (500 ppm)		10.20 % (500 ppm)	

Conclusion

1. **Significant increase has been observed in cocoon production, shell percentage and silk filament length with all CCC treated leaves fed to silkworms.**
2. **Significant increase in cocoon production ranged from 17.28% to 22.08% with 500 ppm in both the seasons. Higher significant increase in cocoon shell percentage (ranging from 3.11% to 6.63%) is also found with 500 ppm in both seasons.**
3. **Increased silk filament length is also observed in 500 ppm (ranging from 10.20% to 20.43%) in both the seasons.**

It can be concluded that CCC as a growth retardant is capable of improving mulberry foliage both quantitatively and qualitatively. All concentrations used are effective in improving the nutrients. Though 500 ppm concentration is capable of bringing higher significant improvement in mulberry foliage in both bushes and trees that too in both of the seasons i.e. spring and autumn but **higher significant results in cocoon yield and silk filament, the ultimate end product is achieved with 100 ppm**. Farmers can use 10 to 100ppm of the concentrations of CCC for better silk production and ultimately maximum economic gain.

So, CCC can be used as a tool to improve the quality and quantity of mulberry foliage for production of good quality silk

<< Back to contents

Melia composita – Status and future scope under agroforestry in Punjab

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Introduction

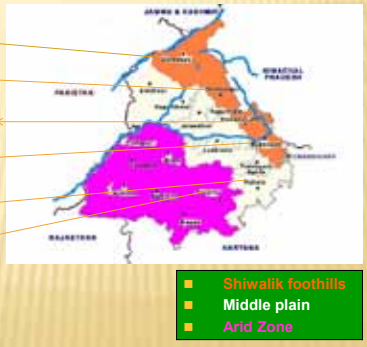
- Medium to large size deciduous tree of family Meliacae
- An Indonesian species usually cultivated in Africa and Australia and known as White Cedar or Ceylon Maghony
- The trade name of the species in India is Mahabar Neem
- In north India popularly known as Burma Drek or Burma Neem
- The species can be grown easily in rainfed areas also under different agroforestry system
- The wood of this species is useful for packing cases, cigar boxes, ceiling planks, building purposes, agricultural implements, pencils, match boxes etc. In Sri Lanka, it is used for outriggers of boats. It is also suitable for musical instruments, tea boxes and plyboard.

Material and methods

1. Survey

District s surveyed:

- Gurdaspur
- Hoshiarpur
- Nawashahar
- Rupnagar
- Patiala
- Sangrur



<< Back to contents

2. Experimentation

Experimental plots were laid in Handesra (distt. Mohali) and Hukran (distt. Hoshiarpur) to observe performance of *Melia composita* with wheat and maize

3. Awareness programme

Awareness programme on agroforestry with special reference to *Melia composita* was done in Village Handesra and Hukran and feedback for future plantation of the species was collected.

Findings

Category of Land holders (farmers)

District	Category of farmers (%)		
	Small (< 5 ha)	Medium (5 to 10 ha)	Large (> 10 ha)
Hoshiarpur	30	45	25
Gurdaspur	35	35	30
Sangrur	28	32	40
Patiala	25	40	35
Rupnagar	28	44	28
Nawashahar	30	40	30
Average	29.33	39.33	31.33

Farmers on adoption of *M. composita* in 6 districts

Category of farmers	Adoption of *M. composita* (%)					
	Hoshiarpur	Gurdaspur	Sangrur	Patiala	Roopnagar	Nawashahar
Small	37	32	36	36	34	35
Medium	38	42	40	41	42	37
Large	22	23	26	25	24	30

Farmers adopted different geometries of plantation

District	Geometry of plantation (%)			
	Scattered	Boundary	Block	Mixed plantation
Hoshiarpur	54	12	24	7
Gurdaspur	57	11	26	8
Sangrur	56	14	27	9
Patiala	50	13	23	6
Roopnagar	56	12	24	5
Nawashahar	60	10	26	10

Overall adoption of *Melia composita*

Category of farmers		Adoption of *M. composita* (%)
Small	(Less than 5 ha)	35%
Medium	(5 – 10 ha)	40%
Large	(More than 10 ha)	25%

Adopted Geometry of plantation

Geometry	%
Boundary plantation	**12%**
Block plantation	**25%**
Mixed plantation (Toon & Eucalyptus)	**7.5%**
Scattered	**55.5%**

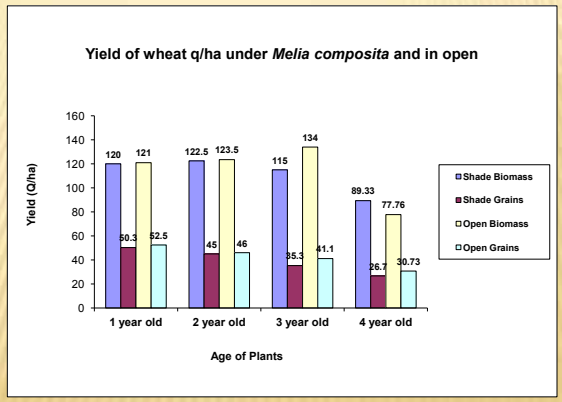
Observation of Research

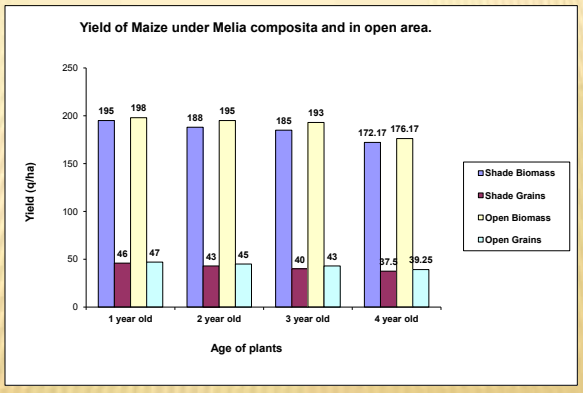
Performance of *Melia composita* under Agroforestry

Age (Years)	Girth (cm)	Height (m)
1	15.00	3.00
2	25.50	7.00
3	32.00	13.00
4	65.50	14.22

<< Back to contents

Melia composita on farmers land





Agroforestry based on *Melia composita*

Conclusion

- A fast growing species and can easily be grown both under irrigated and rainfed conditions.
- Found to be survived in Domat and Sandy soil.
- No major insect attack has been observed on the species.
- Widely acceptable under all types of agroforestry systems.
- Combination with agriculture crops found suitable specially with wheat and maize.
- Not found suitable with paddy crop.
- During awareness programme all farmers desired to take seedling of *Melia composita* for their agricultural fields.
- After getting the performance of plants in experimental plots, they are coming forward to adopt the species on their agricultural fields.

<< Back to contents

Evaluation of growth and soil fertility status in *Dalbergia sissoo – Zea Mays* (Silvi-Agri) agroforestry system

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Introduction:

- Agri-silviculture is quite useful system because this is not only utilizes water efficiently but meets the basic requirements of fodder, fuelwood, pulp and green manure for agricultural crops.
- Shisham is a fast growing long lived tree. During early growth up to 3-4 years arable crops can easily be grown economically.
- *D. Sissoo* can successfully be grown in combination with variety of crops Viz. grasses, agriculture and fruit crops. It is suitable to grow as windbreaks, shelterbelts and soil conservator. Being a leguminous tree it grows well in poor soil and improves soil fertility.
- It is the combination of silvicultural, agricultural, and other land use technologies so that their joint application will increase productivity, sustainability, or equity or achieve other social goals. Positive and negative interactions occur in Agro forestry systems. The balance between these positive and negative effects determines the overall effect of the interactions in a given Agro forestry combination.

Experimental Methods:

1. After site preparation, Laying out and establishment of OSR trial at the TFRI, Jabalpur experimental plot.
2. One year old *Dalbergia sissoo* seedlings were planted in 21 plots (size 10m x 10m each) at 3 different spacing of 4m x 4m, 5m x 5m and 6m x 6m and 3 plots were kept as blank outside the plantation area. Hybrid maize seeds were also sown at a spacing of 60cm x 20cm with tree to crop line spacing of 60cm and 120cm as per design, i.e. Randomized Block Design.
3. Soil samples analyzed after collected from each RBD block at the time of planting and harvesting of maize crop and the pH, E.C., Organic carbon, Available N,P,K, and Ca++, Mg++ was determined as per standard procedures prescribed by Jackson (1973), Piper (1950).
4. Growth parameter i.e. Collar diameter and height of each *Dalbergia sissoo plant* was recorded at the time of planting and harvesting of maize crop.
5. After matured agriculture crop harvesting and collection of maize corn and stalk from each spacing. Weighing and calculation of corn yield and stalk yield of maize crop.

<< Back to contents

Table 1.- Soil properties of the experimental site before planting of *D. sissoo* tree species.

Block & spacing				Available Nutrients(Kg ha^{-1})			Exch. Cations (m.eq./100g soil)	
Tree to Crop Line 60cm spacing blocks	pH (1:2.5)	E.C. (M Mhos/cm)	Organic Carbon (%)	N	P_2O_5	K_2O	Ca^{++}	Mg^{++}
A- 4m x 4m	8.14	0.17	0.527	292.67	1.29	249.08	51.33	7.87
B- 5m x 5m	7.52	0.10	0.335	282.20	2.79	232.75	46.00	16.00
C- 6m x 6m	7.52	0.10	0.395	271.80	4.08	294.00	44.67	15.33
Tree to Crop Line 120cm spacing blocks								
D- 4m x 4m	7.65	0.09	0.681	282.20	1.72	236.83	40.40	18.40
E- 5m x 5m	8.26	0.10	0.356	271.70	1.72	253.17	38.53	27.07
F- 6m x 6m	7.78	0.09	0.583	303.10	1.29	294.00	45.73	12.80
Sole tree blocks								
G1- 4m x 4m	8.62	0.10	0.259	313.60	1.29	306.25	66.00	22.80
G2- 5m x 5m	8.54	0.10	0.387	313.60	1.29	257.25	66.40	15.20
G3- 6m x 6m	8.32	0.10	0.438	188.20	2.58	245.00	56.00	20.80
Sole crop blocks								
H1- 60x20cm	8.51	0.10	0.233	219.50	2.58	245.00	58.80	13.20
H2- 60x20cm	8.04	0.10	0.528	313.60	1.29	367.50	49.60	12.80
H3- 60x20cm	7.16	0.09	0.259	282.20	1.29	220.50	37.20	23.20

Table 2. Soil properties of the experimental site after harvesting of maize crop under different spacing of *D. sissoo* tree species.

Spacing				Available Nutrients (Kg ha^{-1})			Exch. Cations (m.eq./100g soil)	
Tree to Crop Line 60cm spacing	pH (1:2.5)	E.C. (M Mhos/cm)	Organic Carbon (%)	N	P_2O_5	K_2O	Ca^{++}	Mg^{++}
4m x 4m	8.03	0.32	0.71	324.00	2.37	331.06	86.80	24.13
5m x 5m	8.23	0.22	0.58	397.20	1.27	331.06	84.53	43.51
6m x 6m	7.97	0.23	0.69	303.13	1.49	318.80	75.60	31.60
CD (5%)	NS	NS	NS	NS	NS	NS	NS	NS
Tree to Crop Line 120cm spacing								
4m x 4m	8.25	0.29	0.86	324.00	3.23	322.90	88.93	31.20
5m x 5m	8.29	0.23	0.70	219.50	2.79	339.23	100.66	34.53
6m x 6m	7.98	0.25	0.85	240.40	3.86	380.10	83.60	34.80
CD (5%)	NS	NS	NS	64.877	NS	NS	NS	NS
Sole tree (Control)								
4m x 4m	8.29	0.20	0.71	250.80	2.60	355.60	118.00	26.40
5m x 5m	6.86	0.12	0.68	250.80	3.22	313.80	67.20	44.00
6m x 6m	6.94	0.23	0.83	219.50	4.50	330.10	69.60	29.60
CD (5%)	0.073	0.035	0.057	5.998	0.884	7.455	6.730	4.213
Sole crop (Control)								
60x20cm	7.75	0.26	0.67	261.30	7.07	343.33	87.60	40.40
CD (5%)	0.073	0.047	0.114	20.584	1.309	19.545	1.309	2.618

Table 3. Initial average growth parameter of *Dalbergia sissoo* tree species.

Tree Spacing	Tree to crop line 60 cm spacing		Tree to crop line 120cm spacing		Sole tree (Control)	
	Height (cm)	Collar Diameter (cm)	Height (cm)	Collar Diameter (cm)	Height (cm)	Collar Diameter (cm)
4m x 4m	161.95	0.906	175.07	0.959	185.55	1.108
5m x 5m	168.29	0.949	181.99	1.027	177.44	1.042
6m x 6m	167.25	0.922	166.00	0.972	170.00	0.925
Mean	**165.83**	**0.926**	**174.35**	**0.986**	**177.66**	**1.025**

Table 4. Average growth parameter of *Dalbergia sissoo* tree species after harvesting maize crop.

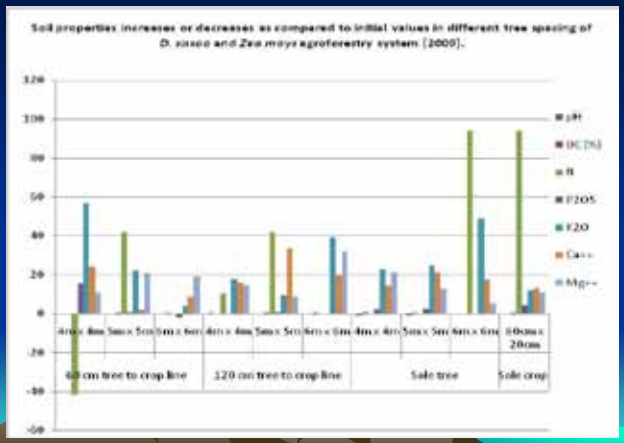
Tree Spacing	Tree to crop line 60 cm spacing		Tree to crop line 120cm spacing		Sole tree (Control)	
	Height (cm)	Collar Diameter (cm)	Height (cm)	Collar Diameter (cm)	Height (cm)	Collar Diameter (cm)
4m x 4m	175.81 (-9.48)	1.44 (+8.27)	189.81 (-2.27)	1.49 (+12.03)	194.22	1.33
5m x 5m	181.36 (-8.66)	1.53 (-3.16)	193.36 (-2.61)	1.58 (0.00)	198.55	1.58
6m x 6m	189.81 (+6.19)	1.55 (0.00)	182.75 (+2.24)	1.57 (+1.29)	178.75	1.55
Mean	**182.33**	**1.51**	**188.64**	**1.55**	**190.50**	**1.48**
CD (5%)	NS	NS	NS	NS	4.978	0.082

Data within the parentheses indicate percent (%) increase or decrease as compared to control (sole tree).

Table 5. Average fresh maize (*Zea mays*) yield (q ha-1) under different spacing of *Dalbergia sissoo* tree species.

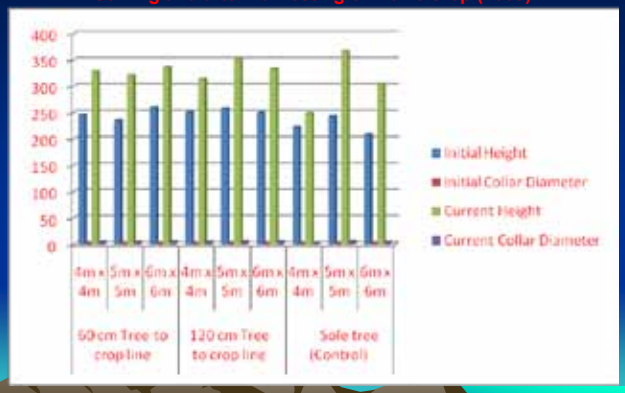
Tree Spacing	Tree to crop line 60 cm spacing			Tree to crop line 120 cm spacing		
	With cover Maize yield (q ha-1)	Without cover Corn yield (q ha-1)	Stalk yield (q ha-1)	With cover Maize yield (q ha-1)	Without cover Corn yield (q ha-1)	Stalk yield (q ha-1)
4m x 4m	34.82 (+37.14)	26.79 (+32.95)	41.69 (-24.65)	25.23 (-0.63)	20.15 (0.00)	48.52 (-12.31)
5m x 5m	53.70 (+111.50)	32.38 (+60.69)	62.00 (+12.05)	26.82 (+5.63)	21.49 (+6.65)	50.84 (-8.11)
6m x 6m	46.61 (+83.58)	37.63 (+86.75)	82.46 (+49.03)	25.49 (+0.39)	20.07 (-0.39)	50.37 (-8.96)
Sole crop (Control)	25.39	20.15	55.33	25.39	20.15	55.33
Mean	40.13	29.24	60.37	25.73	20.47	51.26
CD (5%)	1.611	0.525	1.426	0.997	0.762	0.589

Data within the parentheses indicate percent (%) increase or decrease with regard to control (sole crop).

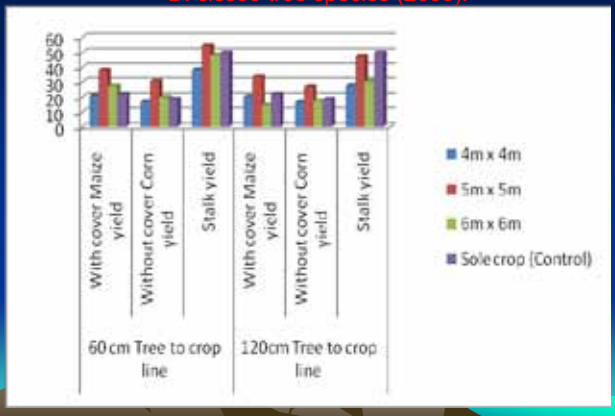


<< Back to contents

Growth Parameters of *D. sissoo* tree species at before sowing and after harvesting of maize crop (2009).



Average fresh maize yeild (q/ha) in different spacing of *D. sissoo* tree species (2009).



Significant achievements:

1. The soil pH initial ranged from 6.88 to 8.62 with an average of 7.90 which is slightly alkaline. It was found that soil pH gradually going down. Electrical Conductivity was also determined and it initial ranged from 0.09 to 0.20 m mhos/cm with an average of 0.11 m mhos/cm and after harvested maize crop it ranged from 0.12 to 0.42 m mhos/cm with an average of 0.25 m mhos/cm respectively.
   - The Organic Carbon, available nutrients (N, P, K) and exchangeable cations (Mg^{++} and Ca^{++}) were found in medium range except available phosphorus was found in all the sites in very low range.
2. The growth parameter of *Dalbergia sissoo* shows a regular increase both in height and collar diameter along with Maize crop in all the sites.
   - The maximum height increases (22.56 cm) and collar diameter (0.628 cm) were observed in spacing of 6m x 6m and 60cm tree to crop line spacing with regard to initial height.
3. The tree distance of 5m x 5m with 60cm crop line spacing proved the maximum yield of maize crop in *Dalbergia sissoo-Zea mays* (Agri-Silvi) agroforestry system.
4. The stalk yield of 82.46 qha^{-1} were found maximum in 6m x 6m spacing with 60 cm tree to crop line spacing respectively.

Site Preparation and design layout

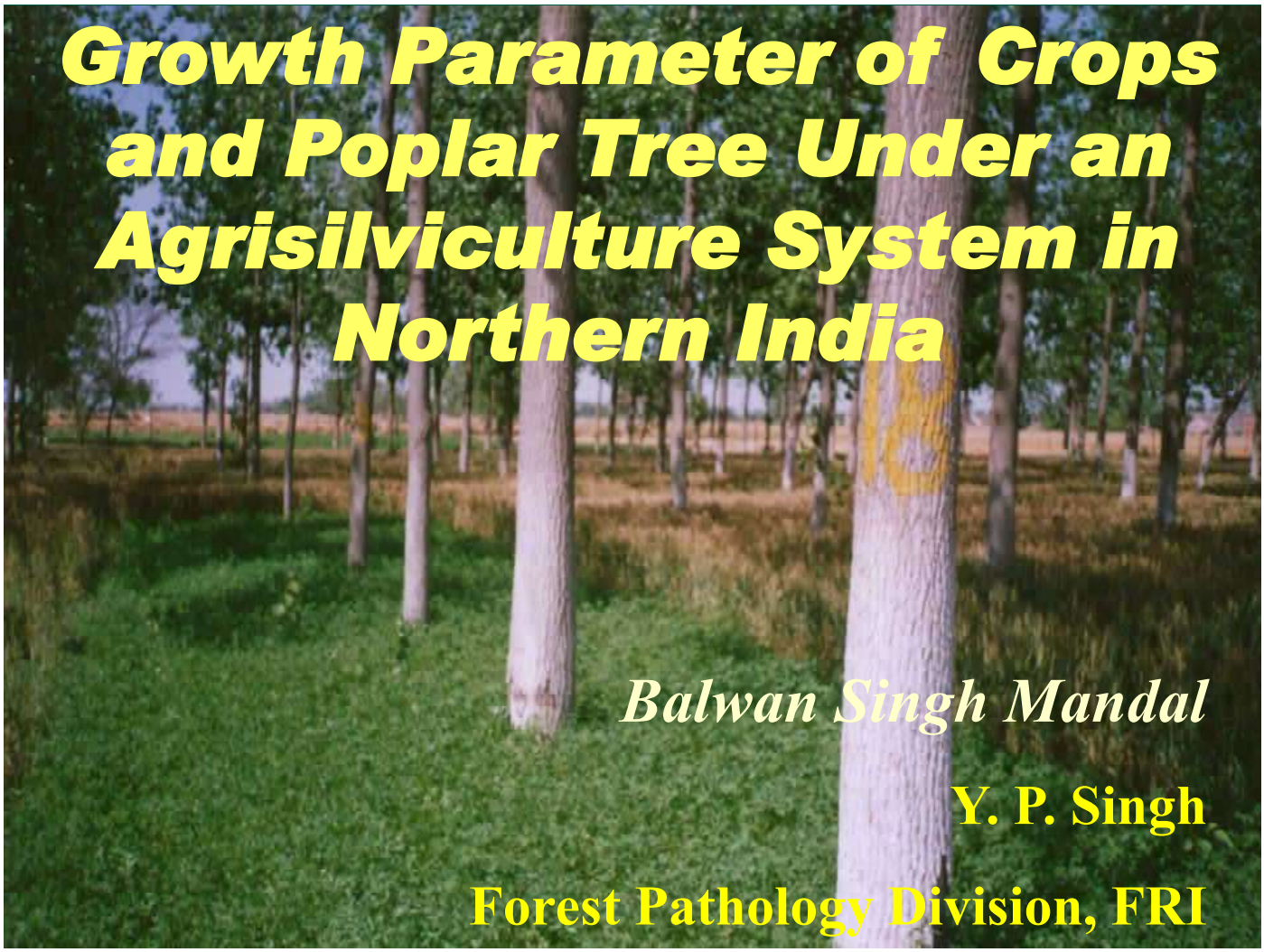
Planting of *Dalbergia sissoo* Sapling

Sowing of Maize Crop (Tree to crop line at 60cm & 120cm) as intercrop with *D. sissoo*

<< Back to contents

<< Back to contents

Growth Parameter of Crops and Poplar Tree Under an Agrisilviculture System in Northern India



Balwan Singh Mandal

Y. P. Singh

Forest Pathology Division, FRI

Need for an Agrisilviculture System

- **Need to increase in the tree cover area**
- **Better option for land diversification**
- **More return in terms of grain, fodder and wood**
- **Higher addition of organic carbon in soil**
- **System is ecofriendly, sustainable and remunerative**

Why Poplar?

- Short rotation tree
- Easy management practices
- Compatibility with agricultural crops like wheat, berseem, sorghum, sugarcane, potato, etc
- Deciduous during winter (better sunlight to rabi crops)
- Leafy stage during monsoon (shade to kharif crop)
- Shallow root system
- Mycotrophic in nature
- Fast nutrient recycling by decomposition and mineralization of leaf litter
- Contribution to environmental improvement and judicious use of resources
- A potential economic alternative

<< Back to contents

Objectives

- To study the growth pattern of crops and poplar tree

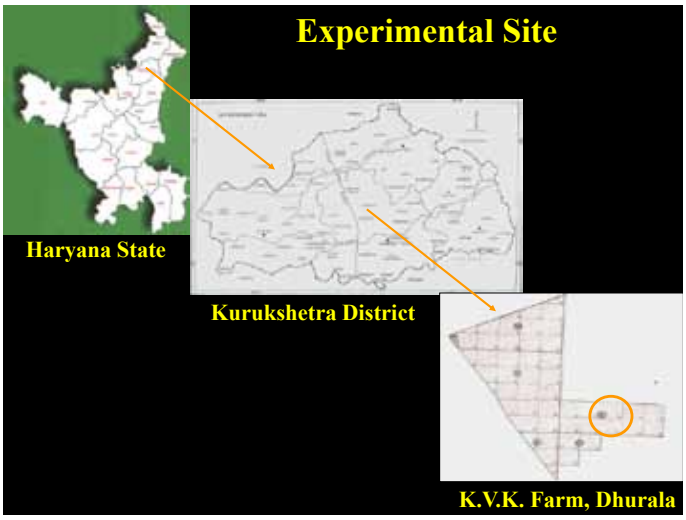
Location and Climate

- *Years of study*: 2001-2003
- *Site*: Farm Dhurala, Krishi Vigyan Kendra, Kurukshetra of Chaudhary Charan Singh Haryana Agricultural University, Hisar

Kurukshetra: It lies in the north eastern part of Haryana state.

- *Climate*: Of pronounced character i.e. very hot in summer (47°C) and remarkably cold in winter (4°C)

Average rainfall in the region is 700 mm. However, the rainfall of the district during 2001-2002 and 2002-03 cropping season was 400 and 452mm, respectively



Month wise Temperature (°C) and Rainfall (mm) at KVK Farm Dhurala, Kurukshetra

Month	Year					
	2001-2002			2002-2003		
	Temperature (°C)		Rainfall (mm)	Temperature (°C)		Rainfall (mm)
	Maximum	Minimum		Maximum	Minimum	
July	35.9	24.0	117.0	39.6	26.2	34.0
August	36.3	23.5	151.0	34.9	23.8	100.0
September	34.3	22.6	16.0	31.7	19.2	198.0
October	30.3	18.4	4.5	30.1	17.8	1.0
November	28.8	12.4	-	24.7	13.3	-
December	20.1	5.0	-	20.1	7.2	3.0
January	17.4	5.1	8.5	13.0	5.2	17.5
February	22.0	8.2	46.0	20.4	7.1	31.0
March	25.9	14.8	17.5	24.6	12.5	10.0
April	34.6	21.5	3.5	35.7	20.4	2.0
May	37.3	26.0	19.0	39.8	23.5	7.0
June	39.2	24.7	16.0	41.5	26.4	49.0

Experimental Details

Tree age: Four-year old G-48 clone (*Populus deltoides*)
Tree spacing and direction: 5x4 m, north to south
Crops: Rabi -Wheat (*Triticum aestivum L.*) variety PBW-343
Berseem (*Trifolium alexandrinum* L.) variety BL-1
Kharif - Sorghum (*Sorghum bicolor L. Moench*) variety HC-260
Dhaincha (*Sesbania aculeate L.*) variety local
Plot size: 12X5 m
Experimental duration: Two years (four-crop- season)
Number of treatments: 26 treatments/crop sequence
Check: Crop without poplar
Number of replications: Three replications
Design: Randomized Block Design (RBD)

Agronomic Schedules Followed for Raising Intercrops with Poplar at KVK, Farm Dhurala, Kurukshetra

Season	Crop	Variety	Growing season	Seed rate (k/ha)		Fertilizer (kg/ha)			
						P(-)		P(+)	
				P(-)	P(+)	N	P	N	P
Rabi	Wheat	PBW-343	November-April	125	125	150	60	150	60
	Berseem	BL-1	October-May	25	25	25	70	25	70
Kharif	Sorghum	HC-260	June-September	50	50	50	-	50	-
	Sesbania	Local	June-July	30	30	-	-	-	-

P(-) = without and P(+) = with poplar

<< Back to contents

Crop Sequence Taken with Poplar for the Year 2001-2002 and 2002-03

S.no.	Tree Crop	Agriculture crop							
	Poplar	I yr (2001-2002)				II yr (2001-2002)			
		Rabi		Kharif		Rabi		Kharif	
		Wheat	Berseem	Sorghum	Sesbania	Wheat	Berseem	Sorghum	Sesbania
1	-	+	-	+	-	+	-	+	-
2	-	+	-	+	-	-	+	+	-
3	-	+	-	+	-	-	+	-	+
4	-	+	-	-	+	+	-	-	+
5	-	+	-	-	+	-	+	-	+
6	-	+	-	-	+	-	+	+	-
7	-	-	+	+	-	-	+	+	-
8	-	-	+	+	-	+	-	+	-
9	-	-	+	+	-	+	-	-	+
10	-	-	+	-	+	-	+	-	+
11	-	-	+	-	+	+	-	-	+
12	-	-	+	-	+	+	-	+	-
13	-	-	-	-	-	-	-	-	-
14	+	+	-	+	-	+	-	+	-
15	+	+	-	+	-	-	+	+	-
16	+	+	-	+	-	-	+	-	+
17	+	+	-	-	+	+	-	-	+
18	+	+	-	-	+	-	+	-	+
19	+	+	-	-	+	-	+	+	-
20	+	-	+	+	-	-	+	+	-
21	+	-	+	+	-	+	-	+	-
22	+	-	+	+	-	+	-	-	+
23	+	-	+	-	+	-	+	-	+
24	+	-	+	-	+	+	-	-	+
25	+	-	+	-	+	+	-	+	-
26	+	-	-	-	-	-	-	-	-

+ = Present and - = Absent

Experimental Fields with Different Treatments

Wheat without poplar

Sorghum with poplar

Status of the Soil Properties from 1997-2001 under Agrisilvimonoculture System

Soil properties	Year							
	1997-98		1998-99		1999-2000		2000-2001	
	Without poplar	With poplar	Without poplar	With poplar	Without poplar	With poplar	Without poplar	With poplar
pH	8.9	8.8	8.9	8.6	8.9	8.6	8.3	8.2
EC (m.mhos)	0.47	0.46	0.46	0.41	0.44	0.39	0.45	0.36
O.C. (%)	0.50	0.50	0.49	0.51	0.50	0.53	0.52	0.55
P (kg/ha)	22.2	21.9	23.7	17.5	22.7	16.1	19.2	13.7
K (kg/ha)	352.0	355.2	349.4	351.3	348.9	346.7	343.6	344.3
Zn (ppm)	1.41	1.40	1.40	1.19	1.39	1.07	1.22	0.81
Mn (ppm)	1.66	1.64	1.67	1.51	1.65	1.17	1.46	0.55
Cu (ppm)	1.12	1.00	1.14	0.93	1.11	0.87	0.95	0.68
Fe (ppm)	6.19	5.99	6.20	5.10	6.17	3.97	5.72	2.05

Tree Growth and Yield Observations

➢ **Poplar**

- *Girth :* Girth (cm) of poplar was taken 1.37 m above the ground level
- *Height :* Height (m) with the help of calinometer
- *Crown spread :* Crown spread (m) of tree was taken by measuring the spread of crown in north-south and east-west direction.
  -The mean value of these two directions was taken as crown spread
- *Leaf fall :* Mean annual leaf fall (kg/ha) of poplar was taken by collecting and weighing the fallen leaves from one square meter area at three randomly selected places
  - Samples were taken two to three times from November to December during leaf fall

Crop Growth and Yield Observations

- *Germination* : Number of plants per running meter
- *Plant height at maturity/harvesting stage* : From soil surface to the base of last fully opened leaf (cm)
- *Earhead length* : With measuring scale (cm)
- *Grains/ear head* : Of ten ear heads per plot
- *Test weight* : Of 1000 seeds (g)
- *Grain yield* : Q/ha
- *Straw yield* : Total yield – Grain yield (q/ha)
- *Fodder yield* : Q/ha (addition of all cuttings for berseem and produce at final harvest for sorghum and sesbania)

Field Observations of the Crops and Tree

Measuring of poplar girth under different tree-crop combinations

Laying out of square frame in the wheat field for germination counting

Harvesting of berseem in the marked area (square meter) under poplar plantation

<< Back to contents

Statistical Analysis

- Analysis of Variance by Fisher (1950)
- Test of significance at 5 per cent

Major Group of Parameter

- Crop/tree growth

Crop Combination Design

Sequence Basis:

- Pure cereal (wheat-sorghum-wheat-sorghum)
- Pure legume (berseem-sesbania-berseem-sesbenia)
- Cereal followed by legume (wheat-sesbenia- wheat-sesbenia
- Legume followed by cereal (berseem-sorghum-berseem-sorghum)

Annual Basis:

- Cereal followed by legume (wheat-sorghum-berseem-sesbania)
- Legume followed by cereal (berseem-sesbania-wheat-sorghum)

Check:

- CK (fallow) and CK (poplar)

Trends: Germination

- Crop germination was more in poplar free plots
- The adverse impact of poplar on crop germination seems to be maximum on sesbania
- The germination in the crop sequences reduced more with age of poplar

Trends: Height

- The height of all the crops was more in open fields than under poplar
- The height of rabi crops (wheat & berseem) were less affected than the kharif crops (sorghum & sesbania)

Trends: Wheat Growth

- All the growth parameters of wheat viz. number of spike, earhead length, number of grains, test weight, grain and straw yield were recorded higher under non-poplar than under poplar fields

<< Back to contents

Trends: Fodders

- The fresh/green and dry fodder yield of sorghum, berseem and sesbania were recorded more in open than in poplar plots
- Also, the yield of rabi fodder (berseem) was less affected than that of kharif (sorghum & sesbania)

Trends: Tree

- The average height, girth, crown spread, leaf fall, green and dry weights of poplar tree were more under different tree-crop combinations than poplar tree alone
- The maximum increase in the growth parameters of poplar occurred with wheat-sorghum-wheat-sorghum crop sequence

Generalization

- Poplar negatively affects different growth parameters of crops
- Crops play positive role in poplar growth parameters

<< Back to contents

DIEFFERENTIAL RESPONSES OF PRUNING INTENSITY ON DALBERGIA SISSOO ROXB. BASED AGRISILVICULTURE SYSTEM UNDER RAINFED TROPICS

Presented By

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Importance

Dalbergia sissoo Roxb. (Shisham) is one of the suitable tree for agroforestry system being a good timber species, moderately fast growing, having nitrogen fixing ability, clean bole, and protein rich fodder leaves.

The species is popular for afforestation / reforestation both in social forestry and agroforestry programmes in different parts of India.

But shade intensity of the tree has strong negative effects on the performance of under storey crops.

Pruning reduces the competitive ability of the trees which allows the crop to take advantage of the higher nutrient availability under the alley cropping system (Hagger *et al*., 1993).

The aim of this study was to find out suitability of different paddy varieties with *D. sissoo* under different pruning intensities.

Materials and Methods

The investigation was carried out at Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, India to study the effect of different intensities of pruning of *Dalbergia sissoo* Roxb. in an agrisilviculture system.

The experiment was conducted during 2010 kharif season on Dusty acre area of JNKVV, Jabalpur. Twelve years old *Dalbergia sissoo* planted at 5m × 5m was intercropped with paddy varieties.

The treatment combinations involved five treatments viz. four pruning intensities (i.e. no pruning, 25%, 50% and 75% pruning) and one open (without tree i.e. crop only) in main plot and three paddy varieties (viz. IR-36, MR-219 and WGL-32100) in sub-plot.

It was laid out in strip plot design with four replications. The soil of the experimental field was medium black, clay loam with pH 5.93, medium in nitrogen (288.1 kg/ ha), high in phosphorous (20.38 kg/ha) and potash (170.45 kg/ha).

<< Back to contents

Results and Discussion

Table 1. Grain yield, straw yield and harvest index of paddy as influenced by different pruning intensities and different varieties in agrisilviculture system

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest Index
Pruning intensities			
P_0 - No pruning	15.06	56.04	19.31
P_1 - 25% pruning	20.97	66.60	23.86
P_2 - 50% pruning	27.16	77.74	25.88
P_3 - 75% pruning	32.50	85.89	27.40
Open -No tree	39.86	97.90	28.92
SEm±	1.29	3.32	1.11
CD (P = 0.05)	3.75	9.69	3.24
Paddy Varieties			
V_1-IR 36	26.88	75.70	25.64
V_2-MR 219	29.37	83.08	25.20
V_3-WGL 32100	24.08	71.71	24.39
SEm±	0.31	1.59	0.59
CD (P = 0.05)	0.91	4.65	NS

Harvest Index

Harvest index was significantly affected by different pruning treatments. Significantly higher harvest index was recorded under open condition (28.92) at par with 75% pruning (27.40) and 50% pruning (25.88). No pruning recorded significantly lowest harvest index (19.31).

This may be due to different pruning intensities resulted different grain yield and biological yield. In open condition more grain and grain+straw ratio was found than the other treatments. This may be due to proportionately more production of grain as compared to other pruning treatments.

Different paddy varieties showed no significant effect on harvest index.

Performance of Paddy varieties in Open condition

MR 219 in Open condition

IR 36 in Open condition

WGL 32100 in Open condition

Performance of Paddy varieties and *D. sissoo* (75% pruning) under agrisilviculture system

MR 219 under 75% pruning of *D.sissoo*

IR 36 under 75% pruning of *D.sissoo*

WGL 32100 under 75% pruning of *D.sissoo*

Performance of Paddy varieties and *D. sissoo* (50% pruning) under agrisilviculture system

MR 219 under 50% pruning of *D.sissoo*

IR 36 under 50% pruning of *D.sissoo*

WGL 32100 under 50% pruning of *D.sissoo*

Performance of Paddy varieties and *D. sissoo* (25% pruning) under agrisilviculture system

MR 219 under 25% pruning of *D. sissoo*

IR 36 under 25% pruning of *D. sissoo*

WGL 32100 under 25% pruning of *D.sissoo*

<< Back to contents

Performance of Paddy varieties and *D.sissoo* (No-pruning) under agrisilviculture system

MR 219 under No-pruning of *D.sissoo*

IR 36 under No-pruning of *D.sissoo*

WGL 32100 under No-puning of *D.sissoo*

Growth of Shisham (*Dalbergia sissoo*)

Table 2. Morphological characters and biomass of *D. sissoo* as influenced by different pruning intensities and different varieties under agrisilviculture system

Treatment	Height (m)	DBH (cm)	Pruned biomass (Kg ha^{-1})	Cylindrical volume (m^3 ha^{-1})	Stand biomass (Kg ha^{-1})
Pruning Intensities					
P_0 - No pruning	9.16	19.81	-	116.43	89716.1
P_1 - 25% pruning	9.88	19.91	189	124.12	95571.7
P_2 - 50% pruning	9.78	17.53	675	97.31	74861.2
P_3 - 75% pruning	8.23	14.21	825	60.05	46861.2
SEm±	0.83	0.8	48	3.16	5884.0
CD (P=0.05)	NS	2.46	165	9.78	18302.1
Paddy verities					
V_1-IR 36	9.51	19.40	734	115.06	90829.5
V_2-MR 219	9.10	18.33	720	99.12	76314.5
V_3-WGL 32100	9.31	18.26	786	101.18	77950.4
Tree only- no crop	9.23	15.41	761	79.5	61240.2
SEm±	0.47	1.33	60	5.34	4111.0
CD (P = 0.05)	NS	NS	NS	17.06	13137.2

Conclusion

Dalbergia sissoo based agrisilviculture study revealed that at 50% pruning intensity of tree recorded higher paddy yield in addition to biomass yield of woody component which may be recommended under rainfed agroecosystem.

<< Back to contents

Extension programme on farm forestry :A case study of Punjab, India

H.P. Singh and Charan Singh

Forest Research Institute
Dehradun

Punjab at a Glance

Total Geographical area	50362 sq.km.
Population	24.29 millions
Population density	482 per sq.km.
No. of Districts	20
No. of Tehsil	72
No. of Blocks	140
No. of Villages	12780
Literacy	69.95%
Per capita income	Rs. 14,916 per annum

Details of the land use pattern in Punjab

S. N	Category	Area (000' ha)	Percentage
1	Total geographical area	5,036	-
2	Reporting area for land utilization	5,033	100
3	Forests	305	6.06
4	Not available for cultivation	381	7.57
5	Permanent pastures and other grazing lands	7	0.14
6	Land under misc. tree crops & groves	10	0.20
7	Culturable wasteland	25	0.50
8	Fallow lands other than current fallows	4	0.08
9	Current fallows	38	0.76
10	Net area sown	4,264	84.72

(Source: State Forest Report, 2005)

<< Back to contents

Map of Punjab

Major farm agro-forestry tree species grown in Punjab

- Poplar
- Eucalyptus
- Shisham
- Drake
- Kikar
- Rajjain
- Mulberry
- Khair
- Bamboo

Identified wood catchments areas

- Amritsar
- Hoshiarpur
- Ludhiana
- Muktasar
- Patiala
- Roopnagar
- Sangrur

Prominent selected farm/ agro forestry mandis

- Amritsar
- Dinanagar (Gurdaspur)
- Hoshiarpur
- Jallandhar
- Kotkapura (Faridkot)
- Ludhiana
- Patiala

Prevailing marketing Channels for farm/ agro forestry Produce

I	Producer	→ Contractor	→ Commission agent	→ Consumer
II	Producer	→ Contractor		→ Consumer
III	Producer		→ Timber trader	→ Consumer
IV	Producer		→ Commission agent	→ Consumer
V	Producer			→ Consumer

Development of MIS system

- Market prices of all selected species from the selected markets collected through Resource Persons.
- Quarterly newsletter "Market Prices of Farm Grown/ Agroforestry Wood in Punjab" published w.e.f. Oct-Dec'06 to Oct-Dec'08 (9 issues).
- Published quarterly news letters sent to the Nodal Officer for quick dissemination among the stakeholders.
- For development of website.

<< Back to contents

Data base on selected tree Species

- Poplar
- Eucalyptus
- Shisham
- Bakain
- Burma drake
- Kadam
- Bamboo



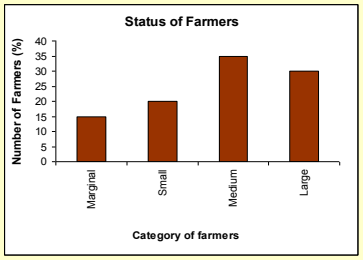
Survey in catchments

- Villages in Roopnagar, Hoshiarpur, Amritsar, Ludhiana, Sangrur, Muktasar and Patiala surveyed for examining the level of farm/agro-forestry plantations and recording of farmers perceptions on formation of tree growers' societies. Survey results revealed the following

Plantation Photographs


Land holding status of farmers in the study area

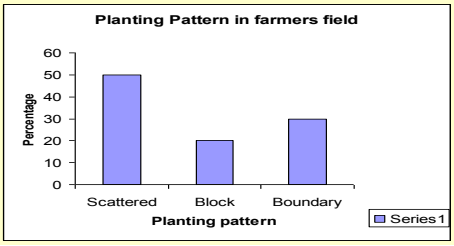
SN	Category (Land holding in ha.)	Percentage
1.	Marginal (Below 1 ha)	**15**
2.	Small (1.1-2.0 ha)	**20**
3.	Medium (4.0 -10 ha)	**35**
4.	Large (10 ha-above)	**30**



Status of farmers on the basis of land holding

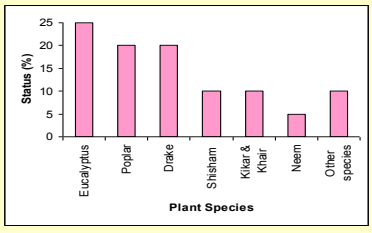
Planting pattern under farm forestry in the study area

S.N	Pattern	Percentage
1	Scattered trees on farm lands	**50%**
2	Block Planting	**20%**
3	Boundary Planting	**30%**



Status of species under plantation in the study area

S.N	Plant Species	Status (%)
1	Eucalyptus	**25**
2	Poplar	**20**
3	Drake	**20**
4	Shisham	**10**
5	Kikar & Khair	**10**
6	Neem	**05**
7	Other species	**10**



<< Back to contents

Formation of tree growers' societies

- Considerable number of tree growers are in favour of formation of cooperative societies but they need proper guidance in respect of formation and functioning of such societies. Forestry Extension wing, therefore, has to take a lead in this direction

Training of PFD Staff

Exposure Visit of Farmers

Training of PFD Staff

Efficient extension programmes

- Close collaboration required between researchers, extension staff/agents and tree growers in the application of research findings on farm/agro-forestry.
- Extension activity to be increased through schools/colleges, particularly in rural areas; religious gurus and private agencies/NGOs.
- Sustained transmission of market intelligence viz. nearest mandi, demand of different species, sizes required and prevailing prices of different species through T.V./ Radio under Krishi Darshan like programmes and through newspapers on weekly/ quarterly basis. It can also be done through publication & dissemination of monthly/quarterly newsletters on market information farm/agro-forestry wood produce. website on internet is a need of today.

Contd…

- The preferred and future promising agro-forestry wood species for different Wood Based Industries (WBIs) in Punjab are; Eucalyptus, Poplar, Drake, Shisham, Mulberry, Kikkar, and Rajjain.
- Extension education programmes for agroforestry should aim to promote the growth of a culture of continuous learning about agro-forestry and related issues.
- Case studies providing objective analysis of the economic environmental and social impact of agroforestry should be used to inform land holders and other stakeholders of its potential benefits. The case studies should include information on outcome under various success stories.

<< Back to contents

Contd…

- Research findings, government reports, and publications on technical aspects and economic returns of agro forestry should be made available not only in printed form but also on appropriate websites and other electronic media.
- Make efforts to bring the farmers and the big wood consumers together for fixing a remunerative price for tree produce.
- Training programmes for tree growers, covering of selection of suitable species, sources of seedling supply, planting techniques, site preparation, cultural operations, pest control, felling, transporting, marketing etc. should also be organized for agro forestry.

Contd…

- Policy makers should give urgent consideration to maintaining or expanding funding for farm forestry extension and advisory programmes in order to achieve the substantial public benefits associated with an increase in well informed adoption of agro forestry.
- Forest department has to strengthen its extension wing. Training has to be organized for the departmental staff to orient them for extension activities.

<< Back to contents

EVALUATION OF GROWTH PERFORMANCE OF SELECTED BAMBOO SPECIES FOR FARMLANDS OF TAMIL NADU.

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Introduction:

- Large scale bamboo plantations are being raised both in forest and non-forest areas under various mission mode schemes of Government of India.
- Productivity of bamboo plantations varies with the species (3.2 – 10 MT/ha/yr.) which is far below its potential (20 – 40 MT/ha/yr).

For achieving potential productivity

- **selection of right species,**
- **use of high quality planting material,**
- **genotype matching with site quality,**
- **proper management practices**
- are essential.

COMMONLY CULTIVATED BAMBOOS OF TAMIL NADU

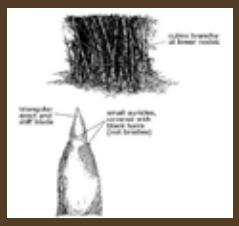
Bambusa bamboos

Uses:

- Paper
- Panel products
- Handicrafts
- Thorny branches - fencing
- Leaves – fodder & medicine
- Erosion control structures

<< Back to contents

Dendrocalamus strictus:



Uses:
- Construction
- Agriculture implements
- Musical instruments
- Furniture

Due to species introduction efforts taken by Tamil Nadu Forest Department

"Non-Thorny bamboos" or "Thorn less bamboos" has generated interest amongst the farmers in TN

Bambusa balcooa,
B. vulgaris,
B. tulda,
B. nutans and
Dendrocalamus giganteus

Study site:

Located at Western Coimbatore – rain shadow region of Western Ghats

Average rainfall – 694 mm (below state average rainfall – 750 mm)

Soil – Red soil with a minimum depth of 15 feet

Soil structure – Sandy loam

Technical programme:

T1: *Bambusa bambos*
T2: *Bambusa balcooa,*
T3: B. nutans,
T4: B. tulda,
T5: B. vulgaris,
T6: Dendrocalamus hamiltonii,
T7: D. asper and
T8: Guadua angustifolia.

Design: RBD

No. of replications: 3

No. of plants / replication:16

Spacing: 5 X 5 M

Date of planting: September 2006.

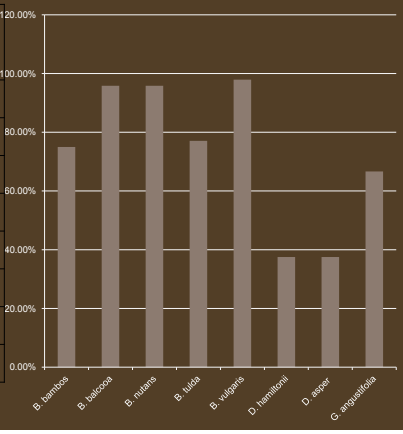
Observations recorded 4 years after planting:

- Survival Percentage
- Number of culms per clump
- Height of tallest culm
- Number of internodes in tallest culm
- Internodal distance of lowest internode
- Diameter of lowest internode
- Internodal distance of fifth internode
- Diameter of fifth internode

Funded by:
National Mission on Bamboo Applications, TIFAC – DST, GOI.

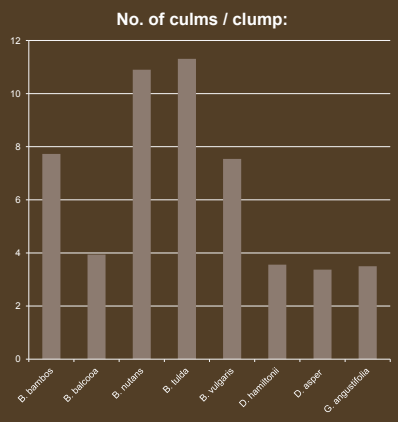
Results: Survival Percentage:

Species	Survival (%)
B. vulgaris	97.92
B. balcooa	95.83
B. nutans	95.83
B. tulda	77.08
B. bambos	75.00
G. angustifolia	66.67
D. hamiltonii	37.50
D. asper	37.50



Results: Number of culms / clump:

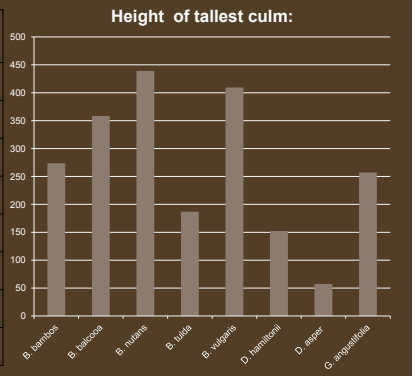
Species	Culms / clump
B. tulda	11.31 a
B. nutans	10.90 a
B. bambos	7.73 b
B. vulgaris	7.54 b
B. balcooa	3.94 c
D. hamiltonii	3.56 c
G. angustifolia	3.50 c
D. asper	3.37 c



<< Back to contents

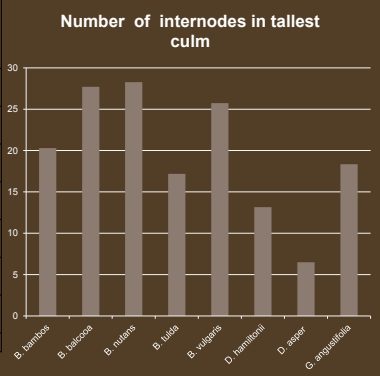
Results: Height of tallest culm:

Species		Height
T3	*B. nutans*	439.06 a
T5	*B. vulgaris*	409.48 a
T2	*B. balcooa*	358.54 b
T1	*B. bambos*	273.85 c
T8	*G. angustifolia*	257.19 c
T4	*B. tulda*	186.77 d
T6	*D. hamiltonii*	152.19 d
T7	*D. asper*	57.29 e



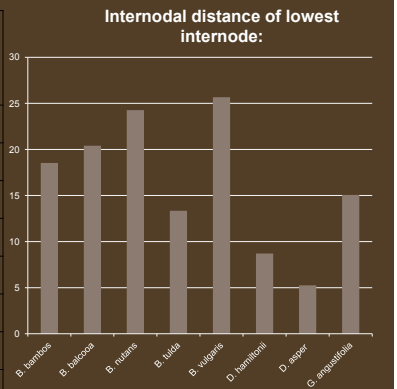
Result: Number of internodes in tallest culm:

Species		Number of internodes
T3	*B. nutans*	28.27 a
T2	*B. balcooa*	27.71 a
T5	*B. vulgaris*	25.73 a
T1	*B. bambos*	20.29 b
T8	*G. angustifolia*	18.35 b
T4	*B. tulda*	17.19 b
T6	*D. hamiltonii*	13.15 c
T7	*D. asper*	6.50 d



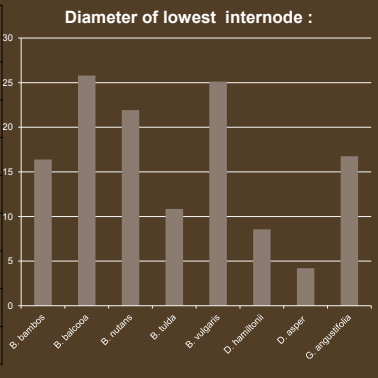
Internodal distance of lowest internode:

Species		Internodal distance of lowest internode
T5	*B. vulgaris*	25.67 a
T3	*B. nutans*	24.27 a
T2	*B. balcooa*	20.40 b
T1	*B. bambos*	18.54 b
T8	*G. angustifolia*	15.06 c
T4	*B. tulda*	13.35 c
T6	*D. hamiltonii*	8.71 d
T7	*D. asper*	5.25 e



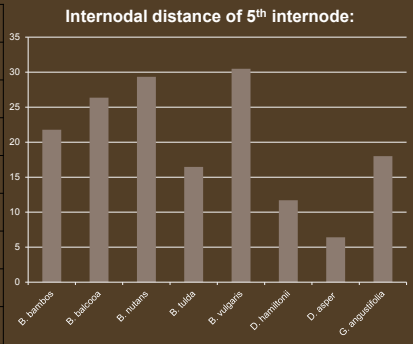
Diameter of lowest internode:

Species		Diameter of lowest internode
T2	*B. balcooa*	25.80 a
T5	*B. vulgaris*	25.13 a
T3	*B. nutans*	21.93 b
T8	*G. angustifolia*	16.76 c
T1	*B. bambos*	16.39 c
T4	*B. tulda*	10.85 d
T6	*D. Hamiltonii*	8.56 d
T7	*D. asper*	4.21 d



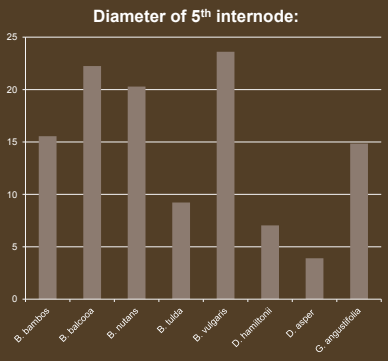
Internodal distance of 5th internode:

Species	5th internode
B. vulgaris	30.48 a
B. nutans	29.33 ab
B. balcooa	26.35 b
B. bambos	21.77 c
G. angustifolia	18.00 d
B. tulda	16.46 d
D. hamiltonii	11.71 e
D. asper	6.42 f



Diameter of 5th internode:

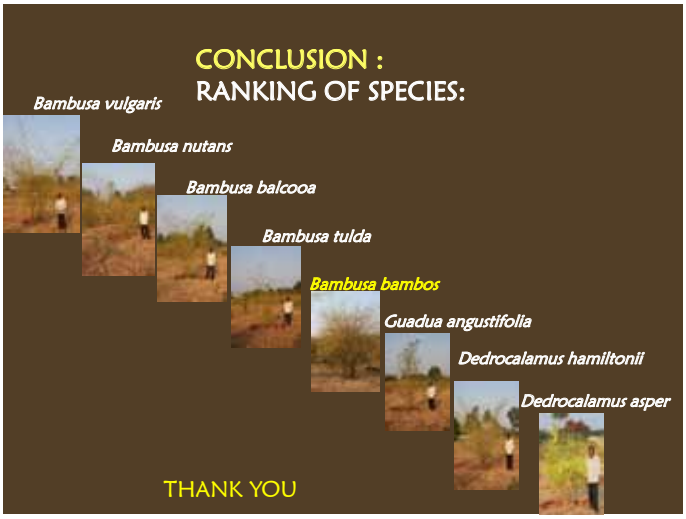
Species	5th internode
B. vulgaris	23.61 a
B. balcooa	22.24 ab
B. nutans	20.29 b
B. bambos	15.55 c
G. angustifolia	14.85 c
B. tulda	9.23 d
D. hamiltonii	7.04 d
D. asper	3.91 e



<< Back to contents

Summary:

Treatment	Species	Survival percentage	No. of culms per clump	Height of tallest culm	Number of internodes in tallest culm	Internodal distance of lowest internode	Diameter of lowest internode	Internodal distance of 5th internode	Diameter of 5th internode
T1	*B. bambos*	75.00	7.73 b	273.85 c	20.29 b	18.54 b	16.39 c	21.77 c	15.55 c
T2	*B. balcooa*	95.83	3.94 c	358.54 b	27.71 a	20.40 b	25.80 a	26.35 b	22.24 ab
T3	*B. nutans*	95.83	10.90 a	439.06 a	28.27 a	24.27 a	21.93 b	29.33 ab	20.29 b
T4	*B. tulda*	77.08	11.31a	186.77 d	17.19 b	13.35 c	10.85 d	16.46 d	9.23 d
T5	*B. vulgaris*	97.92	7.54 b	409.48 a	25.73 a	25.67 a	25.13 a	30.48 a	23.61 a
T6	*D. hamiltonii*	37.50	3.56 c	152.19 d	13.15 c	8.71 d	8.56 d	11.71 e	7.04 d
T7	*D. asper*	37.50	3.37 c	57.29 e	6.50 d	5.25 e	4.21 d	6.42 f	3.91 e
T8	*G. angustifolia*	66.67	3.50 c	257.19 c	18.35 b	15.06 c	16.76 c	18.00 d	14.85 c



<< Back to contents

Harvesting of *Calotropis procera* flowers from different agro-climatic zones of Rajasthan for their medicinal use

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INTRODUCTION

- In India, 4,635 ethnic communities, including over one million folk healers, use around 8,000 species of medicinal plants (Hariramamurthi *et al*, 2007).
- There is growing demand for herbal products in the domestic and global market. Over 90% of the medicinal plants traded in India are harvested from the wild.
- The collection in most of them is in an unsustainable manner.
- Plants produce a wide range of secondary metabolite compounds of various chemical classes which probably are effective in their defense against infection.
- The activity of medicinal plants is due to the presence of these secondary metabolites. The biosynthesis of these is affected strongly by environmental influences.
- As a result there are fluctuations in the concentrations and quantities of secondary metabolites with age, season and region.

<< Back to contents

Calotropis procera- Habit & Distribution

- *Calotropis procera*, (family Asclepiadaceae), is an erect, tall, large, much branched and perennial shrub or small tree.
- Found in most parts of the world in dry, sandy and alkaline soils and warm climate. In India it is found distributed up to an altitude of 1050 m from Punjab, Rajasthan to Assam and Kanyakumari.
- It grows well on rubbish heaps, waste and fallow lands, roadsides, sand dunes and as a weed in agricultural lands.
- In the sandy desert soils of Rajasthan, *Calotropis procera*, a soft wooded evergreen perennial shrub with conspicuous purplish pink flowers is one of the most common and most impressing plants.

Calotropis procera – In natural habitat

Calotropis procera- Uses

- The plant, commonly called as Aak, is used as a traditional medicinal plant with unique properties.
- It is used alone or with other medicinals to treat common diseases such as fevers, rheumatism, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting, diarrhoea etc.
- Flowers of *Calotropis procera* are bitter, digestive, astringent, anthelmintic, tonic, anti-inflammatory, spasmolytic, stomachic, hepatoprotective & antioxidant. They have been used in traditional medicine in treatment of cold, asthma, catarrh, anorexia, inflammations and tumours.

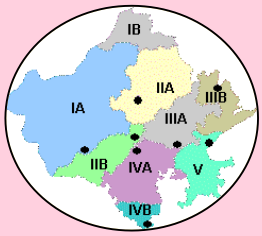
Objective of the study

Calotropis procera flowers are available throughout the year and collected as per need of the Industry. It was proposed to study the variation of secondary metabolites in flowers from different regions of Rajasthan so as to identify the best zone for their collection.

MATERIALS AND METHODS

- The fresh weight of flowers collected was taken and they were dried in shade and moisture content was determined.
- The pulverized flowers were extracted with petroleum ether 60°-80° followed by extraction with methanol and the total extractives (Petroleum ether extractives, PEE, and Methanol extractives, ME) were determined.
- The extracts were analysed for sterols and alkaloids using standard procedures (Harborne, 1973). Total sterol and alkaloid content was estimated by method of Akihisa *et al*, 1990 and Higuchi & Bodin, 1961.

On the basis of climatic conditions and agricultural produce, Rajasthan has been divided into nine Agro-Climatic Zones (ACZ). *Calotropis procera* is found distributed in all the zones. The flowers were collected in single season (winter) so as to nullify the effect of temperature. Reconnaissance surveys were undertaken to different places in various ACZs in January 2007–February 2007 and flowers were collected.

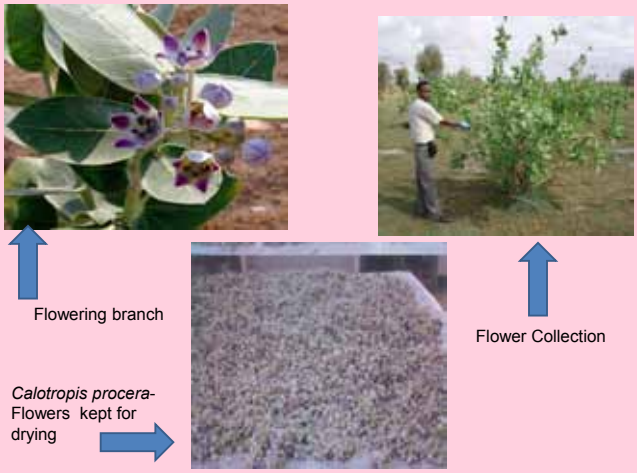


Agro-Climatic Zones (ACZ) of Rajasthan

<< Back to contents

TABLE 1 : Collection of *Calotropis procera* flowers from different Agroclimatic Zones of Rajasthan

Agro-Climatic Zone	Districts lying in the zones	Place of collection
IA (Arid Western Plain)	Bikaner, Jodhpur, Jaisalmer, Barmer	Jaisalmer
IB (Irrigated North-Western Plains)	Ganganagar, Hanumangarh	Suratgarh
IIA (Transitional Plain of Inland Drainage)	Sikar, Jhunjhunu, Churu, Nagaur	Churu
IIB (Transitional Plain of Luni Basin)	Pali, Jalore, Sirohi	Pali-Sirohi
IIIA (Semi-arid Eastern Plain)	Jaipur, Ajmer, Tonk, Dausa	Jaipur
IIIB (Flood Prone Eastern Plains)	Alwar, Bharatpur, Dhaulpur, Sawaimadhopur, Karauli	Alwar
IVA (Sub-humid Southern Plains & The Aravalli Hills)	Sirohi, Udaipur, Rajsamand, Chittorgarh, Bhilwara	Udaipur
IVB (Humid Southern Plains)	Dungarpur, Banswara, Chittorgarh	Banswara
V (Humid South-Eastern Plains)	Jhalawar, Kota, Bundi, Baran, Sawai madhopur	Kota



RESULTS AND DISCUSSION

Maximum moisture content was found in flowers from ACZ IV B. Minimum moisture content was recorded in ACZ IIB and ACZ IA .

TABLE 2 : Fresh , dry weight & moisture contents of *Calotropis procera* flowers from nine different Agroclimatic Zones

Agro-Climatic Zone	Fresh weight (Kg)	Dry weight (Kg)	Moisture (%)
IA	6.5	0.935	85.6
IB	10	1.04	89.6
IIA	11	1.16	89.5
IIB	12	1.82	84.8
IIIA	10	0.845	91.6
IIIB	8	0.712	91.1
IVA	8	0.832	89.6
IVB	4.5	0.328	92.7
V	14	1.624	88.4

- **Extractive determination showed that maximum content of PEE was found in ACZ IIIA (1.98%). Minimum content of PEE was found in ACZ IA (1.42%) and ACZ IIA(1.41%). The trend for PEE is in accordance with the earlier reports that more moist and cooler conditions lead to higher fat storage (Si *et al*, 1999; Tripathi *et al*, 1997).**
- **The yield of ME was maximum from ACZ V (16.16 %) and ACZ IA (12.93 %). Minimum ME was obtained from ACZ IIIA (7.05 %) and IB (7.65 %). So except for ACZ V, the amounts of PEE and ME are inversely related.**
- **The higher values in ACZ V are attributed to leaching / dilution effects.**
- **Maximum yield of total extractives was from ACZ V (17.71%) and minimum from ACZ IIIA (9.03%).**

TABLE 3 : Yield of total extractives of *Calotropis procera* flowers in petroleum ether and methanol

ACZ	Petroleum ether extract (%)	Methanol extract (%)	Total Extractives (%)
IA	1.42	12.93	14.35
IB	1.78	7.65	9.43
IIA	1.41	11.38	12.79
II B	1.61	12.09	13.70
IIIA	1.98	7.05	9.03
III B	1.51	13	14.51
IVB	1.74	9.96	11.70
IVA	1.67	9.85	11.52
V	1.55	16.16	17.71

Total individual sec. metabolite content determination showed:

- **Maximum content of sterols (2.65 %)and alkaloids was obtained from ACZ IA (8.03 %).**

TABLE 4 : Yield of total sterols and alkaloids in different Agroclimatic zones of Rajasthan

S.N.	ACZ	Total Sterols (%)	Total alkaloids (%)
1	IA^{e6}	2.65	8.03
2	IB^{a3}	1.19	3.97
3	IIA^{d4}	2.17	5.26
4	$II\ B^{e1}$	2.63	3.05
5	$IIIA^{c3}$	1.92	4.09
6	$III\ B^{e5}$	2.54	6.65
7	IVB^{c2}	1.95	3.63
8	IVA^{b1}	0.83	3.08
9	V^{d2}	2.31	3.63

Common superscripts show no significant difference between means (a-e for sterols; 1-6 for alkaloids)

<< Back to contents

Duncan multiple range test (DMRT) was applied to compare the means at 5% level of significance. The analysis shows that there exists significant difference between the steroid content in various agroclimatic zones viz. F=20.163, p=0.000. Similarly, there exists significant difference between the alkaloid content in various agroclimatic zones viz. F=1029.62, p=0.000.

CONCLUSIONS

- **Significant regional variations in secondary metabolite content were found to occur in flowers of *Calotropis procera* with maximum content found in flowers from ACZ IA.**
- **For obtaining optimum concentration of active constituents in *Calotropis procera* flowers these should be harvested from Jaisalmer region in Rajasthan.**
- **The annual collection of *Calotropis* flowers is about 500-1000 kg per year from Rajasthan. Present results can be used for collection of quality raw material in sustainable manner for Ayurvedic use.**

<< Back to contents

PERFORMANCE OF DIFFERENT AGROFORESTRY SYSTEMS IN SEMI-ARID ECOSYSTEM

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Region Characteristics and Geographical Spread

- In India almost 53.4 per cent land area comprises arid and semi-arid regions *(First NATCOM, GoI)*
- Arid and semi-arid regions are characterized by with no or insufficient rainfall to sustain agricultural production
- About 19 % of the country experiences arid conditions every year *(First NATCOM, GoI)*.
- Main crops in semi-arid region are millets, wheat and pulses.
- Traditional practice is rainfed agriculture

Arid and Semi-arid Regions

Source: Velayuthamet aI. 1999

Where We Are ?

- **Bawal (28.1° N, 76.5° E and 266 m above msl)**
- **Low and erratic rainfall (300-550 mm)**
- **Light textured soils**
- **High solar radiation (Temp. 45^{0}C)**
- **High evapo-transpiration (18.0 mm)**
- **Poor nutritional status of the soil (0.19% OC)**
- **High wind velocity**
- **Low water holding capacity**
- **Poor quality underground water**
- **Frequent crop failure (drought, flood etc.)**
- **Undulating soil surface**
- **Low crop yields**
- **Poor economy of the farmers**
- **Poor health of cattle as well as farmers**

<< Back to contents

Demand and supply of timber for furtinure, agriculture and industry (million cum)

Particulars	2001	2006	2010*	2020*	2025*
Demand	73	82	89	107	116
Supply from forests	12	12	12	12	12
Supply from plantation and agroforestry	47	53	61	90	100
Deficit	14	17	16	5	4

Source: Ganapathy (1997) and Saxena (1990), * Dahyani et al, 2010

Supply and demand of fodder (million tonnes)

Particulars	2005	2010	2020	2025
Green Fodder				
Supply	385	395	406	426
Demand	988	1061	1134	1170
Deficit	603	666	728	744
Dry Fodder				
Supply	428	451	473	484
Demand	549	590	630	650
Deficit	121	139	157	166

Source: Down to EARTH (2004); DAHD (2002)

OPTION ?

• Integration of trees on farm/community lands (Agroforestry)

What is Agroforestry?

Agroforestry is a land-use system that involves socially and ecologically acceptable integration of trees with agricultural crops and/or animals, simultaneously or sequentially, so as to get increased total productivity of plant and animal in a sustainable manner from a unit of farmland, especially under conditions of low levels of technological inputs and marginal lands.

Proven impacts of Agroforestry

- Reducing poverty
- Availability of fodder.
- Contributing to food security.
- Reducing deforestation
- Increasing diversity
- Augmenting accessibility to medicinal trees.
- Security against drought and flood.
- Carbon Trading

Agroforestry Systems

- ✓ **Agri-silvi**
  Tree species: Khejri, Rohida, Kikar, Alianthus, Mopane, Anjan
  Crops: Cowpea, Bajra, Guar, Raya,
- ✓ **Agri-horti**
  Fruit trees: Aonla, Ber, Bael, Guava, Karonda
- ✓ **Silvi-pastoral**
  Grasses : Anjan, Dhaman,
- ✓ **Agri-silvi-horti**
- ✓ **Horti-pastoral**
- ✓ **Shelter belt/wind break**
- ✓ **Bund plantation**

<< Back to contents

Prosopis *cineraria* (Khejri) based agroforestry model

- **Spacing 6x 6 m**
- **Crops:**
  - Cow pea- todia (*Brasica tournefortii*)
  - Clusterbean -todia
  - Perl millet –todia
  - *Cenchrus ciliaris*
- **Replications: 5**

Grain Production (t/ha) of crops

Crop sequence	Kharif				Rabi			
	1st year	2nd year	3rd year	Mean	1st year	2nd year	3rd year	Mean
With khejri								
Cowpea-todia	0.85	0.98	0.92	0.92	9.90	7.92	7.65	8.49
Pearlmillet -todia	1.20	1.35	1.26	1.27	8.96	7.00	6.00	7.32
Clusterbean-todia	0.87	0.78	0.81	0.82	10.00	6.96	7.00	7.98
Sole cropping								
Cowpea-todia	0.70	0.85	0.80	0.78	9.00	7.60	7.00	7.86
Pearlmillet -todia	1.00	1.14	1.05	1.06	8.34	6.00	5.96	6.76
Clusterbean-todia	0.79	0.62	0.67	0.69	8.75	7.25	6.45	7.48
CD (5%)	0.06	0.13	0.11	-	0.54	0.23	0.19	-

Economics (Rs./ha) of Kharif crops in relation with rabi todia (fodder) grown alone and in association with khejri (mean of 3 years)

Crop sequence	Cost of cultivation	Gross income	Net income	B:C ratio
With khejri				
Cowpea- todia	5791	19370	13579	3.34
Pearlmillet - todia	6185	15550	9365	2.51
Clusterbean - todia	5945	18670	12725	3.14
Sole cropping				
Cowpea- todia	4126	7800	3674	1.84
Pearlmillet - todia	4520	4240	-280	0.94
Clusterbean - todia	4280	6900	2620	1.61

Green fodder yield (t/ha) of different crops grown sole and in association with khejri trees

Crop sequence	Kharif				Rabi			
	1st year	2nd year	3rd year	Mean	1st year	2nd year	3rd year	Mean
With khejri								
Cowpea-todia	10.01	10.45	13.52	11.33	24.32	19.43	18.03	20.59
Pearlmillet -todia	13.84	12.57	18.15	14.85	23.09	18.86	16.52	19.49
Clusterbean-todia	6.10	7.32	8.51	7.31	23.95	18.10	17.22	19.76
Buffel grass-buffel grass*	4.25	6.22	7.78	6.08	-	-	-	-
Sole cropping								
Cowpea-todia	8.16	8.87	10.34	9.12	21.83	17.96	16.54	18.78
Pearlmillet -todia	10.73	10.15	14.57	11.82	20.11	15.22	13.83	16.39
Clusterbean-todia	5.22	6.10	7.27	6.20	20.75	16.88	15.77	17.80
Buffel grass-buffel grass*	5.07	6.51	8.03	6.54	-	-	-	-
CD (5%)	1.14	1.05	1.20	-	1.84	1.47	1.32	-

*Perennial grass was dormant in rabi

Economics (Rs./ha) of fodder crops (mean of 3 years)

Crop sequence	Cost ofcultivation	Gross income	Net income	B:C ratio
With khejri				
Cowpea- todia	5641	20046	14405	3.55
Pearlmillet - todia	5575	20772	15197	3.73
Clusterbean - todia	5795	18591	12796	3.21
Buffel grass - grass	6303	12276	5973	1.95
Sole cropping				
Cowpea- todia	3976	8370	4394	2.10
Pearlmillet - todia	3910	8463	4553	2.16
Clusterbean - todia	4130	7200	3070	1.74
Buffel grass - grass	4638	1962	2676	0.42

Grain yield (t/ha) and economics of oilseed crops

Crop sequence	Rabi			Economics		
	1st year	2nd year	3rd year	Gross income (Rs/ha)	Net Income (Rs/ha)	B : C ratio
With khejri						
Fallow-mustard	1.55	1.40	1.30	27510	21377	4.48
Fallow-taramira	0.99	0.93	0.84	16840	10732	2.76
Sole cropping						
Fallow-mustard	1.25	1.19	1.12	141600	9692	3.17
Fallow-taramira	0.74	0.70	0.61	4760	317	1.07
CD (5%)	0.22	0.19	0.20	-	-	-

<< Back to contents

Jatropha based agroforestry system

Spacing: 4x3m

Crops:

- Cowpea
- Pearl millet
- Cluster bean
- Dhiancha
- Watermelon

Design: RBD

Replication: 3

Grain yield (t/ha) of different crops

Crop	Yield (t/ha) 1st year	2nd year	Mean
With Jatropha			
Cowpea	0.84	0.77	0.81
Pearl millet	1.32	1.22	1.27
Cluster bean	0.85	0.94	0.90
Dhiancha	0.90	0.88	0.89
Watermelon	13.64	12.00	12.80
Sole			
Cowpea	0.86	0.81	0.84
Pearl millet	1.35	1.30	1.33
Cluster bean	0.89	0.91	0.90
Dhiancha	0.92	0.88	0.90
Watermelon	12.52	12.85	12.67
CD (5%)	0.52	0.48	-

Fodder yield (t/ha) of different crops

Crop	Fodder yield (t/ha)					
	Green			Dry		
	1st year	2nd year	Mean	1st year	2nd year	Mean
With Jatropha						
Cowpea	17.50	17.65	17.57	5.06	5.15	5.11
Pearl millet	20.20	20.00	20.10	6.25	6.09	6.17
Cluster bean	17.00	16.90	16.95	5.20	5.00	5.10
Dhiancha	24.00	24.10	24.05	7.59	7.65	7.62
Sole						
Cowpea	17.80	17.40	17.60	5.20	5.12	5.16
Pearl millet	20.30	21.00	20.65	6.32	6.51	6.41
Cluster bean	16.80	17.30	17.05	5.10	5.23	5.16
Dhiancha	24.20	23.90	24.05	7.48	7.35	7.41
CD (5%)	1.04	1.64		1.35	1.11	

<< Back to contents

Agri-silvi-horti system

- **Forset tree species:** Shisham, Khejri
- **Fruit tree species:** Aonla + Guava
- **Crops:**
  - Ridge gourd-tomato
  - Mung bean- fallow
  - Clusterbean-fallow
- **Irrigation (Drip)**
  - » 100, 70 and 40% ETc

Yield (t/ha) of intercrops as affected by different trees and irrigation

Trees	Irrigation scheduling (ETc)								
	100%			70%			40%		
	Moong bean	Cluster bean	Ridge gourd	Moong bean	Cluster bean	Ridge gourd	Moong bean	Cluster bean	Ridge gourd
S+ G	0.36	0.88	5.26	0.35	0.92	5.06	0.34	0.86	4.76
S + A	0.36	0.90	5.23	0.36	0.85	4.93	0.31	0.91	4.68
K+ G	0.39	0.93	5.30	0.33	0.85	5.00	0.37	0.90	4.60
K + A	0.30	0.90	5.18	0.35	0.89	5.09	0.34	0.88	4.66

CD (5%)	Moongbean	Clusterbean	Ridgegourd
Trees	NS	NS	NS
Irrigation	NS	NS	0.24
Tree x Irrigation	NS	NS	NS

Yield (t/ha) of tomato as affected by different trees and irrigation

Tree species	ETc		
	100%	70%	40%
Shisham + aonla	46.14	43.60	34.57
Shisham + guava	45.97	43.94	34.17
Khejri + guava	46.07	43.40	33.54
Khejri + aonla	46.22	43.80	34.40

CD at 5%	Tomato
Tree	NS
Irrigation	8.80
Interaction	NS

Economics of the agri-silvi-horti system developed under drip irrigation

Tree species	ETc								
	Cucurbit - tomato			Clusterbean – Fallow			Moongbean - Fallow		
	100 %	70 %	40 %	100 %	70 %	40 %	100 %	70 %	40 %
S + A	162955	152193	116113	1260	1100	-20	-5500	-5270	-5600
S + G	164393	153413	118233	-500	-1300	300	-6430	-6750	-5600
K + G	164833	150433	135837	1100	300	1100	-5230	-5990	-6470
K + A	164873	154833	119033	300	-20	-340	-6670	-6470	-5990



<< Back to contents

Grain yield of different crops (mean of 3 years)

Tree species	Mean grain yield (t/ha)			
	Pearlmillet	Clusterbean	Raya	Chickpea
D. sissoo+ M. alba	1.001	0.725	1.008	0.959
D. sissoo+ E. officinalis	1.007	0.732	1.030	0.940
A. indica + E. officinalis	1.561	0.748	1.034	0.979
A. indica + M. alba	1.073	0.764	1.054	0.989
Sole crop	1.104	0.800	1.092	0.100
CD (5%)	NS	NS	NS	NS

Economic returns (Rs./ha) of different crops under various tree combinations (mean of 3 years)

Tree species	Pearlmillet	Clusterbean	Raya	Chickpea
D. sissoo+ M. alba	147	3066	5267	4827
D. sissoo+ E. officinalis	069	3294	5560	4667
A. indica + E. officinalis	303	3515	5614	5072
A. indica + M. alba	391	3736	5880	5214
Average	228	3403	5573	4945
Sole crop	4408	7937	10199	9034

Agri-silviculture for fodder

- **Tree species**
  - Mopane
  - Anjan
  - Acacia
- **Crops**
  - Cowpea
  - Pearlmillet
  - Clusterbean
  - Cowpea + P (1:2)
  - Clusterbean +P (1:2)
- **Spacing**
  - 6x6 m
  - Age 14 years

Green fodder yield (q/ha) of crops under top feed tree species

Tree species	Cowpea	Pearl millet	Clusterbean	Pearl millet+ Clusterbean	Pearl millet + Cowpea
C. mopane	103.1	170.4	47.0	155.9	164.8
A. bevinosa	93.85	174.9	38.0	159.7	160.9
H. binnata	91.0	169.0	44.7	142.0	153.9
Open	140.8	228.2	92.0	191.0	201.0

Mopane based agroforestry system

<< Back to contents

Anjan based agroforestry system

Conclusions

- The grain and fodder yields of crops were higher in 20 years old Khejri based agroforestry system as compared to sole cropping
- Cowpea-todia sequence earned maximum net returns (Rs.13579/ha)
- Daincha for green fodder and pearl millet for grain purpose were found suitable crops with Jatropha during initial 2 years of establishment
- Ridgegourd –tomato rotation was found most remunerative in silvi-horti system with drip irrigation.
- Arable crops like pearlmillet, cluster bean, raya and chickpea can be raised in the interspaces of different silvi-horti system and can met the initial cost of establishment of tree component.
- Overall there was reduction in fodder yield of crops in hardwikia and mopane based agroforestry system as compared to sole cropping, but this reduction was supplemented by fuel wood and leaf forage

<< Back to contents

INDIAN FORESTRY CONGRESS, 2011

Impact of *Lemon grass* and *Dalbergia sissoo* based agroforestry system on Red lateritic wastelands in Chhattisgarh

Speaker: Dr. Sajiwan Kumar

SCHOOL OF STUDIES IN FORESTRY & WILDLIFE
BASTAR VISHWAVIDYALAYA, JAGDALPUR (C.G.)

INTRODUCTION

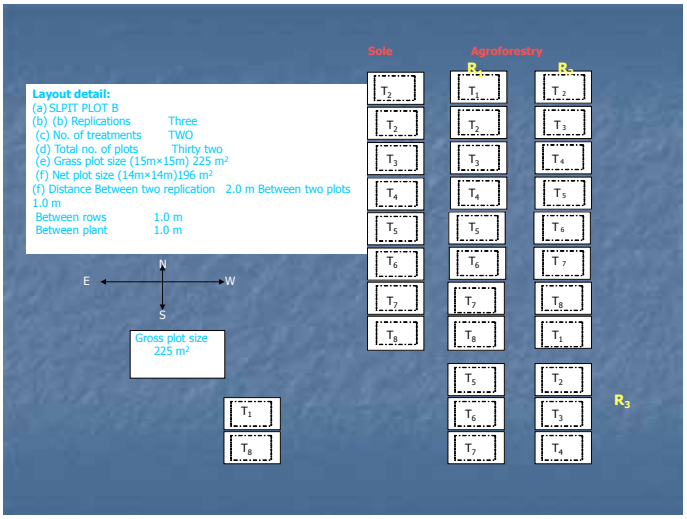
- Agroforestry is an old age practices and now a days it is a new science of land management.
- Recently importance of Agroforestry has increased dramatically.
- Main aims of AF are the production of timber, fuel, fodder, fibre, fruit and non timber forest products, medicinal and aromatic plants besides agricultural crop production for food.
- AF also helps for environmental conservation and rehabilitation of soil resources needed for future production.
- The Chhattisgarh is estimated to have around 20% areas under *Entisols* (*Bhata* land).
- *Dalbergia sissoo* Roxb. is an important multipurpose tree and widely used in different agroforestry system of India.
- The Chhattisgarh state has been declared as herbal state.
- *Cymbopogon flexuosus* is one of the important commercial grass.
- The essential oil of Lemon grass having its chief constitutes Citral.

EXPERIMENTAL DETAILS

Location	: Dr. Richharia Research and Instructional Farm, Baronda Dept. of Forestry, IGKV Raipur (CG)
Tree crop	: *Dalbergia sissoo* Roxb.
Plantation year	: July, 1998
Plantation spacing	: 5x5 meter
Lower storey crop	: *Cymbopogon flexuosus var.* Krishna
Planting year of Lemon grass	: July, 2007 (Root slip transplanting)
Grass spacing	: 1x1 meter
Soil type	: *Entisols* or *Bhata* land (Red lateritic soil)
Treatments	: 8
Replication	: 3
Design	: Split Plot Design

<< Back to contents

Location map of study area



Skeleton of analysis of variance of Split Plot Design

Source of variation	Degree of freedom	Sum of square	Mean sum of square	Calculated F value	Table F value
Replication	(r-1)	RSS	RSS/(r-1)	= MRSS/ EaSS	CF> TF * CF< TF **
Main plot	(m-1)	MSS	MSS/(m-1)	= MMSS/ EaSS	
Error- A	(r-1) (m-1)	EaSS	EaSS/(r-1) (m-1)		
Sub plot	(s-1)	SSS	SSS/(s-1)	= MSSS/ EbSS	
I (M x S)	(m-1) (s-1)	ISS	ISS/(m-1) (s-1)	= MISS/ EbSS	
Error- B	m (r-1) (s-1)	EbSS	EbSS/ m (r-1) (s-1)		
Total	rms-1	ToSS			

Tip: * denoted significant at 5% level of significance, and ** denoted non significant at 5% level of significance

OBSERVATIONS

1.Following plant characteristics recorded in *Cymbopogon flexuosus* sole crop (*i.e.* without tree) and in intercrop with tree of *Dalbergia sissoo* under different fertilizer treatments during the two cropping season (*i.e.* 2007 & 2008).

- Dry Matter production
- Oil Production

2. Determination of oil : Harvesting of grass was carried out at the height 10-15 cm from ground surface. The oil content of fresh samples for each treatment was distilled by the laboratory method with the use of Clevenger apparatus. The oil content analyzed and determined in consequence three growth periods *i.e.,*
   - September
   - December and
   - February

3. Growth behaviour of tree recorded during the two cropping season (2007 & 2008) from with and without intercropping plots. Data are recorded for following characteristics:

- Total height of tree
- Collar diameter
- Diameter at breast height
- Crown length
- Crown width

The tree growth characteristics *i.e.,* Height, CD, DBH, Crown length and Crown width etc. was measured as per standard method by use of caliper, 30 m tape, meter scale and standard graduated bamboo pole (Chaturvedi and Khanna,1982).

Analysis of physical and chemical status of soil

Soil samples collected from 18 plots comprising under agroforestry system, sole crop of Lemon grass and open field (tree alone and lemon grass alone) as well as one adjacent barren field *i.e.* without any tree and crop at the depth of 15-30 cm, with the help of soil agar.

The following standard methods will be used to determine the physio-chemical properties of the soil:

Field moisture	:	Oven dry basis (monthly)
WHC	:	Determined by perforated soil box method.
Soil pH	:	Digital pH meter using Soil-water suspension method by Jackson, 1958.
Organic matter	:	Ammonium ferrous sulphate and potassium dichromate method by Walkley & Black,1934.
Available N	:	Micro-kjeldahl method (Jackson, 1958).
Available P	:	Olsen's method (Olsen *et al.*, 1954)
Available K	:	Flame photometer (AOAC, 1975)

<< Back to contents

Performance of *Dalbergia sissoo* under Agroforestry system and sole cropping system

Treatment	Total Height (m)			DBH (cm)			Crown Width NS (m)			Crown Width EW (m)		
	July 2007	July 2009	MAI	July 2007	July 2009	MAI	July 2007	July 2009	MAI	July 2007	July 2009	MAI
Sole	7.13	8.55	0.71	6.78	9.30	1.26	3.55	4.75	0.60	2.94	4.32	0.69
SEm ±	±1.12	±1.52		±1.32	±1.10		±0.53	±0.25		±0.64	±0.61	
AFS	6.89	7.71	0.41	6.30	8.66	1.18	3.19	4.20	0.50	2.76	3.88	0.56
SEm ±	± 1.29	±1.34		±1.42	±1.23		±0.48	±0.49		±0.52	±0.44	

*MAI during the study period 2007 to 2009

Performance of *C. flexuosus* under agroforestry system during two cropping year (2007 to 2009)

Treatment	Harvesting Schedule I		Harvesting Schedule II		Harvesting Schedule III	
	Dry matter (q ha^{-1})	Oil prod (kg ha^{-1})	Dry matter (q ha^{-1})	Oil prod (kg ha^{-1})	Dry matter (q ha^{-1})	Oil prod (kg ha^{-1})
Cropping system (2007-08)						
Sole crop	56.69	76.68	50.76	62.69	32.92	38.88
AFS (intercrop)	16.83	21.48	13.37	18.94	9.50	7.13
CD (at 5%)	7.84	12.39	7.83	3.5	1.84	1.65
Cropping system (2008-09)						
Sole crop	86.80	91.66	70.81	88.35	53.87	65.44
AFS (intercrop)	19.36	26.34	16.35	25.39	11.67	18.20
CD (at 5%)	7.02	4.30	5.69	3.93	1.92	0.67

Impact of Lemon grass+ Shisham based cropping system on Entisols

Treatment	pH	WHC (%)	Org. C (%)	Available N (Kg ha^{-1})	Available P (Kg ha^{-1})	Available K (Kg ha^{-1})
Cropping system (2007-08)						
Sole crop	6.12	36.13	0.61	163.57	15.81	84.02
AFS (Intercrop)	5.92	45.62	0.55	151.89	11.82	80.02
Sole Tree	5.25	35.20	0.48	122.35	13.26	76.11
Adjacent	5.42	31.75	0.33	108.76	10.39	72.35
CD (5 %)	NS	2.85	NS	7.43	0.80	3.53
Cropping system (2008-09)						
Sole crop	5.72	33.26	0.78	182.97	18.52	108.04
AFS (Intercrop)	5.61	46.12	0.68	155.76	15.04	100.15
Sole Tree	5.17	38.40	0.54	140.78	14.42	84.36
Adjacent	5.43	32.36	0.35	112.16	11.18	78.45
CD (5 %)	NS	1.43	NS	6.15	2.99	2.57

Conclusion

The study indicated that the agroforestry system was proved as most reliable tools for utilization and development of wasteland comprises of tangible and intangible benefits to community and environments.

The Chhattisgarh plains have 20 per cent red lateritic wasteland with poor structure, texture, nutrients status such as organic carbon, nitrogen, phosphorus and potash and other micro nutrients. The increasing biotic interferences are further found to be responsible for degrading this productivity as and when used as upland farming.

The several studies recommends for adopting the agro forestry models to utilize and conserve such immature soil. It is suggested that practise of alternative land management through Silvi-agriculture, Agri-silviculture and Silvi-pasture practices in such marginal and degraded and lands noted to be established with appropriate need based models developed by consistent research studies. These strategies will help in reducing the biotic pressure and also restoring and conserving the fragile Entisols of Chhattisgarh and other part of the country.

<< Back to contents

Soil Nutrient Budget under Plantation of *Leucaena leucocephala* to Reclaim the Wasteland Lands of Chhattisgarh Plain

M.N.Naugraiya and A.S.Sisodia

Department of Forestry
Indira Gandhi Agricultural University, Raipur

Chhattisgarh State

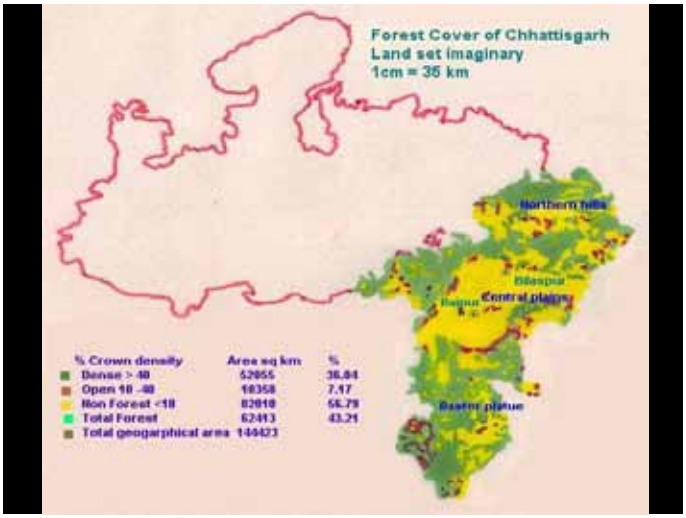
AGRO-CLIMATIC

Topographic status		Chhattisgarh
Location	:	17° 41' N to 24° 45' N Latitudes 79° 30' E to 84° 15' E Longitudes
Forest type	:	Tropical Dry/ Moist Deciduous
Climate	:	Sub-humid-topics
Rainfall	:	1600-1200 mm; Av. 1400 mm.
Temperature	:	Max. 48 ° C (Summer), Min. 5 ° C
Relative Humidity	:	Highest 85 % (Rainy), Lowest 26.5% (Summer) Av. 69 to 51 %
Sunshine	:	Av. 8.6 Hrs.
Evapo -transpiration	:	Max. 14 mm (May), Min. 2.6 mm (December) Av. 5.86 mm

<< Back to contents

Land Utilization of the State

Attributes	Sq km	%
Total Geographical Area	144423	100
Forest cover	63647	44.07
Area not available for cultivation		
a. Land put to non Agric. Area	7077	4.90
b. Barren & Uncultivated Land	4087	2.83
Permanent pasture & Grazing land and under miscellaneous tree crops & Grooves	9431	6.53
Culturable wasteland	3654	2.53
Fallow Land	5719	3.96
a. OLD Fallow	2845	1.97
b. Current Fallow	2874	1.99
Total uncultivated Lands	116983	20.75
Net sown Area	50808	35.18
(Irrigated Area)	(9459.7)	(6.55)

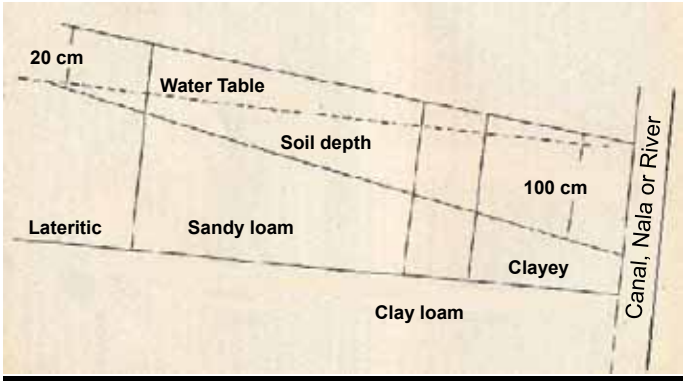


Physical Properties of Red lateritic soil

Slop	Undulating roling
Colour	Reddish to dark reddish brown
Texture	Gravely, Coarse Loamy to Sandy
Consistency	Non-sticky & Non Plastic, Cracks Absent, Depth Very Shallow
Internal drainage	Rapid
Bulk density (gm/cc)	1.76-1.80
Mechanical Composition (%)	
Sand	60-80
Silt	15-22
Clay	9-20
Infiltration rate (cm/hr)	5.0-7.0
Field Capacity (cm)	5.5
Wilting Point (cm)	3.37
Available Water (cm)	2.15
Porosity (%)	45.0

Chemical Properties of Red lateritic soil

pH	5.7-6.5
E.C.	0.17
O.C. (%)	0.27-0.5
CEC (c mol (+)/kg)	7.0-10.6
Av Nitrogen (%)	0.006
Exchangeable cations	
Ca	3.5-6.2
Mg	1.7- 3.4
K	0.1- 0.3
Na	0.3 – 0.4

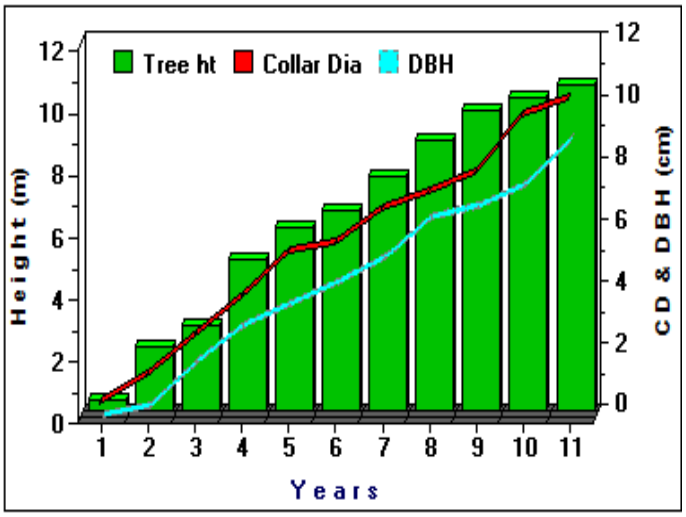


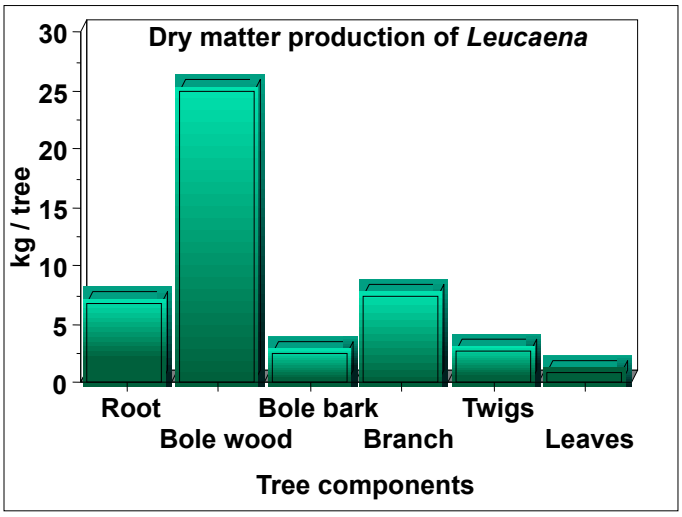
Soil topography, Soil depth and Water Table during peak Mansoon in Chhattisgarh

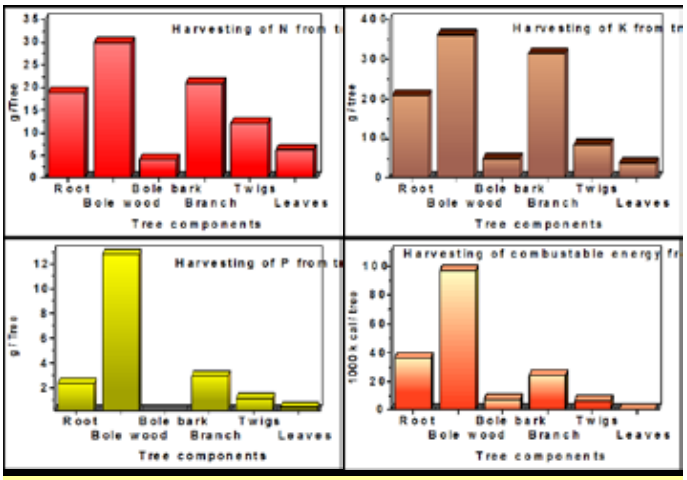
There are number of tree species suitable for various climate as well as purposes. *Leucaena leucocephala* an Exotic MPTS belongs to Leguminosae is potential tree species adopted in all over the country. It is a very promising fast growing spp. which showed straight bole growth to produce biomass for fuel, small timber and pulp. In the study, the growth and Biomass production was found good enough with reclamation of red lateritic soil, which is ever recognized as poorest soil in the Chhattisgarh.

The red lateritic soil shared 20 % lands in Plains which is mostly lying as unproductive fellow wasteland can be used for plantation of such improve variety of trees to produce the not only the wood and foliage biomass for meeting out requirement of small timber, fuel wood, fodder, paper pulp but also improve the soil profile over a period.

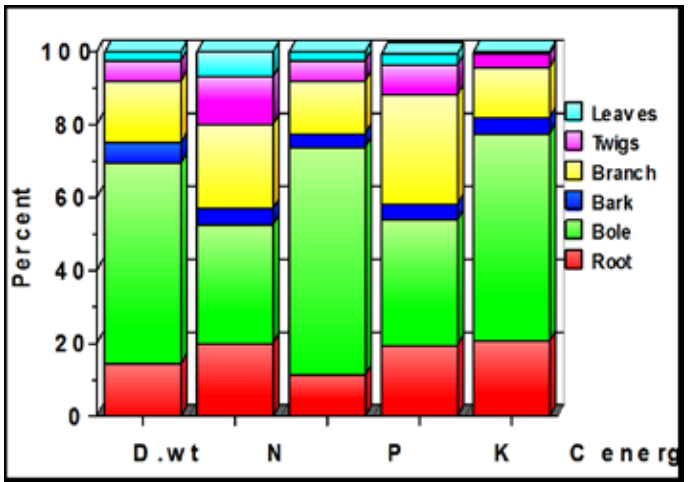
<< Back to contents



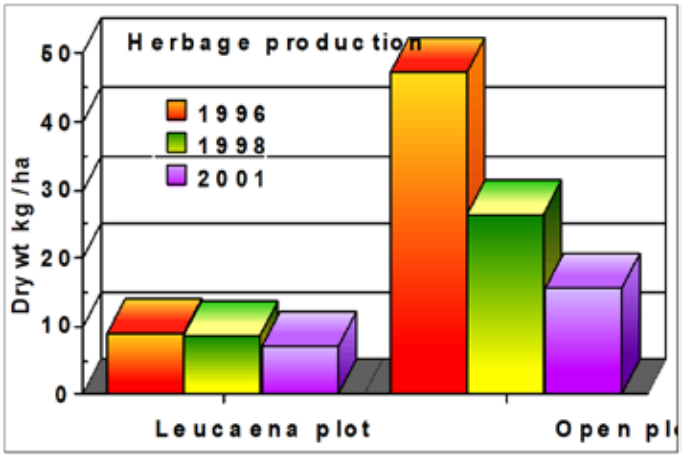




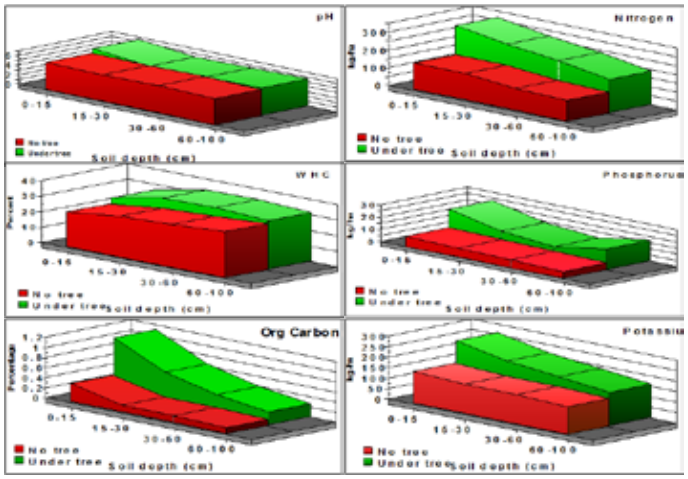
Harvesting of NPK & Combustible Energy from *Leucaena* felling



Distribution of Biomass, NPK & Combustible Energy in *Leucaena* tree



Herbage Production under *Leucaena* Plantation



Changes in Soil Properties in *Leucaena* plot comparison to barren plot

<< Back to contents

Indian Forestry Congress, 2011

22.11.2011 to 25.11.2011 in Delhi

Theme : Forest in Expanding Economy

Sub Theme : Forest Product : Management for Livelihood

Presentation Title : Minor Forest Produce for Livelihood in Chhattisgarh and National Perspective

Presentation by

A.K.Singh, IFS

Principal Chief Conservator of Forests

Managing Director

Chhattisgarh State Minor Forest Produce (Tr. & Dev.)
Co-operative Federation Limited, Raipur
Chhattisgarh, INDIA

National Forest Policy 1988

MFP Related Provisions

- In the basic objectives -
  - Meeting the requirement of minor forest produce and rural of tribal population.
- Essentials of Forest Management -
  - Minor forest produce provides sustenance to tribal population and to other communities residing in and around forests. Such produce should be protected, improved and their production enhanced with due regard to generation of employment and income.
- Strategy
  - Tribal People and Forest
    - Protection, regeneration and optimum collection of minor forest produce along with institutional arrangement for marketing of such produce.

National Forest Policy 1988

MFP Related Issues

- The MFP has not been assigned proper importance in the Policy as there is no mention of MFP in preamble.
- In the basic objectives it should be mentioned that MFP should be managed as a major source of livelihood in rural and tribal areas.
- In essentials of the forest management there should be mention of processing and value addition of MFP also.
- There is no mention of the importance of MFP in providing health security to rural people and raw material for manufacturing of Ayurvedic and Unani drugs.
- The National Policy provides for the marketing Institutions of MFP but in general there is lack of marketing Institutions specially for non-nationalised MFP. As far as Govt. of India is concerned TRIFED could not provide required support.

<< Back to contents

About Chhattisgarh State

- 44% of the geographical area comes under Forest.
- State is rich in availability of M.F.P.
- 60 % of the state area falls under tribal sub- plan.
- About 14 lakh families, mostly tribals, are engaged in M.F.P. collection.

Chhattisgarh Forest Policy, 2001 on Minor Forest Produce (MFP)

Highlights

- Minor Forest Produce (MFP) including medicinal plants provides sustenance to the tribal population
- These should be conserved, developed and their non-destructive harvesting methods evolved
- Promote processing and value addition of the same, at the local level rather than exporting MFP in raw form.

- MFP used to add sizeable revenue to the state exchequer, which is now distributed among the gatherers.
- Appropriate measures being taken through Chhattisgarh State MFP Federation for sustainable utilization and long term conservation of all MFP found within the forests of the state.
- Endowment of ownership rights to local communities as per the provisions of the *Panchayat (Extension to Scheduled Areas) Act.* 1996.

C.G. State Forest Policy 2001

Essentials of Forest Management

•People's Protected Area (PPA) to be a proactive and people's friendly framework to ensure long term protection and maintenance of biological diversity and providing at the same time a sustainable flow of natural products and services to meet local community needs.

Strategy

- For sustainable forest development, livelihood security and bio-cultural diversity conservation, People's Protected Areas (PPAs) should be established.

Contribution of NTFPs in Rural Economy in Chhattisgarh

- The Livelihood School, BASIX, Bhopal conducted a study in 2010 on the above mentioned subject sponsored by C.G.M.F.P. Federation, Raipur.
- Sixty villages of 6 Forest Divisions were selected.
- Total 1200 collectors of MFP were included in the detailed survey.
- A few observations of study are being reproduced in the various tables.

Social Category Wise NTFP Collection

Income of the Household	Total price of NTFP items used by Household (in Rs.)	Percentage	Total price of NTFP items collected by the Household for commercial purposes (in Rs.)	Percentage	Total value of NTFP items collected by the household in a year (in Rs.)
General	1122.84	19.08%	4761.32	80.92%	5884.16
OBC	890.93	16.12%	4635.65	83.88%	5526.58
SC	844.72	17.60%	3956.08	82.40%	4800.81
ST	1201.79	12.84%	8156.33	87.16%	9358.12
Average	1107.2	13.60%	7034.57	86.40%	8141.77

<< Back to contents

Collection and Sale of NTFPs Farmer Category Wise

Farmer Category	Total price of NTFP items used by HH	Percentage	Total price of NTFP items collected by the HH for commercial purposes	Percentage	Total value of NTFP items collected by the household in a year
Landless	1154.77	15.60%	6248.31	84.40%	7403.08
Marginal farmer	1062.45	14.55%	6238.53	85.45%	7300.97
Small farmer	1120.19	12.54%	7814.80	87.46%	8934.99
Middle farmer	999.59	14.87%	5720.46	85.13%	6720.05
Big farmer	1572.11	11.23%	12427.25	88.77%	13999.36
Grand Total	1107.20	13.60%	7034.57	86.40%	8141.77

Contribution of Various Activities in Income of Household

Activities	North Sarguja	Manendragarh	Dharamjaigarh	Kawardha	East Bhanupratappur	Jagdalpur	Average
Agriculture	29%	33%	56%	50%	37%	45%	44%
NTFPs	15%	15%	29%	8%	22%	33%	23%
Others	56%	52%	15%	42%	41%	22%	33%
Total	100%	100%	100%	100%	100%	100%	100%

Contribution of NTFPs in Economy of Different Types of Households

	Landless		Marginal Farmer		Small Farmer		Midiam / Big Farmer		Average	
Activity	Total Production %	Total Sale %	Total Production %	Total Sale %	Total Production %	Total Sale %	Total Production %	Total Sale %	Total Production %	Total Sale %
Agriculture	0%	0%	32%	8%	57%	43%	68%	63%	48%	38%
NTFP	41%	39%	32%	45%	24%	33%	12%	15%	23%	28%
Other	59%	61%	36%	47%	19%	24%	20%	22%	29%	34%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Engagement of Households in NTFP Collection

Forest Division	Upto 45 Days	45 to 75 Days	75 to 120 Days	Above 120 Days	Total
North Saguja	21.50%	47.00%	25.00%	6.50%	100.00%
Manendragarh	78.50%	12.50%	9.00%		100.00%
Dharamjaigarh	6.00%	14.50%	56.50%	23.00%	100.00%
Kawardha	30.00%	43.50%	23.00%	3.50%	100.00%
East Bhanupratappur	75.50%	22.00%	2.50%		100.00%
Jagdalpur	1.50%	14.00%	18.00%	66.50%	100.00%
Average	35.50%	25.60%	22.30%	16.60%	100.00%

Engagement of Household in NTFP Collection (Men)

Forest Division	Total days given in collection of NTFPs by the household in a year	Average time spent in collection of NTFPs per day	Average distance travelled for collection of NTFPs
North Saguja	68.70	4.50	3.20
Manendragarh	38.80	4.60	6.70
Dharamjaigarh	100.00	5.50	3.40
Kawardha	62.00	5.40	4.60
East Bhanupratappur	39.20	5.10	2.20
Jagdalpur	166.66	4.50	6.00
Average	79.20	4.90	4.40

Days given in Collection of Particular NTFPs by Household

NTFP Item	Percent days given by hosuehold in collection
Mahua Flower	57.30
Sal seed	11.10
Tendu leaves	10.10
Others	21.50
Total	100.00

<< Back to contents

Background of MFP Trade of Chhattisgarh/ Madhya Pradesh

- Prior to 1964 there was no legal provision for the collection rate to be paid to the collector of MFP. The purchaser of the forest unit used to decide the rate.
- To save the MFP collector from exploitation, C.G. Tendu Patta Adhiniyam 1964 for tendu leaves and CG Vanopaj (Vyapar Viniyamn), Adhiniyam 1969 for salseed, myrobolans and gums were enacted. The result was that the collectors got the rate fixed by the Government and the Government revenue also increased.
- The remaining species remained non nationalized and the system of sale of unit to the contractor continued till 1986. From 1986 this contractor system was abolished and the collectors became free to sell the collected MFP to any purchaser at mutually agreed rate.

Forest Management Committees in Chhattisgarh

The forest policy of Government of India of 1988 emphasized the people's participation. The Joint Forest Management Committees (JFMC) were constituted and are involved in forest management and protection. At present there are 7887 JFM committees in the State. All the members of the Gram Sabha are the members of JFMC and all the Panch/Sarpanch or the members of executive body of JFMC. 30% seats of the executive body are reserved for women. MoEF, GOI provides a lot of funds for the development of the forests and forest village development through Forest Development Agency (FDA) and whose members are JFMCs of Forest Division.

Institutional Development for Trade of MFP in Chhattisagrh

- The Forest Policy of 1988 of GOI, also suggests for the strong institutional support for the trade of M.F.P.
- Accordingly three tier cooperative structure was established in 1988 consisting of primary forest produce cooperative society of actual collectors of MFP only, forest division level district forest produce cooperative union with primary societies as members and state level CGMFP (Trade & Development) Federation Ltd. with District unions as members.
- The main objective for the establishment of cooperative structure was to ensure the active participation of the collector in collection, storage and marketing of MFP.

Elections and Nominations in the Co-operative Societies in Chhattisgarh

- The bye laws of the Primary Society, District Union and the C.G.M.F.P Federation regulate the working of these institutions.
- After the formation of Chhattisgarh State, the powers of the Registrar, Co-operative Societies excluding audit were delegated to the Executive Director C.G.M.F.P. Federation at the state level and to Divisional Forest Officers at Forest Division level for smooth functioning.
- The last election of Board of Directors of the Primary Societies, District Unions and State Federation was held in 2008. The election was conducted by Divisional Forest Officers under the over all guidance of Executive Director C.G.M.F.P. Federation, Raipur.

Constitution of the the Co-operative Societies in Chhattisgarh

- The number of the elected members in the board of the Primary Society is 11 (minimum 2 females) . The nodal officer of the society from the Forest Department, the block level officer from Co-operative Department and two presidents of the Joint Forest Management Committee nominated by the D.F.O. are the four nominated directors of the Primary Society .
- There are 10 (minimum 2 females) elected members in the District Union. D.F.O. is the Managing Director of the Union. Besides him Collector, S.P., Dy. Registrar/ Asstt. Registrar Co-operative Societies and President of the District Co-operative Bank are the nominated member of the District Union.

Important Features of the Cooperative Societies in Chhattisgarh

- The president or the vice president of the primary cooperative society will be a woman only.
- The president of the primary cooperative society of the scheduled area will be tribal only.
- There is also the provision for reservation of scheduled caste, scheduled tribe & backward caste in the societies.
- Two seats are reserved for women in all the three tiers of the cooperative structure.
- At present the elected chairmen and vice chairmen of the CGMFP federation are tribal only.
- Many Societies have constructed their offices also.

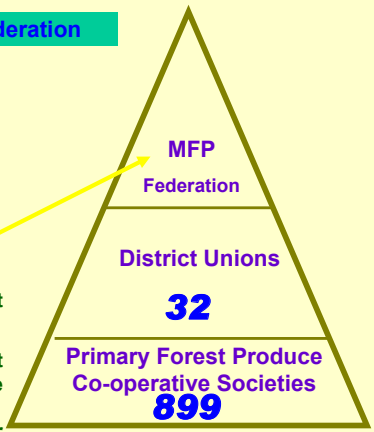
<< Back to contents

Advantages of Three Tier Cooperative System in Chhattisagrh

- The direct participation of collectors through their elected primary societies ensures transparency.
- The collectors get the payment of collection price and bonus through their elected society.
- The managers performing the administrative work of the society and collection centre Munshi are directly responsible to the society.
- Society being a registered cooperative society can take up other works also.
- Since these societies have only the collectors of MFP as the members, they are better representative of the stake holders than the gram sabhas who have non collectors also as the members.

Structure of C.G. M.F.P. Federation

- Three-tier Cooperative structure registered under C.G. cooperative societies Act.
- Apex body i.e. MFP Federation
- 32 District Unions at intermediate level.
- 899 Primary Forest Produce Co-operative Societies of collectors, mostly tribals of minor forest produce.



Annual Trade of Raw NWFP in Chhattisgarh

S. No.	Category of NWFP	Species/ Produce	Estimated value of Raw Material in Rs. Crores
1.	Nationalised	Tendu leaves, Sal seed, Harra, Gums-Kullu, Dhawda, Babul, Khair	500
2.	Non - Nationalised	Imli, Mahua, lac, Kosa, Mahul Leaves, chironjee, Baibaring, Vanjeera, Kalmegh, Aonla etc.	500
		Total	1000

Important Non-nationalised NTFP of State

No.	Name of Produce	Approx. Annual Production (Lakh Quintals)	Approx. annual Value (Rs. in crores)
1.	Mahua flower	5	110.00
2.	Mahua Seed	3	45.00
3.	Tamarind	5.10	91.80
4.	Lac	0.85	90.00
5.	Mahul Leaves	0.52	5.20
6.	Niger seed	0.1	40.00
7.	Ber fruits	0.3	2.43
8.	Charota seed	7	42.00
9.	Palas flowers	0.22	1.54
10.	Dhawai flowers	0.26	2.60
11.	Malkangni	0.03	1.00
12.	Bel	0.16	2.40

Contd…

Important Non-nationalised NTFP of State

No.	Name of Produce	Approx. Annual Production (lakh Quintals)	Approx. annual Value (Rs. in crores)
13.	Kosa	5 crores no.	5.00
14.	Aonla	0.31	12.40
15.	Baheda	0.29	2.03
16.	Karanj Beej	0.30	2.00
17.	Van Tulsi	0.4 0	4.40
18.	Baibiding	0.12	6.00
19.	Nagarmotha	0.15	2.10
20.	Honey	0.05	3.50
21.	Kalmegh	0.14	1.90
22.	Other's	1.00	26.64
Total			500.00

Trade of Tendu Leaves in Chhattisgarh

Collection Season	Collection Rate (In Rs. Per S.B.)	Collected/Sold (Lakh St. Bags)	Collection Wages (In Rs. Crores)	Sale Price (In Rs. Crores)	Gain (In Rs. Crores)
2006	450	14.72	66.24	140.02	55.53
2007	500	17.18	85.96	325.59	207.89
2008	600	13.78	82.77	197.61	87.34
2009	650	14.67	95.33	256.41	120.75
2010	700	15.45	108.15	335.31	176.94
2011	800	13.57	108.52	355.31	202.70

<< Back to contents







Tendu Leaves Tendering System of C.G./M.P.

The system of tendering is unique based on purchase capacity & priority. Tender forms, tender document, lot list and list of collection centers are available only on Federation's website. The facility of downloading of tender form has added a new dimension in that the intending tenderers are unable to know the identity or number of other tenderers likely to participate in the tendering process.

A large number of traders and manufacturers from all over the country participate in these tenders.

Participation in Tenders of Tendu leaves Sale in Chhattisgarh

As an illustration, the data for the first tender of last five seasons are shown in the table below: -

Collection Season	Lots put to Tenders	No. of Tenderers	Total No. of Offers by Tenderers	Purchase Capacity (Rs. Crores)	Average No. of offers for lot
2007	929	518	17698	799	19
2008	931	289	9073	355	10
2009	931	401	12527	546	13
2010	931	435	13284	723	14
2011	931	359	13096	848	14

Tendu Leaves Tendering System of C.G.

The details of the tenderers along with their offers are fed into a computer software. The decision for the sale of nationalised Minor Forest Produce is taken by Inter-departmental committee consisting of the following members-

1. Hon'ble Forest Minister — Chairman
2. Principal Secretary, Forest — Member
3. Principal Secretary, Finance — Member
4. Principal Secretary, Commerce and Industries — Member
5. Principal Secretary, Tribal Welfare — Member
6. Principal Chief Conservator of Forests — Member
7. Chief Conservator of Forests (Production) — Member
8. Conservator of Forests (Production) — Member Secretary

Under the existing system, tendu leaves are sold at the best price because of the large volumes that are put to national tenders through the centralised system to ensure direct participation of wholesale traders and end-users, whereby sub-district, district and state level intermediaries are eliminated.

It is unfortunate that in spite of such a fair and competitive system of sale of Tendu leaves which has stood the test of time; aspersions are caused by some non-government individuals and the persons even sitting in the Governments.

Trade of Sal Seed in Chhattisgarh

After Tendu leaves, Salseed is the next important nationalized species. It's market rate and annual production fluctuates very widely resulting in loss also in some years as evident from the following table :-

Collection Season	Collection Rate (Per Quintal)	Collected Quantity (Lakh Quintals)	Collection Wages (In Rs. Crores)	Sale Price (In Rs. Crores)	Average Sale Price (In Rs. Crores)	Expendi-ture (In Rs. Crores)	Gain (In Rs. Crores)
2006	500.00	0.488	2.44	3.59	735.55	2.49	1.10
2007	500.00	6.06	30.32	59.09	974.39	30.93	28.16
2008	1000.00	0.899	8.99	12.64	1407.39	9.10	3.54
2009	1000.00	8.864	88.64	51.07	582.21	100.41	-49.34
2010	500.00	1.34	6.72	6.76	502.85	6.94	-0.18
2011	750.00	0.392	2.94	3.72	960.33	2.96	0.76

<< Back to contents




Collection Rate of Harra (Myrobolans) and Kullu Gum (Rs. per Quintal)

The collection rates of other nationalized species like Harra (Myrobolans) and Kullu Gums are also increasing as evident from the following table :-

Name of the Produce	2007-08	2008-09 and 2009-10	2010-11	2011-12
Harra	275.00	375.00	450.00	1000.00
Kachriya of Harra	687.50	937.50	1125.00	2000.00
Bal Harra	1925.00	2650.00	3150.00	3500.00
Kullu Gum Grade-I	15400.00	17000.00	22000.00	27000.00
Kullu Gum Grade-II	11000.00	11000.00	15000.00	20000.00

Implementation of PESA

- The entire value of the MFPs realised from purchasers is ploughed back to the MFP collectors as basic price, incentive wages etc.
- Primary Co-operative Societies are the basic unit for calculating the amount of profit. This results in competitive spirit among primary co-operative societies so as to earn maximum income through quality control.
- Each society compensates for losses incurred in the previous years and no cross subsidisation.
- The whole profit earned from the trade of Tendu Leaves up to 2007 season was distributed in the following manner.

1.	70% of profit as incentive wages to the Collector of Tendu leaves.
2.	15% of profit for village resources development by Primary Co-operative Societies.
3.	15% of profit for development of forest and Forest Produce.

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Implementation of PESA

- Since at present the lots of funds are available for item (2) and (3) above from MNREGA, CAMPA etc. the profit earned from the trade of Tendu Leaves from 2008 season is being distributed in the following manner.

1.	80% of profit as incentive wages to the Collector of Tendu leaves.
2.	15% of profit for purchasing, processing and storage of non-nationalised MFPs by Primary Co-operative Societies.
3.	5% of profit for the fund created to temporarily meet the loss from the trade of the Societies.

Distribution of Profits of Trade

Collection Year	Forest Produce	Incentive Wages to the Collectors (In Rs. Crores)	Amount for Infrastructural Development Works (In Rs. Crores)	Amount for Development for Forests (In Rs. Crores)	Amount for Trade, Storage and Value Addition of Non-nationalised MFPs (In Rs. Crores)
2001	Tendu leaves	28.64	6.69	6.69	---
2002	Tendu leaves	39.95	8.59	8.59	---
2003	Tendu leaves	33.31	7.10	7.10	---
2005	Tendu leaves	25.37	5.58	5.58	---
2010	Tendu leaves	24.48	5.25	---	---
2006	Tendu leaves	31.54	6.76	---	---
2007	Tendu leaves	116.32	22.69	---	---
2008	Tendu leaves	65.75	---	---	12.35
2009	Tendu leaves	94.27	---	---	17.67
2010	Tendu leaves	138.66	---	---	26.00
2007	Salseed	19.81	4.26	4.26	---

Implementation of PESA

There is no Government royalty on non-nationalised minor forest produce and the collector gets the full sale proceed. So the trade of MFP in Chhattisgarh and M.P. is in according to spirit of PESA. Though PESA is applicable only to scheduled areas, in Chhattisgarh and M.P. there is no discrimination between scheduled areas and remaining areas. A.P. and Maharashtra States have also started distributing profits of Tendu leaf trade to the collectors. Besides, the Chhattisgarh Govt. has allotted Rs. 60 crores from its budget to compensate for the losses from trade of nationalised Salseed in the interest of MFP collectors which is much more then PESA stipulates.

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<< Back to contents

Implementation of PESA

In most of the states more than 90% of the MFP's are non-nationalised on which forest dwellers are having ownership rights since decades, as they are free to collect, process and sell in the open market. For example forest dwellers enjoy ownership rights since 1986 of Mahua fruits and flowers, Tamarind, Aonla, Kosa, Baheda, Honey, Wax, Medicinal plants etc. in Chhattisgarh an M.P., but this has not given them any benefit because there is no organized marketing for most of the produce, and tribal families are exploited in isolated local markets by the middle men.

The best way to enhance the income of the forest dwellers is to provide strong marketing support and give the full usufruct.

Shri A.K.Sharma Committee Report on PESA

Govt. of India, Ministry of Panchayati Raj had appointed a committee headed by Shri A.K. Sharma on the implementation of PESA only which in its report observed/recommended the following -

i. The three-tier society based federal system for the collection of MFP at the village, intermediate and district level as in M.P. and Chhattisgarh states appears to be the best democratic and decentralized system that comes closest to the soul of the PESA. It is recommended that various state may consider adoption of this system as an option.

ii. The committee recommended minimum statutory price (MSP) for MFP and a regulatory authority at the state level to oversee the Minimum statutory price for MFP. Each PESA state must declare every year a comprehensive list of MFP along with their procurement price dealt with by their FDCs/TDCs/FEDs.

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Left Wing Extremism and PESA

Though the profits from the trade of Tendu leaves is fully returned to the collectors in Madhya Pradesh., Chhattisgarh, Andhra Pradesh and Maharashtra and no revenue is earned by State exchequer from non nationalized species. Non implementation of provisions of PESA in respect of MFPs in the Scheduled Areas is being talked about as one of the causes of the spread of Left Wing Extremism and the perception of some people, both outside and inside the government, perhaps is that it is really so. This perception is perhaps based on account of lack of information/miss-information and is illfounded.

Demand to Change the Existing Trade System of C.G.

The demand of doing away with extant State regulations and three tier co-operative structure and vesting full and final authority in respect of MFPs to the Gram Sabhas is not being raised by the MFP collectors, or by the forest committees of the local inhabitants, or by the elected Panchayats, or by the elected representatives of the tribal areas, but by the outsiders who are not well acquainted with the existing system in place and the benefits thereof.

Consequences of Dismantling the Present Trade System of Chhattisgarh

If the state intervention is withdrawn and Gram Sabhas are authorized to handle the MFPs on their own, they will not be able to undertake the required activities and discharge the responsibilities. Small, petty and other intermediates are sure to enter the system bridging the gap between the Gram Sabhas and the end-users and in the process, each intermediary i.e. sub district, district and state level would mop his own commission / profit in the chain. In such a new system, total gain of the MFP collectors will reduce drastically.

Social Welfare of the M.F.P. Collectors of Chhattisgarh

(i) Footwear Distribution

To protect the feet of Tendu leaves pluckers from vagaries of the nature, one pair of footwear is distributed to each family every year from the funds of state exchequer.

Year	Footwear Distributed (In Lakh Pair)			Purchase Rate per Pair (In Rs.)	Amount Received from State Govt. (In Rs. Crores)
	Male	Female	Total		
2006-07	7.90	4.63	12.53	88.00	11.345
2007-08	9.30	3.30	12.60	76.40/81.70	13.00
2008-09	---	12.82	12.82	63.36	8.00
2009-10	---	13.22	13.22	52.98	10.00
2010-11	13.76	---	13.76	105.00	10.00
2011-12 (in progress)	13.76	---	13.76	105.00	10.00

<< Back to contents

Social Welfare of the M.F.P. Collectors of Chhattisgarh

(ii) Jan Shree Group Insurance Scheme for the Tendu Leaves Plucker's Families of Chhattisgarh

- Jan Shree Group Insurance Scheme for all the Tendu leaves plucker's family head was started from 01.05.2007.
- The 50% amount of the insurance premium is paid by Government of India and 75% and 25% of the balance 50% amount is paid by State Government and Federation respectively. Annual premium per member is Rs. 200/-.
- The family head or his nominee gets following amount on his death/disability :-
  - Normal death – Rs. 20000/-
  - Partial disability due to accident – Rs. 25000/-
  - Accidental Death or Permanent disability – Rs. 50000/-
- Two children of the family head studying between 9th and 12th class and ITI get scholarship @ Rs. 300/- per quarter under Shiksha Sahyog Scheme.

Social Welfare of the M.F.P. Collectors of Chhattisgarh

Jan Shree Beema Yojna for the Tendu leaves pluckers

Financial Year	No. of Claims Settled	Amount Paid to the Claimants (In Rs. Crores)	No. of Student Received Scholarship	Amount Paid as Scholarship (In Rs. Crores)
2007-08	2143	4.49	42319	2.40
2008-09	6883	14.65	119764	7.05
2009-10	4252	8.86	26068	1.97
2010-11	7390	15.77	67926	8.15
2011-12 (Up to 31.10.2011)	5248	11.34	68835	8.26

Social Welfare of the M.F.P. Collectors of Chhattisgarh

(iii) Group Insurance Scheme for the Tendu leaves pluckers

- Started from 1992.
- Pluckers between the age of 18 and 60 years except the head of the family are insured.
- The collector/nominee of deceased gets as follows :-
  - Normal death – Rs. 3500/-
  - Partial disability due to accident – Rs. 12500/-
  - Accidental Death or Permanent disability – Rs. 25000/-

Social Welfare of the M.F.P. Collectors of Chhattisgarh

(iv) Brilliant Student Motivation Scheme of the Federation

(a) To recognize the meritorious one boy and one girl of every primary forest produce cooperative society, the following cash awards are being given from 2011-12

Examination	Prize Amount
Class VIII	Rs. 2000/-
Class X	Rs. 2500/-
Class XII	Rs. 3000/-

(b) To encourage the professional education like Medical, Engineering, Law & MBA etc, one student in every society will be given Rs. 10000/- in first year and Rs. 5000/- from 2nd year to fourth year. The alternate year is earmarked for girl student only.

Development of Resource People's Protected Areas (PPA)

- The basic objective of establishment of PPA's is to enhance the production of NWFP and their sustainable harvesting to provide income to forest dependent communities and ensure ecological security. Each PPA consists of 3000 ha. of forest area rich in NWFP. Every year, 1000 ha. of this area is brought under in-situ conservation.
- The Resources survey is carried out every year in the month of September – October in-situ conservation areas of People's Protected Areas (PPA) by laying out systematic sample plots of 0.1 ha. at corners of grids of size 450m. x 450m to collect the maximum information about three canopies especially ground flora.

People's Protected Areas (PPA)

Main Activities

- Soil and moisture conservation of forest area.
- Assisted natural regeneration in forest area.
- Protection against fire & grazing of forest area.
- Sustainable harvesting and primary processing of M.F.P. along with training of villagers and staff.
- Establishment of Herbal Hospitals.

<< Back to contents

Non destructive Harvesting of MFP

- Forest dwelling community has been traditionally collecting NTFP/Medicinal plants in destructive manner to earn their livelihood.
- There is a lot of pressure of overexploitation of Medicinal plants mainly due to demand from Ayurveda industry.
- It is desirable that NTFP should be properly conserved, sustainably managed, and harvested non-destructively.

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Non destructive Harvesting of MFP

- To overcome the problem of destructive harvesting, Federation developed manual for non destructive harvesting methods of commercially important species for trade. with the help of subject experts from Dabur, Himalaya Herbals and Tropical Forest Research Institute Jabalpur etc. in European commission project.
- The medicinal plant/NTFP collectors, local SHG's, Forest committees, Primary Cooperative societies are being actively involved and trained in sustainable and non destructive harvesting of forest produce.

Contd…

Non destructive Harvesting of MFP

- The projects for development of sustainable harvesting practices of following species have been given to TFRI, Jabalpur by Federation are;
  - Bhui-aonla (*Phyllanthus amarus*)
  - Arjuna (*Terminalia arjuna*)
  - Salparni (*Desmodium gangeticum*)
  - Baichandi (*Dioscprea hispida*)
- Sustainable and non-destructive harvesting practices should be developed for all the commercial species by Forest Research Institute, Dehradun.
- There is a need to have legal provisions for enforcement of sustainable harvesting practices.

Resource Survey of NTFP in C.G.

- The resources survey field work and data entry for the year 2007, 2008 and 2010 have been completed in 2358, 2460 and 79 plots respectively and analysis is in progress.
- The software for resource survey was developed by Forest Survey of India Dehradun. This survey gives an insight on availability of MFP in Chhattisgarh.
- This survey gives an insight of availability of medicinal plants in Chhattisgarh.

Ethnobotanical Survey of C.G.

- Ethnobotanical Survey has been completed at 21 locations of the state, 418 traditional healers were interviewed and 3401 traditional herbal formulations for various purpose were documented.
- By the team of Ayurved experts, 2359 herbal formulations have been validated, out of which 47 Herbal formulations were identified for further research from Central Council for Research in Ayurveda and Siddha (CCRAS), New Delhi.
- Out of 47 herbal formulations 09 formulations have been sent to CCRAS, New Delhi for further research and validation. CCRAS, New Delhi has initially started work only on four formulations due to business of the organization in other engagements.

Establishment of Vanausadhalaya (Herbal Dispensary) in C.G.

- To promote the traditional herbal health care 50 potential sites for vanausadhalaya (Herbal Dispensary) establishment have been identified, out of which 15 centers have been established.
- To provide the primary treatment 50 traditional healers (T.H.) have been selected for vanausadhalaya from various remote areas of Chhattisgarh on the basis of ethnobotanical survey.
- 38 traditional healers were trained on basic concepts of Ayurveda, identification of species, preparation method of herbal medicine & dosage, purification methods of poisonous herbs, common diseases and their symptoms, hygiene & sanitation and First Aid by State Health Resource Centre, Raipur in collaboration with C.G.M.F.P. Fed. Raipur.

<< Back to contents

Establishment of Vanausadhalaya (Herbal Dispensary) in C.G.

- There is a need to develop system to recognize the traditional healers as practitioners.

Value Addition of M.F.P. & Marketing in Chhattisgarh

- NWFP based Microenterprises are established to promote collection, processing and marketing of minor forest produce.
- The main activities include raw MFP procurement and sale, honey collection and processing and production of herbal products and retail marketing of herbal products.
- Each Microenterprise is managed by a group of SHG's working at different levels.
- SHG's work at village level , Hat bazar & storage level and Sanjeevani level and are involved in procurement, value addition and marketing.
- Federation provides financial assistance to local SHG's for establishing NWFP based Microenterprises.
- Village level SHG's purchase the produce from collectors at fix price, pack and resale the same to Haat bazar level at the fix price.
- Haat bazar level SHG's are incharge of temporary storage and sale centre and they purchase above produce at fixed rate and resale the same at NWFP mart at a predetermined rate.
- The SHG's get commission over collection price & transportation charges.
- Forty NWFP have been shortlisted for collection and accordingly purchase price declared by Federation.

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Value Addition of M.F.P. & Marketing in Chhattisgarh

The following main processing activities are being carried out in C.G.

- Four Honey processing units have been set up.
- Tamarind deseeding and packaging in the bricks of different sizes.
- One Tamarind candy unit has been established in Jagdalpur.
- Mahul leaf processing to prepare plates and cups.
- Chronjee processing and packaging in to packets.
- Preparation of Murabba, Candy and syrup from Bel and Aonla.
- Production of 37 herbal medicines.
- Tikhur and Baichandi processing and packaging.
- Brooms from Phul bahari grass.
- Lac processing.

Value Addition of M.F.P. & Marketing in Chhattisgarh

- Various types of basic and technical trainings are organized to enhance the skill and knowledge of beneficiaries & Staffs for the development of Microenterprise.
- Technical support for Drug license, Quality testing, labeling & packaging, Good manufacturing practices and development of Standard Operating Procedure (SOP's) are provided by Federation to SHG's.

R & D on Herbal Processing in Chhattisgarh

The following research projects have been assigned by Federation to develop value added products to CFTRI, Mysore.

- *Aegle marmalos* (Bael) Fruit - Murabba, Spread and RTS Beverage
- *Curcuma angustifolia* (Tikhur) Rhizome – Powder

The project to develop the most appropriate primary processing technique for Bael has been given to TFRI, Jabalpur.


Tamarind Tree


Deseeded & De fibered Tamarind


Paking of Tamarind Bricks


Packet Tamarind

<< Back to contents

Livelihood generation by Women SHGs

Processing of Mahul Leaves

Lac Production

Range of Herbal Products

Contd…

Herbal Food

Herbal Cosmetic

International Trade Fair, New Delhi in November 2007

Visit of H.E. Governor, Hon'ble C.M. & Hon'ble F.M. of Chhattisgarh

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European Commission Project

CGMFP Federation is implementing an integrated project namely NWFP based Livelihood Activities in Chhattisgarh with the financial assistance of European Commission State Partnership Programme.

Project objective - Ensuring sustainable livelihood to NWFP collectors through collection, processing, value addition and marketing of non-nationalized NWFP.

Project Outlay - Rs. 21.20 cores

The project covers various support components also such as resource inventory, capacity building, management information system, marketing, certification, traditional knowledge and R&D.

[<< Back to contents]

Lac Cultivation in Chhattisgarh

1. Lac host plants like Kusum, Palash, & Ber are found abundantly in forest and non forest areas of the State.
2. Lac cultivation provides employment and sustainable income at the door step of the beneficiary. The cultivation of lac is very lucrative.
3. A kusum tree produces about 30 kg of lac per year yielding an income of about Rs. 4500 and a palash tree produces 4 kg of lac per year providing an income of Rs. 300.
4. State level Inter Departmental Cell headed by Hon'ble Forest Minister has been constituted for promotion of cultivation, processing and marketing of Lac in CGMFP Federation. Special efforts were made to promote lac cultivation since 2004-05.
5. The capacity building through training and supply of brood lac were the main support to the beneficiaries.
6. The result was that the production of lac increased by 58% in two years and Chhattisgarh produced 7198 MT lac in year 2008-09 which was the highest in the country.

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Lac Development in Chhattisgarh

1. Lac development scheme has been started from the State budget with annual provision of about Rs. 2.00 crore.
2. Six Lac Facilitation Centers headed by executives have been established to provide technical support to the cultivators.
3. About 200 twelfth pass local rural youth trained in lac cultivation work as lac facilitator to perform extension activities.
4. Besides primary cooperative society managers also carry out extension work.
5. Twenty Lac cultivation micro enterprises have been established, in which about 7067 beneficiaries cultivate lac on approximate 18498 Kusum trees, 20099 Palas trees and 4770 other host trees.
6. Lac training centre is also being established in Kanker at cost of Rs 1.00 Crores.

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Lac Development in Chhattisgarh

- C.G.M.F.P. Federation is also implementing a livelihood project sanctioned by Ministry of Rural Development, Govt. of India, New Delhi under special SGSY scheme of Rs.14.98 crores for the poverty alleviation based on lac cultivation and processing in Chhattisgarh for 13000 beneficiaries.
- Lac has good demand in export. Lac cultivation and processing should be promoted in M.P., Maharastra, C.G., Orissa and Jharkhand having large number of lac host trees to provide substantial income at the door step with a little effort cultivation of lac ensures protection of host trees against felling also.

❖

Host Tree - Kusum

Brood Lac

Inoculation of Insect

Organic Production and Certification

- Organic farming/collection is gaining gradual momentum all over the world.
- The ill-effects of chemicals used in cultivation have changed the mindset of health conscious consumers in different countries including India who are now buying organic with high premium.
- Growing environmental awareness has increased the demand of organic food.
- While trend of rising consumer demand for organics is becoming discernible, sustainability in cultivation/wild collection is very important.
- The Ministry of Commerce of G.O.I. has launched National Programme on Organic Production (NPOP) to promote organic production and cultivation.

Forest Resources - Organic

- These forest areas, are 'organic' by default also.
- Tribals have been using traditional methods of cultivation and many of them are yet to come under the intensive use of chemical fertilizers and pesticides to enhance production.
- The abject poverty amidst tribal prevents them from affording inorganic fertilizers and chemical pesticides even if they were willing.
- Thus, the forest and tribal habitation maps of Country overlap largely with organic areas.

<< Back to contents

Establishment Of Organic Certification Body in Chhattisgarh

- An autonomous body CGCERT i.e. Chhattisgarh Certification Society has been accredited by Ministry of Commerce, Govt. of India for organic certification as per National Programme on Organic Production (NPOP) in September 2009.
- CGCERT has now registered 31 operators from Chhattisgarh and M.P.

Certification of Organic Products for Domestic Selling

- Certificate of Authorization (CA) was granted to CGCERT from AGMARK, GOI, Faridabad for organic products on 10th Jan 2011.
- CGCERT is the 1st Certification Body (CB) granted CA in the country.
- The nature of activity will cover inspection & certification of agricultural commodities produced through organic agriculture as per the provisions in Agricultural Products (Grading & Marking) Act, 1937, General Grading & Marking Rules, 1988, Organic Agriculture Produce Grading & Marking Rules, 2009, Specific Commodity Grading & Marking Rules & Guidelines issued for the implementation.

Voluntary Certification Scheme for Medicinal Plants (VCSMP)

- The National Medicinal Plant Board (NMPB) & Quality Council of India (QCI) have launched a Voluntary Certification Scheme for Medicinal Plants (VCSMP) in 2010.
- The objective of the scheme is to enhance confidence in the quality of India's Medicinal Plant Produce and make available good quality raw material to the AYUSH Industry.
- The National Medicinal Plant Board (NMPB), Department of AYUSH & World Health Organization (WHO) have prepared India specific Guidelines on Good Agriculture Practice (GAP) & Good Collection Practices (GCP) for medicinal Plants.

Voluntary Certification Scheme for Medicinal Plants (VCSMP)

Beneficiaries

The scheme will benefit:-

(a) Medicinal plant producers/collectors/group of producers or collectors.

(b) Traders/Manufacturers of herbal medicine/AYUSH Industry.

(c) AYUSH Consumers due to the assured quality of medicinal plant/herbs.

CGCERT is planning to take accreditation as certification body.

Ministry of Tribal Affairs, G.O.I. Scheme of M.F.P.

The Scheme of 'GIA to STDCCs for MFP Operations' introduced by the Central Government in the year 1992-93, provides for funding of State Tribal Development Corporations/ Federations for the following activities:

a) increasing the quantum of MFP handled by setting off operational losses, if need be;
b) strengthening the share capital base of the Corporation for undertaking MFP operations;
c) setting up of scientific warehousing facilities, wherever necessary;
d) establishing processing industries for value addition with the objective of ensuring maximum returns on the MFPs for the tribals;

The Central Govt. provided Rs. 9.52 crores to C.G.M.F.P. Federation, Chhattisgarh from 2004-05 to 2010-11. The scheme is good but fund flow is irregular and allotment in the scheme is meagre compared to the requirement of the country.

Minimum Support Price for MFP

• The 10th Report of the Standing Committee of members of parliament on Social Justice and Empowerment (2005-06) recommended Minimum Support Price (MSP) of MFP so that the tribals get proper value for the forest produce collected by them.

• Ministry of Panchayati Raj of Govt. of India has constituted a committee to ensure fair price to the M.F.P. collectors. MoEF, GOI has decided to purchase Mahua flower and seed, Lac, Imli, Myrobolans and Salseed to purchase on support price.

<< Back to contents

Procurement of MFP

Procurement of MFP should be aimed at ensuring remunerative and best possible prices to the collectors of MFP and not merely the support price.

Constitution of collection units specifying the geographical area for each species is the first step to start procurement. In my opinion there are following three options :

Procurement Option - 1

Sale of units in advance of collection to purchasers (traders). Purchase price fixed by the Government to be paid by the purchaser to the collector at predecided collection centres/ bazars.

Advantages	Disadvantages
1. Financial requirement is not much.	1. Sale of all units in the beginning years is doubtful.
2. Traders will ensure quality of the produce and it may increase the sale price.	2. Sale price of forest produce may be influenced by the local small traders, as it may be difficult for big traders to manage many small collection centers.
3. No. problem of transport and godowning.	
4. Overhead expenditures are not much.	

Procurement Option - 2

Sale of produce after godowning. Purchase of NWFP by institution authorized by the Sate Govt. at a price fixed by the Government at predecided collection centres/bazars.

Advantages	Disadvantages
1. Stored NWFP may get good price in tenders because big traders from different states will participate in the tender.	1. Requirement of financial resources is very high and overhead expenditures are more in comparison to Option-1 but much less then Option-3.
	2. Need of huge storage facilities.
	3. Transportation management is needed.
	4. Difficulty in ensuring quality of the produce.

Nationalisation of NWFP is essential to eliminate the malpractices of middle men at collection centres and the profit in option 1 & 2 can be distributed as incentive wages, as is being done for tendu leaves in many States.

Procurement Option - 3

Purchase of MFP by Govt./Federation/Corporation at support price at predecided collection centres fixed by the Govt. Trader can also purchase MFP if the collectors want to sell to him at mutually agreed rate.

Advantages	Disadvantages
1. Collectors may be benefited when market prices are lower than support price.	1. Possibility of good quality material going to the traders and bad quality material coming to the Govt.
	2. If the market price of the produce is much more than the support price, then local traders will purchase it from collectors and sell it in the bigger markets at much higher price than paid to the collector.
	3. If market price is less than the support price, Govt. will have to procure huge quantity and incur losses. Even the local middlemen will try to push their stock in Govt. purchase.
	4. Manpower, financial resources and storage facility requirements will be very high.
	5. Large overheads, specially when the purchase volume is low.

Procurement Option - 3

- **It is worth mentioning that no big trader of Bastar area trade in tendu leaves in spite of huge production in the area. They trade mainly in Mahua and Imli because of much higher profit in the trade of non-nationalised species to the traders due to exploitative practices.**
- **Traders in Chhattisgarh oppose the option 1 and 2 but favours the option 3. In my opinion proposed option 1 is the best for the procurement of MFP, as it has been successful for tendu leaves. This option ensures the best possible competitive price to the collector by way of procurement wages and incentive wages.**

Role of Organisations of Govt. of India

Ministry of Tribal Affairs

- **At present funds flow for M.F.P. operations is small and irregular.**
- **The Tribal Ministry should provide sufficient funds for procurement and value addition of MFP and storage Godowns.**
- **The funds should be earmarked every year on the basis of Forest Area, Tribal population and potential of MFP production. The tentative allotments should be intimated to every state in the month of April so that projects are sent accordingly.**
- **There is a lot of support for agriculture sector in terms of various subsidies/ support price but MFP procurement is not being supported at all though the poorest of the poor specially tribals are engaged in MFP collection.**

<< Back to contents

Role of Organisations of Govt. of India

TRIFED

- TRIFED is an apex co-operative body which is supposed to promote the interest of tribals through MFP operations but at present there seems to be a little contribution from this Organisation.
- As far as procurement of MFP is concerned the operations should be left to CGMFP Federation and similar organisation of other states as the state organisations have vast network of societies through out the states.
- TRIFED should establish or facilitate in establishing modern processing units in urban and rural areas to enhance the return from MFP to tribals.
- At present there is a lot of potential of export of raw herbs and herbal products, TRIFED should play active role in undertaking marketing in general and export in particular.

Role of Organisations of Govt. of India

Ministry of Environment & Forests

- ❖ MOEF should initiate special schemes for In-Situ conservation of NWFP rich areas. This scheme should have components of resource inventory, conservation, good collection practices, capacity building of collectors of NWFP, JFM committees and Primary Cooperative Societies and processing and value addition of NWFP.
- ❖ Appropriate and proactive guide lines should be issued under Forest Conservation Act to promote the cultivation of MFP /Medicinal plants in forest areas.
- ❖ Standardisation of sustainable harvesting and good collection practices of NWFP through ICFRE, IIFM and other institutes.
- ❖ Legal provisions for National Transit Permits to avoid unnecessary delays/inconvenience in transit of forest produce due to change of T.P. at states borders.

Role of Organisations of Govt. of India

Ministry of Health

- ❖ Collect the information on source and quantity of the various raw material used by the pharmaceutical companies.
- ❖ At present the Sal Fat, which is cocoa butter equivalent, is not allowed to be used in chocolate manufacturing in India, though it is allowed in Japan and European countries. If the permission for use of Sal fat in chocolate manufacture is granted under P.F.A. in India, Sal seed can fetch much better price resulting in better remuneration to collectors of Sal seed of C.G., M.P., Jharkhand and Orissa.
- ❖ Should evolve some recognition system for traditional healers for better utilization of traditional knowledge.

Role of Organisations of Govt. of India

Ministry of Commerce & Industries

- ❖ It should insist on NWFP based industries to declare the source and species and quantity of NWFPs they are using to develop NWFP based database at National Level for arriving at a strategy to promote domestic trade and export.
- ❖ Probably SHEFIXIL, Kolkatta is not proactive enough to promote the exports of MFP other than Lac.

Role of Organisations of Govt. of India

Ministry of Agriculture

- ❖ In view of the large production of tree borne oil seed from Mahua, Sal, Karanj & Neem an M.P., Maharastra, C.G., Orissa, Jharkhand and A.P. A Tree Borne Oil Seed Research Institute of ICAR should be established in Raipur to develop value added products.

Conclusion

1. In view of the above, it is clear that C.G. and M.P. Govt. are providing the collectors of M.F.P. more than what PESA stipulates, I am of the considered view that if the extant State regulations and three tier co-operative structure, which have stood the test of time are done away, there will be complete anarchy and MFP collector families of Chhattisgarh and M.P. would suffer loss of income. Therefore, we strongly feel that the present trade system of nationalized species in C.G., M.P., A.P., Maharashtra and Orissa should continue.
2. The Govt. of India should provide financial assistance for purchase of non-nationalised species similar to purchase of agriculture produce as their value and volume are substantial to ensure fair price to the collectors. The forest produce collectors deserve the priority as they constitute the poorest strata of the society. However the detailed mechanism for the purchase of forest produce will be quite different from that of agriculture produce and may be state specific.
3. The role of established existing institutions like Forest committees, Cooperative societies and State level Corporations/ Federations should continue and strengthened.

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<< Back to contents

Conclusion

4. The State Govt. must have full jurisdiction to regulate the trade of M.F.P through State rules and regulations to protect the interest of the collectors as they are still very vulnerable to exploitation by middlemen.
5. The ownership of M.F.P. should be interpreted as full right of the collectors on usufruct only. Ownership should not be interpreted literally, as the forests, whose owner is Government & MFP, are intricately mixed and forests perform much more important regional/ national/ global environmental functions.
6. The State Govt. should have full powers to enforce sustainable harvesting principles which include restriction on the quantity of harvesting even to ban the exploitation of endangered species. Sustainable and non-destructive harvesting practices should be developed for all the commercial species by Forest Research Institute, Dehradun. The working plans should incorporate effective sustainable NTFP management also. There is a need to have legal provisions for enforcement of sustainable harvesting practices.

Contd…

Conclusion

7. The processing and Value addition of M.F.P. should be promoted in all the States like Chhattisgarh, Madhya Pradesh and Andhra Pradesh.
8. Maximum number of lac host trees i.e. Kusum, Palas and Ber etc. should be brought under lac cultivation.
9. Organic production and certification of MFP under NPOP and Certification of Medicinal Plants under VCSMP should be promoted.
10. The Social Welfare Schemes in Chhattisgarh for M.F.P. collectors like insurance and distribution of shoes can be adopted by other States also.
11. The herbal hospitals benefiting the society from traditional knowledge should be established in biodiversity rich areas of the Country. If some recognition system is evolved by Department of AYUSH, Ministry of Health GOI, the healer will feel dignified.

Contd…

Conclusion

12. GOI should make legal provisions for National Transit Permits to ensure smooth movement of forest produce through out the country.
13. Interministerial NTFP board in MoEF Govt. of India should be constituted to provide necessary state specific support and subsidy to state organizations like MFP Federation/Tribal Corporations, for conservation and development of MFP, fair price procurement, value addition, certification, marketing and capacity building etc. in MFP sector.
14. The various Ministries of GOI should play proactive role as specified above.

<< Back to contents

Bamboo shoots: Standardization of harvesting time for obtaining quality produce to augment its utilization

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Tropical Forest Research Institute, Jabalpur

What is Bamboo?

- Bamboo is a grass
- Grows naturally in biologically diverse forests
- Grows more rapidly than trees
- Yields within three to four years
- Single most important forest produce used by the rural communities

Significance of Bamboo

- 132 genera,1250 species with about1500 possible uses
- 2.5 billion people worldwide use bamboo
- Over 2 million tonnes of edible bamboo shoots are consumed annually around the world
- 20-30 million tonnes of bamboo shoots are utilized for production of canned bamboo shoots annually
- Currently, India's domestic bamboo economy is estimated at ₹ 2,000 million
- Consumed by the local people and tribals in north east and central India.
- Provides Livelihood, Ecological and Food Security.

<< Back to contents

- Approximately 435 tonnes, 426.8 tonnes and 26.2 tonnes of bamboo shoots are harvested in Meghalaya, Mizoram and Sikkim, respectively.
- The annual average consumption of bamboo shoots in Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura is 1979 tonnes, 2188 tonnes, 442 tonnes, 433 tonnes, 442 tonnes and 201 tonnes respectively
- In Meghalaya, the total area under bamboo shoot cultivation is 50,000 hectares with 1.2 lakh MT of tender bamboo shoot available for processing every year.

Source: Choudhury *et al.*, 2011

Bamboo Shoots

- A new emerging young culm is known as bamboo shoot or juvenile shoot
- Harvested before significant fiber development.
- The shoots are progressively formed from latent buds on rhizomes.
- The edible part consists of young and tender culms enveloped in a protective, non- edible leaf sheaths.

Shoots of different ages

4 days old

8 days old

10 days old

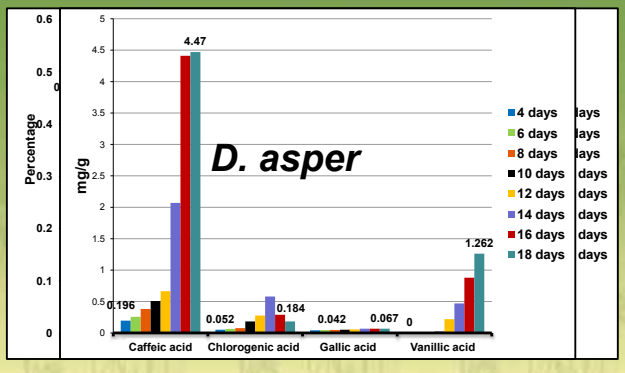
- The shoots are :
  - Low in fat
  - Contain considerable amount of carbohydrate
  - Total phenols
- Are a good source of
  - Potassium
  - Vitamin B6, thiamine, riboflavin, niacin,
  - Vitamin C
  - Dietary fibres like hemicelluloses, cellulose, pectin and lignin

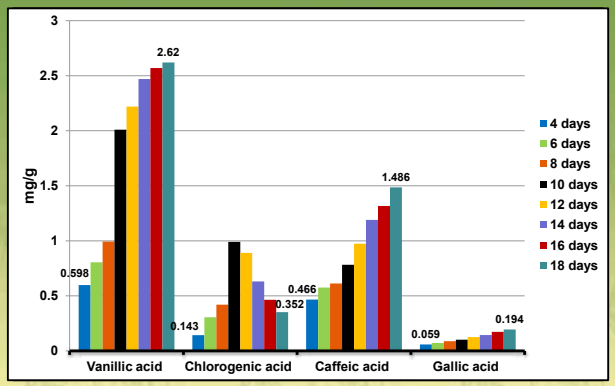
- **Cyanogenic glycoside : Taxiphyllin**
  - varies in different species
  - 0.3 to 0.8% HCN
  - 0.16% in tip reducing to 0.01% at the base
  - increase with the age/maturity of shoots
- Thus, it is necessary to harvest shoots, at right time, before the lethal concentration gets accumulated.

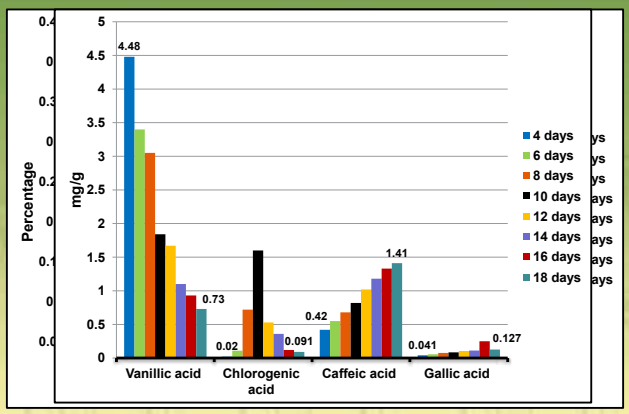
<< Back to contents

- Species selected for the study were *Bambusa tulda*, *Dendrocalamus asper* and *D. strictus*.
- The newly emerging shoots were harvested on different days
  - *D. asper* : 4-18 days
  - *D. strictus* : 4-18 days
  - *B. tulda* : 4-18 days

- **Total carbohydrate** : Anthrone's method
- **Total proteins** : Lowry's method
- **Total phenols** : Folin- Ciocalteau method
- **Ascorbic acid** : Titrimetric method
- **Dietary Fiber** : Gravimetric method
- **Cyanogens** : as hydrocyanic acid equivalents
- **Minerals** : Wet digestion (Na & K- Flame photometer, P- Spectrophotometer, Ca & Mg- Titration)
- **Phenolic acids** : HPLC
- **Antioxidant activity** : DPPH Assay







Antioxidant activity of bamboo shoots harvested at the optimum age

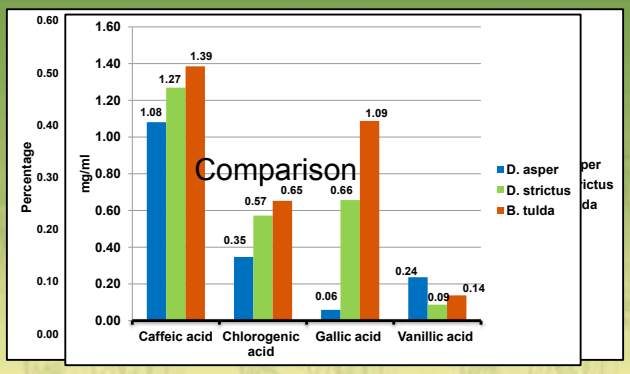
Species	EC_{50} mg/ml
Dendrocalamus asper	42.64 ± 0.09 a
Dendrocalamus strictus	45.27 ± 0.12 a
Bambusa tulda	42.82 ± 0.11 a

Data presented as mean ± SD (n=3). Values denoted by different letters differ significantly at p p≤ 0.05

<< Back to contents

- Harvesting time determines the quality of shoots.
- Early harvest provides very small sized shoots with more leafy portion
- Late harvesting makes the shoots woody and tough
  - having higher concentration of cyanogen

D. asper **: 10-14 days old**
D. strictus **: 6-10 days old**
B. tulda **: 10-16 days old**



CONCLUSION

- Young shoots are nutritionally richer and contain lesser concentration of cyanogens.
- Shoots harvested at right maturity are of superior quality and will be helpful in augmenting their utilization.
- Bamboo shoots hold the prospect of value added economic activity at community and industrial levels through cultivation, processing, packing and commercialization.

<< Back to contents

Influence of growth parameters on wood traits in seed raised trees of *Dalbergia sissoo* Roxb.

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INTRODUCTION

*** Wood is a highly variable material. In order to produce and use wood efficiently, the variation patterns within trees, among trees within species, among provenances within species and among species must be understood. Because of its importance, numerous studies have been made, relative to wood properties and the causes of wood variation.

*** Growth and wood properteis are two important parameter, needs to be assessed for higher productivity and wood quality for the products and also to see the impact of growth in wood properties and their relations.

*** In view of the above, the work presents the impact of growth on thewood properties in seed raised plantations of *Dalbergia sissoo* Roxb.

Materials and methods

The materials were procured from State Forest Department, Punjab. The material from mean tree og different dbh –classes was collected from four sites *viz*. Kharkan, Hoshiarpur , Dhirwal, Hosiyarpur, Kamalpur, Amrtisar and Dharmkot, Ferozpur.

Twelve trees of different dbh (13.6 – 42.3 cm) were selected for the study as mean tree on the basis of different available diameter classes.

Five transverse discs of 10 cm thickness were cut out from the trunk at 2m, 4m, 6 m, 8 m and 10 m heights from each tree to study intra-tree radial and vertical variations.

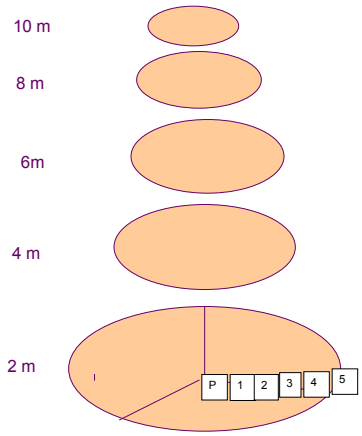
Character of interest

Heartwood, Sapwood
Tension wood
Fiber Idimensions
Vessel element dimensions
Specific gravity

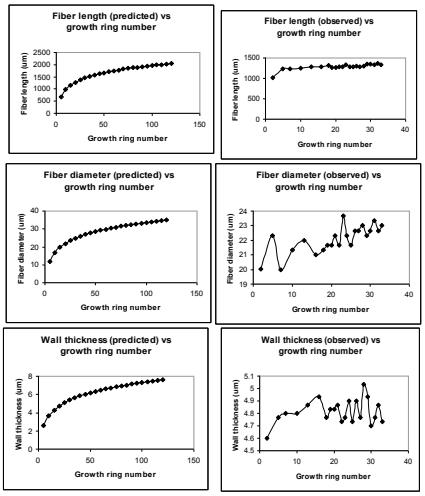
<< Back to contents

Table: Tree growth parameters

Tree No.	Diameter class (cm)	Den. (tree ha^{-1})	dbh (cm)	Height (m)	Biomass (kg tree^{-1})	NPP (kg tree^{-1}y^{-1})	Bole Biomass (kg tree^{-1})	NEP (kg tree^{-1}y^{-1})
1	10-15	117	13.1	11.7	83.56	3.286	37.63	1.14
2	15.1-20	88	19	12.95	245.68	9.82	83.02	2.52
3	15.1-20	70	19.1	10.95	168.18	6.23	79.10	2.59
4	20.1-25	166	20.5	15.55	274.07	10.96	123.21	3.73
5	20.1-25	109	24.8	13.6	374.94	13.89	199.28	7.38
6	25.1-30	151	25.9	13.8	425.17	12.89	174.47	5.29
7	25.1-30	244	28.1	18.9	464.36	16.01	273.9	9.44
8	31.1-35	14	34.8	17.95	900.58	27.29	499.37	15.13
9	35.1-40	36	36.4	18.33	865.26	32.05	403.85	14.96
10	35.1-40	14	37.5	17.95	905.88	27.45	499.37	15.13
11	40.1-45	11	42.3	22.1	1226.94	42.31	724.26	24.97
12	40.1-45	112	43.19	18.7	1516	60.64	642.54	25.70



Sampling of wood samples from trees at peripheral, radial and vertical directions



RESULTS WITH IN TREE RADIAL VARIATION

Fig. Fiber dimensions (µm) at different growth rings

Fiber dimensions increased with age.

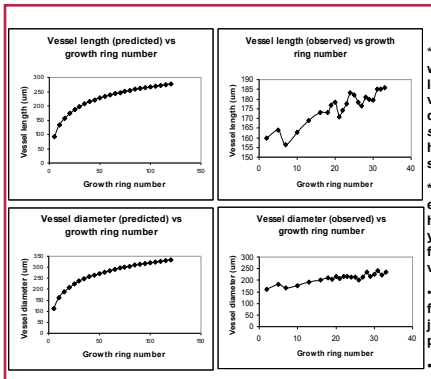


Fig. Vessel element dimensions at increasing number of growth rings

*** Significant differences in different wood elements dimensions *viz*, fiber-length, fiber-diameter, wall thickness, vessel-element-length, vessel-element-diameter of the 33 years old tree of *D. sissoo* due to location, direction and height, and may related to the non stabilization of characters.**

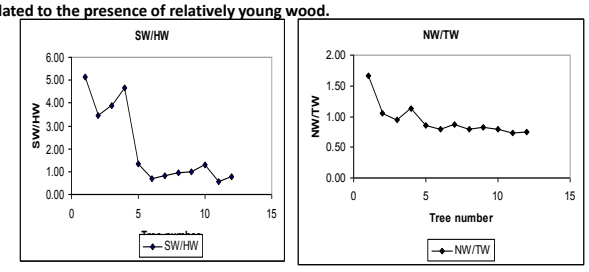
*** The dimensions of the wood elements increased with the age, however, the trend after the age of 28th years of age seems to be stabilized for fiber-length, vessel-element-length and vessel-element-diameter.**

•No particular trend was observed for fiber wall thickness. It showed that juvenile wood had impact on wood properties up to this age.

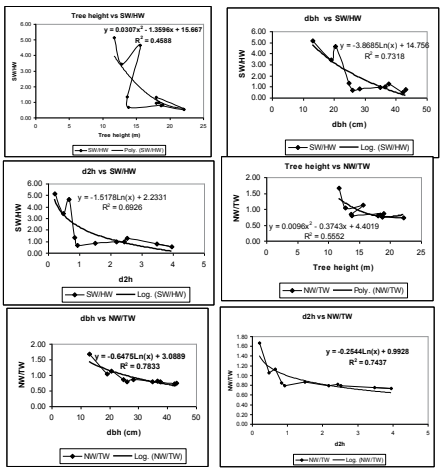
•Inter- and intra-tree radial and vertical significant variations in wood properties showed the heterogeneous wood properties from the seedling seed raised trees of *Dalbergia sissoo* even at the age of 27 years though the trend seems to stabilized after the age of 35th years.

IMPACT OF GROWTH ON HEART AND TNSION WOOD

The general trend of heart and tension wood was increasing in the trees with increase in the diameter while trend was decreasing at the different heights from ground to upward. Growth had positive impact on the formation of heart- and tension-wood.
The less amount of heart- and tension-wood towards the upper side of the tree may be related to the presence of relatively young wood.



Sap/ heart wood (SW/HW) and normal/tension (NW/TW) wood ratio decreased with tree height, dbh and d^2h. Though, heart wood increased with increased growth, yet sap wood formation more positively affected by growth than of the heart wood. So SW/HW declined with growth.



Fiber-length, fiber-diameter and specific gravity showed negative relationship with NW/TW ratio.

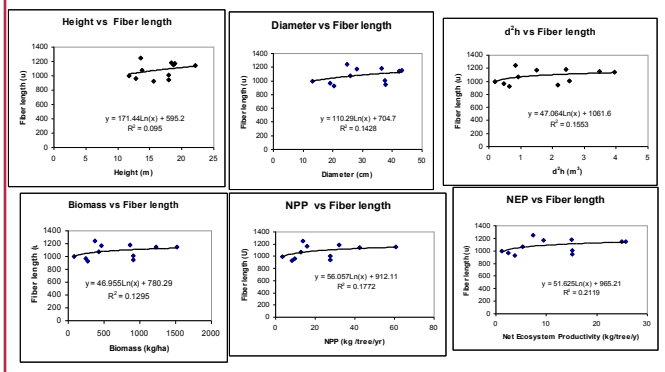
Fiber-length and vessel-element-diameter showed negative relationship with SW/HW.

Specific gravity increased during early increasing dbh of trees and then declined. It showed that increasing heart wood proportion affected positively to specific gravity

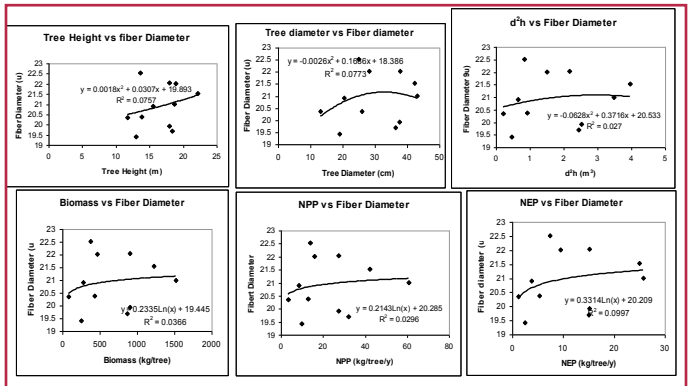
Impact of growth parameters on sap/heart and normal/tension wood ratio

<< Back to contents

Relationship between growth parameters vs. fiber-length

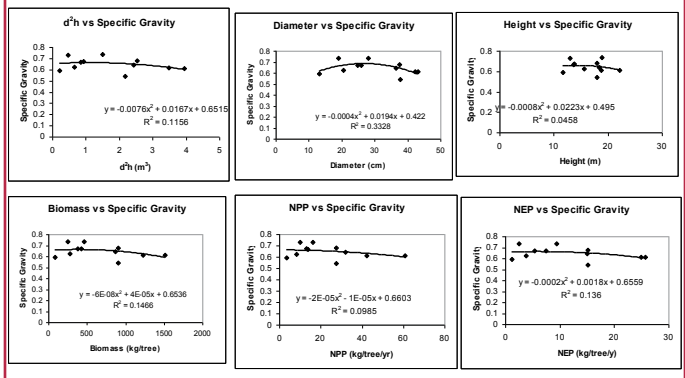


Growth has positive impact on fiber length



Relationship between growth parameters vs. fiber-diameter

Growth has positive impact on fiber diameter



Relationship between growth parameters vs. specific gravity

Specific gravity negatively affected by growth.

IMPACT OF GROWTH ON WOOD ANATOMICAL PRPERTES AND SPECIFIC GRAVITY

In general, growth parameters showed increasing trend with fiber length.

R^2 values indicated that NEP (Net Ecosystem Productivity), NPP (Net Primary Productivity), tree volume and diameter affected more the fiber length.

Tree height showed poor relationship with fiber length. NPP showed positive relationship with vessel element length.

Growth parameters showed negative relationship with specific gravity.

It showed growth affected positively the length of fiber and negatively to the specific gravity.

Dimensions of wood anatomical parameters showed lower values till the tree of 25.9 cm dbh thereafter increased and stabilized.

Fiber-diameter and specific gravity showed negative relationship with NW/TW ratio.

Fiber-length and vessel-element-diameter showed negative relationship with SW/HW while specific gravity increased during early increasing dbh of trees and then declined and showed that increasing heart wood proportion affected positively to specific gravity

<< Back to contents

POTENTIAL OF NEEM SEED OIL FOR BAMBOO PROTECTION AGAINST DEGRADING AGENCIES

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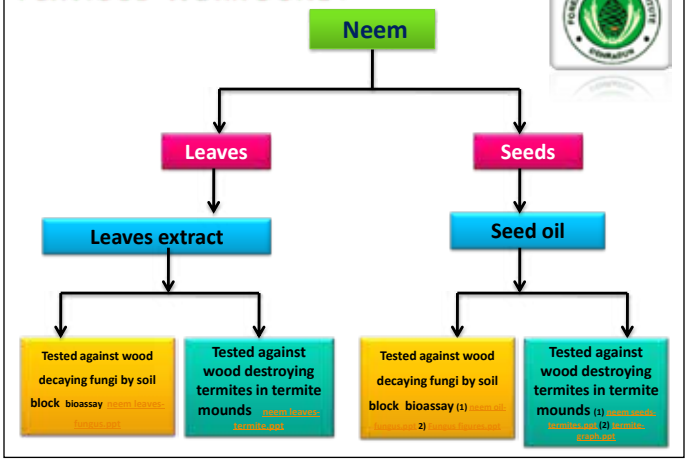
INTRODUCTION

- Importance of wood/bamboo and need for its preservation.
- Common/Commercially used wood preservatives, CCA, CCB, PCP etc.
- Need to develop eco-friendly preservatives.
- Plant extracts and oil of natural origin containing various active compounds tested against insects and micro-organisms.

PERVIOUS WORK DONE :



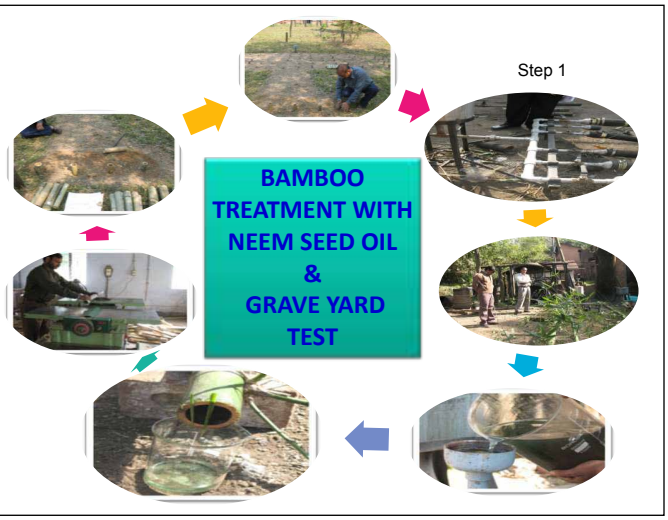
<< Back to contents

OBJECTIVE

To evaluate the potential of neem seed oil for bamboo protection in field conditions.

METHODOLOGY

- Collection of plant material.
- *Extraction of oil from neem seeds.* neem seed oil.ppt
- Treatment of bamboo with neem seed oil By Boucherie process .
- Preparation of samples and installation in test yard.
- Data analysis



RESULTS

Performance of Bamboo treated with Neem seed oil after Installation in Field

Months	Conc. (%)	Species		(%)Sound samples	
		B. nutans	*D. strictus*	*B. nutans*	*D. strictus*
3	Control	Sw (1)	N (0)	100	100
	5	N (0)	N (0)	100	100
	10	N (0)	N (0)	100	100
	15	N (0)	N (0)	100	100
	20	N (0)(100)	N (0)	100	100
6	Control	Mw-Vsf (2.25)	Vsw (0.5)	80	95
	5	N (0)	N (0)	100	100
	10	N(0)	N (0)	100	100
	15	N(0)	N (0)	100	100
	20	N(0)	N (0)	100	100
9	Control	Mw-Vsf (2.25)	Vsw (0.5)	80	90
	5	Mw (2)	Vsw (0.5)	90	98
	10	Vsw (0.5)	N (0)	90	100
	15	N(0)	N (0)	100	100
	20	N(0)	N (0)	100	100
12	Control	Bw-Mf (4)	Mw (2)	75	80
	5	Mw (2)	Sw (1)	85	95
	10	Sw (1)	Vsw (0.5)	85	98
	15	N(0)	N (0)	100	100
	20	N(0)	N (0)	100	100
24	Control	Dwf (5)	Bw (3)	0	0
	5	Dw (5)	Mw-Vsf (2.25)	10	10
	10	Mwf (3)	Mw (2)	20	20
	15	Bw-Vsf (3.25)	Swf (1.5)	20	20
	20	Mw-Vsf (2.25)	Sw (1)	20	20

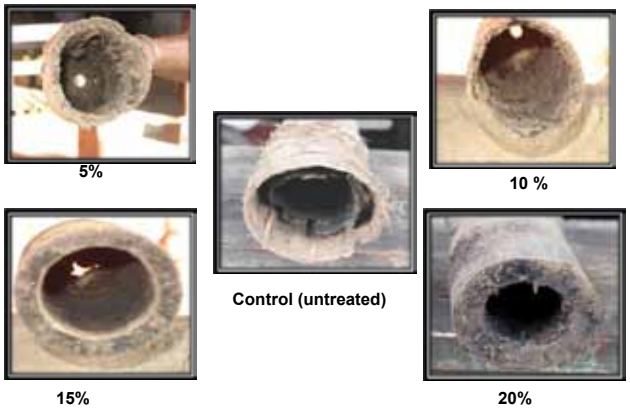
Values in parenthesis are scores based on Table -1

Table 1:Extent of decay caused by fungus and termites and their scores

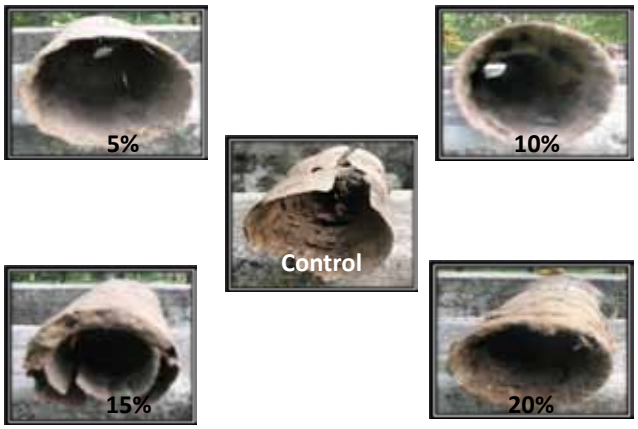
Symbol	Score	Detailed description of attack
N	0	No attack
Vsw	0.5	Very slight termite attack
Vsf	0.5	Very slight fungus attack
Vswf	0.75	Very slight termite and fungus attack
Sw	1	slight termite attack
Sf	1	slight fungus attack
Sf+Vsw	1.25	slight fungus and very slight termite attack
Sw+Vsf	1.25	Slight termite and very slight fungus attack
Swf	1.5	Slight termite and fungus attack
Mw	2	Moderate termite attack
Mf	2	Moderate fungus attack

<< Back to contents

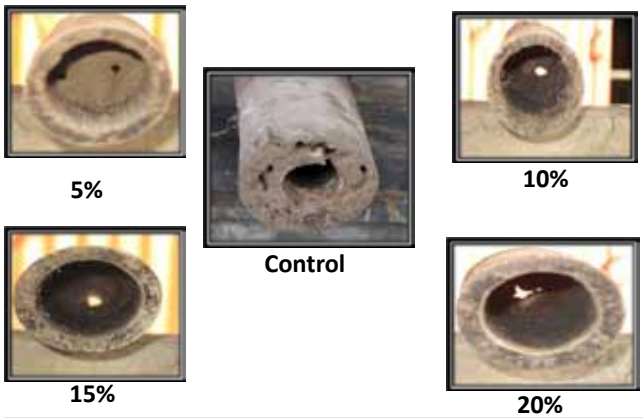
Mf+ Vsw	2.25	Moderate fungus and very slight termite attack
Mw+Vsf	2.25	Moderate termite and very slight fungus attack
Mf+ Sw	2.5	Moderate fungus and slight termite attack
Mw+Sf	2.5	Moderate termite and slight fungus attack
Mwf	3	Moderate termite and fungus attack
Bw	3	Bad termite attack
Bf	3	Bad fungus attack
Bf+VSw	3.25	Bad fungus and very slight termite attack
Bw+Vsf	3.25	Bad termite and very slight fungus attack
Bf+Sw	3.5	Bad fungus and slight termite attack
Bw+Sf	3.5	Bad termite and slight fungus attack
Bf+Mw	4	Bad fungus and moderate termite attack
Bw+Mf	4	Bad termite and moderate fungus attack
Bwf	4.5	Bad termite and fungus attack
Dw	5	Destroyed by termite attack
Df	5	Destroyed by fungus attack
Dwf	5	Destroyed by termite and fungus attack



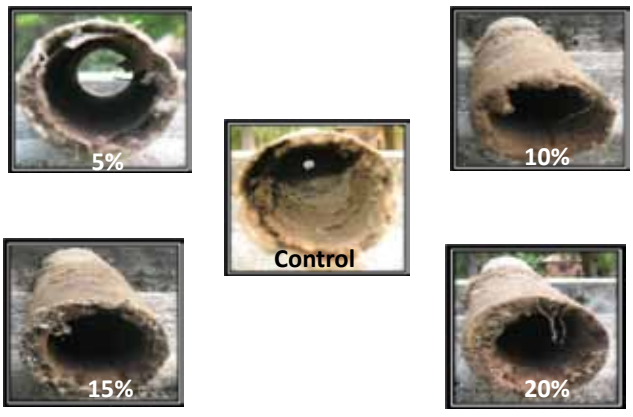
Conditions of treated and untreated samples of *Bambusa nutans* removed after 12 months



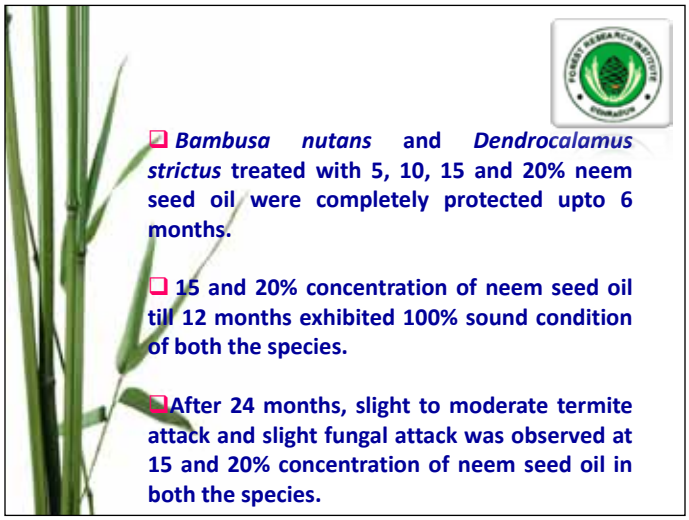
Conditions of samples of *Bambusa nutans* after 24 months



Conditions of treated and untreated samples of *Dendrocalamus strictus* removed after 12 months

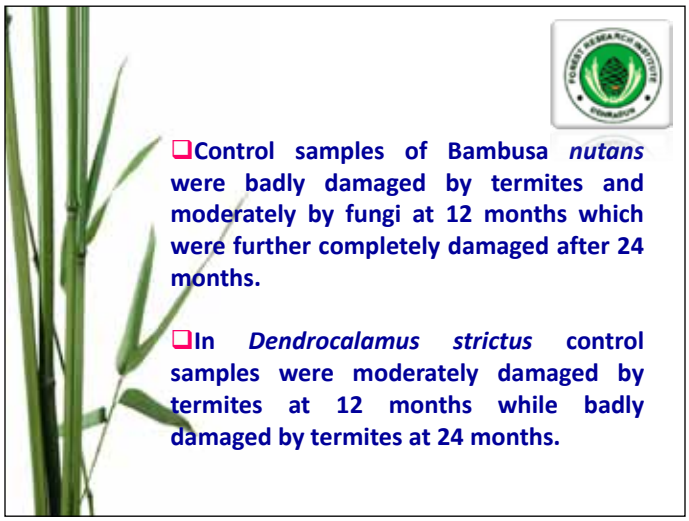


Conditions of *Dendrocalamus strictus* samples after 24 months



- *Bambusa nutans* and *Dendrocalamus strictus* treated with 5, 10, 15 and 20% neem seed oil were completely protected upto 6 months.
- 15 and 20% concentration of neem seed oil till 12 months exhibited 100% sound condition of both the species.
- After 24 months, slight to moderate termite attack and slight fungal attack was observed at 15 and 20% concentration of neem seed oil in both the species.

<< Back to contents



- Control samples of Bambusa *nutans* were badly damaged by termites and moderately by fungi at 12 months which were further completely damaged after 24 months.
- In *Dendrocalamus strictus* control samples were moderately damaged by termites at 12 months while badly damaged by termites at 24 months.

CONCLUSION

Dendrocalamus strictus has comparatively more natural durability as compared to *Bambusa nutans* but both the species could not be completely protected after neem oil treatment in exterior ground contact condition. Samples above ground in open were not affected even after 24 months.

Thank You

<< Back to contents

"Quality assessment of *Dalbergia sissoo* by ultrasonic technique"

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Introduction

•Timber is a natural products.
•Early hidden defects (hollowness and multiple cracks in the log) detection may be of a prime importance to the timber stockiest for prescribing suitable treatment and also to the industries in term of quality assessment and estimation of volume which directly affects the production of wood and wood based products.

Defect evaluation for imaging internal possible in logs and trees :
• X-rays, computer tomography
• Magnetic resonance
• Acoustic tomography
•Applications to logs has been limited health hazards etc (except Acoustic tomography)

Literature Survey

•Due to the porous structure and good strength, timber and timber products are known to be one of the main valuable building materials. But in the present scenario, scarcity and high cost of timber has drawn attention of the users to select a good quality timber for a specific application.

•Stephen (1991) reported a relationship of stress wave and static bending-determined properties of four northeastern hard woods.

•Dolwin et al (2003) used stress wave to measure fungal decay in small wood blocks and found a significant reduction in stress wave velocity of decayed wood blocks.

•Sandoz (1989) found that modulus of elasticity and modulus of rupture in flexure for beams of commercial sized section can be estimated by observing the speed of propagation of a longitudinal wave applied to the longitudinal axis of the beam and graded construction timber (spruce) by ultrasound.

<< Back to contents

Methodology

Defect detection in timber by ultrasound

The ultrasonic waves propagation is based on the vibration of the wood microstructure, fundamentally on the elastic properties of the propagation axis.).

Degradation ratio may be determined based on the formula given below (Sandoz 1996) :

Degradation ratio = { (Vr – Vm)/ Vr } *100 [%]

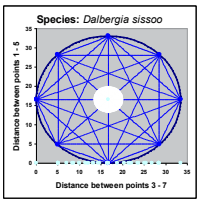
Defect detection in timber by ultrasound

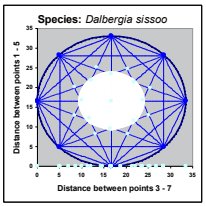
Reference values of ultrasonic velocity

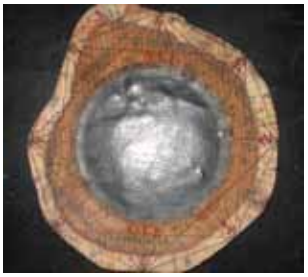
R(ref) 1-5	T(ref.)1- 4	T(Ref.)1-3	T(Ref.)1-2
1763	1746	1638	1469

Photograph: 1 (a).

Photograph: 1 (b).







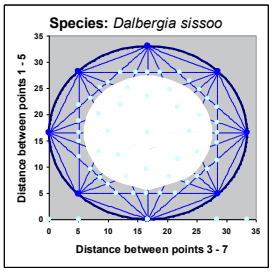


Table- 1

Estimated hole size of artificially made hole at the centre of the disc by ultrasonic technique

S.No.	Species	Actual size of the hole diameter at the centre of the disc (cm.)	Estimated size of the hole diameter at the centre of the disc (cm.)	Error (%)
1	*Dalbergia sissoo*	7	6.65	-5.0
2		14	14.79	5.64
3		21	21.48	2.23

Strength properties

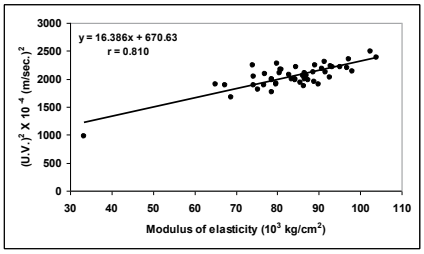


Fig.- 1.Square of ultrasonic velocity as a function of modulus of elasticity

<< Back to contents

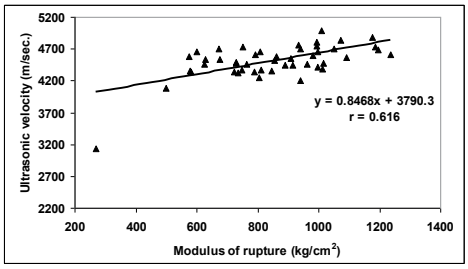


Fig.- 2. Ultrasonic velocity as a function of modulus of rupture

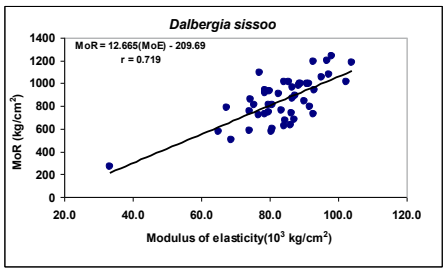


Fig.- 3. Modulus of rupture as a function of modulus of elasticity.

Table - 2

Statistical analysis

Parameters	Count	Average	Minimum	Maximum	S.dev.	CV (%)
Density (gm/cm^3)	47	0.797	0.721	0.847	0.02	3.09
MoE	47	83.7	33.4	104.0	11.43	13.66
MoR	47	85.0	271	1235	201.30	23.68
(U.V.)	47	4510	3132	4988	276.11	6.14
$(U.V.)^2 X 10^{-4}$	47	2042	981	2488	231.09	3.09

Conclusion:

Ultrasonic testing may be a tool for defect detection in log at site prior to its processing and also for determination of strength properties of timber.

<< Back to contents

Indian Forest Congress -2011

Picrorhiza kurrooa **of natural pockets from Jumla district Nepal**

Picrorhiza kurrooa **in Dhanulti Nursery of Uttrakhand**

Chemical constituents from genus *Picrorhiza* - a review

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23 November 2011

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Layout

- Introduction
- Rationale
- Objective
- Materials and methods
- Results and discussion
- Conclusions
- Acknowledgement

3

<< Back to contents

Introduction

- **Nepal, the Himalayan nation has globally significant and biologically diverse ecosystems. It has all the climate zones of the globe representing alpine to tropical in different physiographic zones**
- **This unique geography of Nepal has made it rich in biological resources having valuable MAPs**
- **The role and contribution of MAPs are crucial amongst the rural communities of developing countries including Nepal**

4

- **About 80% of the population of Nepal depends on NTFPs for their primary needs & income generation that ultimately support the livelihood of the people**
- **Conservation and sustainable utilization of MAPs to poverty alleviation was stated in the Tenth five-years Plan (2002-2007) and Interim three years Plan of Nepal (2007-2010)**

5

MAP are used world-wide

Table 1: How many plants are used medicinally world-wide?

Country	Plant species	Medicinal plant species	%
China	26 092	4 941	18.9
India	15 000	3 000	20.0
Indonesia	22 500	1 000	4.4
Malaysia	15 500	1 200	7.7
Nepal	6 973	700	10.0
Pakistan	4 950	300	6.1
Philippines	8 931	850	9.5
Sri Lanka	3 314	550	16.6
Thailand	11 625	1 800	15.5
USA	21 641	2 564	11.8
Viet Nam	10 500	1 800	17.1
Average	13 366	1 700	12.5
World	**422 000**	**52 885**	

Sources: Duke and Ayensu (1985); Govaerts (2001); Groombridge and Jenkins (1994, 2002); Jain and DeFillipps (1991); Moerman (1998); Padua *et al.* (1999)

6

MAP species are traded

Table 2. The 12 leading countries of import and export of medicinal and aromatic plant material from 1991-1998

Country of import	Volume [tonnes]	Value [1000 US$]	Country of export	Volume [tonnes]	Value [1000 US$]
Hong Kong	73 650	314 000	China	139 750	298 650
Japan	56 750	146 650	India	36 750	57 400
USA	58 000	133 350	Germany	15 050	72 400
Germany	45 850	113 900	USA	11 950	114 450
Rep. Korea	31 400	52 550	Chile	11 850	29 100
France	20 800	50 400	Egypt	11 350	13 700
China	12 400	41 750	Singapore	11 250	59 850
Italy	11 450	42 250	Mexico	10 600	10 050
Pakistan	11 350	11 850	Bulgaria	10 150	14 850
Spain	8 600	27 450	Pakistan	8 100	5 300
UK	7 600	25 550	Albania	7 350	14 050
Singapore	6 550	55 500	Morocco	7 250	13 200
Total	**342 550**	**1 015 200**	**Total**	**281 550**	**643 200**

Figures based on commodity group *pharmaceutical plants* (SITC.3: 292.4 = HS 1211).
Source: UNCTAD COMTRADE database, United Nations Statistics Division, New York (Lange 2002).

7

MAP are threatened world-wide

Table 3: How many medicinal plant species are threatened?

Number of flowering plant species worldwide (Govaert 2001)	422 000
12.5% of them are used medicinally	52 000
8% are threatened (Walter and Gillett 1998)	4 160

8

How to implement sustainability: The role of CITES

Table 9. List of plant species which have been included in the CITES Appendices because of trade for medicinal purposes

Species	Family	Date of inclusion in CITES	Appendix
Adonis vernalis	Ranunculaceae	16.8.2000	II
Aquilaria malaccensis	Thymelaeaceae	16.2.1995	II
Cistanche deserticola	Orobanchaceae	16.8.2000	II
Dioscorea deltoidea	Dioscoreaceae	1.7.1975	II
Guaiacum officinale	Zygophyllaceae	11.6.1992	II
Guaiacum sanctum	Zygophyllaceae	1.7.1975	II
Hydrastis canadensis	Ranunculaceae	18.9.1997	II
Nardostachys grandiflora	Valerianaceae	18.9.1997	II
Panax ginseng only populations of the Russian Federation	Araliaceae	16.8.2000	II
Panax quinquefolius	Araliaceae	1.7.1975	II
Picrorhiza kurrooa	Scrophulariaceae	18.9.1997	II
Podophyllum hexandrum	Berberidaceae	18.1.1990	II
Prunus africana	Rosaceae	16.2.1995	II
Pterocarpus santalinus	Leguminosae	16.2.1995	II
Rauvolfia serpentina	Apocynaceae	18.1.1990	II
Saussurea costus	Asteraceae (Compositae)	1.7.1975 App. II 1.8.1985 App. I	I
Taxus wallichiana	Taxaceae	16.2.1995	II

9

<< Back to contents

Rationale for selection of genus *Picrorhiza*

- Well known for its therapeutic value
- Constitute the group of those medicinal plant species used by different communities in Nepal
- Its domestication and conservation has recently gained unprecedented importance because of the large gap in its demand and supply resulting into its over exploitation, adulteration and contamination leading to inconsistent supply of the quality raw material and ultimately threat to its efficacy and existence
- Genus *Picrorhiza* have a threatened medicinal plant species of world wide

Genus of *Picrorhiza*

- Family: *Scrophulariaceae*
- Common name: Kutki
- Habit: Small perennial herb
- Habitat: Herb of alpine region, growing in moist, rocky slopes as well as in organic soils; prefers to grow generally on sloppy and cliffy mountains
- Distribution: Himalayan region (Garhwal to Bhutan), Southeast Tibet, North Burma and West China
- Nepal: It is found in alpine himalayas at 3000-5000 msl in the western, mid western and far western development region of north western aspect, growing on open, stony, grassy slopes and on the turf of glacial flats.

- Parts used: Dried rhizomes
- Harvesting: After completion of reproductive phase in September to December
- Market Rate: IRs. 300/Kg (Dolpa), 600/kg (Nepalgunj), Price Rs 1040/kg in Indian cities
- Nepal is the main supplier of kutki to international market (Olsen, 2005)

Bio active markers, *picroside I and II*

Ethno botanical importance

Treating worms, constipation, low fever, scorpion sting, asthma and ailments the liver. Root paste is used for speedy healing of wounds and the decoction of roots in water is given with salt to feverish cattle as antipyretic

Pharmacological actions

Hepatoprotective, antioxidant, immunomodulator, anti-inflammatory, anti-allergic, anti-asthmatic. anticholestic, hypolipedaemic and laxative

(Alternative Medicine Review, 2001)

Objective

To identify chemical constituents from genus of *Picrorhiza species*

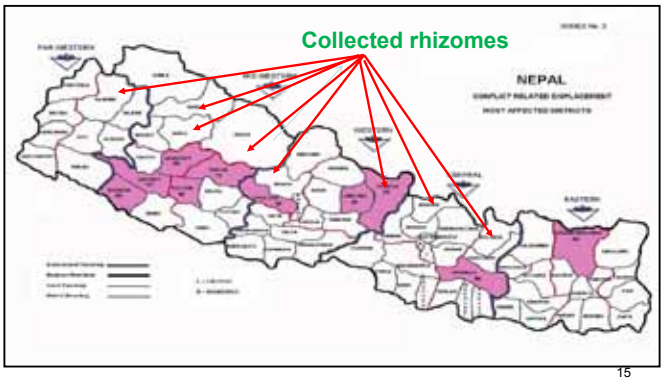
13

3. Materials and methods

- **3.1. Site Selection: Collection of Medicinal Plants:**
- *P. kurrooa rhizomes* was collected from the natural habitats and used by the local people of Bajhang, Dolpa, Jumla, Mugu, Myagadi, Gorkha Rasuwa and Dolkha districts of Nepal.
- The zone of collection was stratified based on altitude, aspect and slope within the range of plants availability and vegetation type, GPS was used to locate the plant collection points in different strata.

14

Collected rhizomes P. from different districts of Nepal



15

<< Back to contents

Data collection:

3.1.3. Establishment of sample plots and measurement:

- Pokhepani CF in Dolpla and Setidevi Gumba CF in Dolkha district were selected and divided into four strata based upon the altitude with the consideration of aspect and slope for the establishment of five sample plots.
- One sample plot in each stratum was established on the basis of the high, medium and low content of *Picrorhiza kurrooa* plants by simple random sampling technique.
- Community Forest Resource Inventory Guideline (HMG Nepal, 2004) was followed for the collection of plant by making 1m x 1m plot for herb together with the other associated herb species.
- The *Picrorhiza kurrooa* species was measured in each plot. Other herb species were also counted to know the association of selected MAPs.

Table 1: Bio physical Data of *Picrorhiza kurrooa*

S. N.	Particulars	Central Region Dolkha District	Mid Western Region Dolpa District	Far Western Region Bajhang District	Western Region Myagdi District
1.	Locations VDC & CFUG	Gauri Shankar- Setidevi Gumba CF, Sindhukhark, Rigu, 4,	Majhphal, Pokhepani, CFUG, Majhpha 3, 4,5,Khskhase(Garidada)	Kotdewal 1,2, and 3, Ranada CFUG, Kharkhre Hiamal or KharkhrePhad	Gurja VDC National Forest area, Phose Khola
2.	Date of collection	3 Sept. to 29 Sept. 2010	10 Oct.-27 Oct. 2010	28 Oct.- 18 Oct. 2010	28 Nov.-24 Dec. 2010
3.	Nos. of plot size measured 1 m X 1m	Five plots	Four plots	Four plots	Seven plots
4.	Av. No. of plants with in plot	25	11	17	23
5.	Altitude(m)	4166, 4157, 4167, 4161, and 4175	3944, 3954, 3950, 3962	3186, 3170, 3175, 3213	3832, 3829, 3885, 3844, 3863, 3891, 3883
6.	Latitude (X –axis)	0425277,0425276,0425283, 0425292, and 0425277	0672061, 0672063, 0672071, 0672071,	0526016, 0525944, 0525913, and 0526045	0713786, 0713795, 0713785, 0713797, 0713795, 0713829, and 0713820
7.	Longitude (Y-axis)	3087701,3087705, 3087705, 3087719, and 3087681	3203749, 3203743, 3203742, and 3203729	3261332,3261340, 3261352, and 3261314	3169969, 3169982, 3169947, 3169995, 3169972, 3170021, and 3170000
8.	Aspects	NW, NW, NW and NW	NW, NW< NW, and NW	NW, NW, SW, and SW	NW, NW, NW, NW, SE, NW, and NW
9.	Slope (in Degree)	28, 32, 28, 33 and 37	32, 38, 36, and 40	35, 30, 34, and 28	43, 45, 50, 48, 43, 42, and 39

17

Socio economic data

S.N	Name of Districts VDC, Wd. No.	Name of CFUG and Area	Handed over to CFUG	Nos. of HH CF & population	Potential MAPs availability at site	Uses of MAPs by local people (Indigenous uses)
1.	Dolkha Gauri Shankar-4	Setidevi Gumba CF, Sindhukhark, Rigu, 4, 83.96 Hects.	2066/7/12	31, 93	Kutki, Sunpati, Panchaunle, Chiraito, Lokta,	Fever,Stomachache, Constipation, Astonic ,wounded portion of the body, body pain,
2.	Dolpa Majhphal-3, 4, and 5	Pokhepani, CFUG, 1800.0 Hect.	2053/3/32	107, 575	Kutki, Jatamansi, Padamchal, Chiraito Bajardant, Yarshagumba, Panchaunle, Lothsalla	Fever, Stomachache, Constipation, Astonic , wounded portion of the body, Body pain, Cut portion of body
3.	Bajhang Kotdewal, 1, 2, and 3	Ranada CFUG 48.0 Hect.	2051/1/19	169 327	Kutki,Sunpati, Okhar,S ugandhwal Lothsalla, Yarshagumba, Satuwa, Atish	Fever, Stomachache, Constipation, Astonic ,wounded portion of the body, body pain,
4.	Myagdi Gurja 1, 3, 4, 6, and 9	Jhayngkhore CFUG-1,3, Burkhani CFUG-4,5,6 Peuithwa CFUG 1, 2, 3, 0.8 Hect National Forest area, Phose khola	2057/4/1 2056/3/25 2056/3/25	65 191 66 456 68 350	Panchaunle, Kutki,Sunpati, Yarshagumba Nirmansi, Chiraito,Bikh Bajardant, Padamchal, Bojpatra,, Allo, Lokta and Bhale Chiraito	Cut portion of body, Asthma Fever,Stomachache, Constipation, Astonic ,wounded portion of the body, body pain, Fever, typhoid, Gastric, reducing poison effect Skin diseases, Bloodpurification Cattle's medicine (If blood seen in cattle's urine

18

Sindhukhark, District Dolkha, CDR, Nepal (Collection of Plant Material)

19

Revenue from *Picrorhiza kurrrooa* (Kutki) in Nepal

S. N.	Year wise	(kg)	Amount in NRs.
1.	2004-05	10586	103583
2.	2005-06	11082	110820
3.	2006-07	13364	133640
4.	2007-08	49166	472133
5.	2008-09	25657	384830
6.	2009-10	37062	555880
7.	2010-2011	47218	710010
	Total	1,91,235	24,70,896

*Source: Hamro Ban, 2011

20

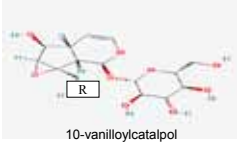
Chemical constituents

Iridoid glycosides (e.g. picrosides I, II, III, IV and V, Kutkoside, pikuroside) apocynin, drosin, D-mannitol, vanillic acid, some steroids and twenty three cucurbitacin glycosides.

Active principal / marker constituent: Kutkin

(kutkoside and picroside I- 1:1.5)

(Dhawan, 1995)



10-vanilloylcatalpol

Kutkoside: R= vanilloyl group

6-O-cinnamoylcatalpol

Picroside I

<< Back to contents

Chemistry

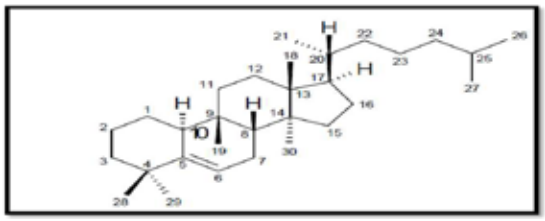
The plant is extracted in alcohol

Analytical methods

TLC, HPTLC, RP-HPLC, LC-MS/MS and NMR Systematic bioassay from fractionation of ethanolic extract of P. kurroa contains *Picroliv* as a potential hepatoprotective agent. Picroliv is an enriched iridoid glycoside fraction containing at least 60% of 1:1.5 mixture (w/w) of picroside I, kutkoside and the remainder (40%) being a mixture of iridoid and cucurbitacin glycosides. iridoid glycosides with a common unit known as catalpol (Negi *et, al., 2008).*

22

Cucurbitacins



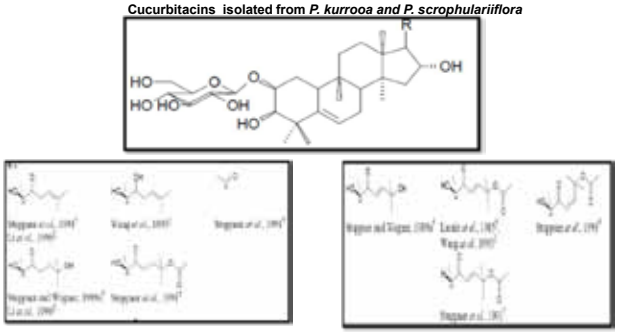
structure of the10 -α Cucurbit-5-ene skelton (9 ꞵ-methyl-19-norlanosta-5-ene)
(Lavie and Glotter 1971)

23

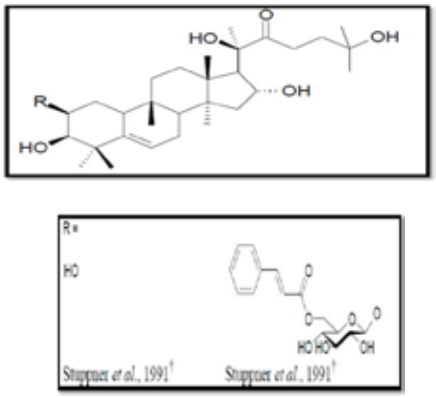
Cucurbitacins from *Picrorhiza kurrooa*

23 Cucurbitacin glucosides and 1 aglucone have been isolated form *Picrorhiza kurrooa species mainly from P. kurrooa*

Cucurbitacins isolated from *P. kurrooa and P. scrophulariiflora*



24



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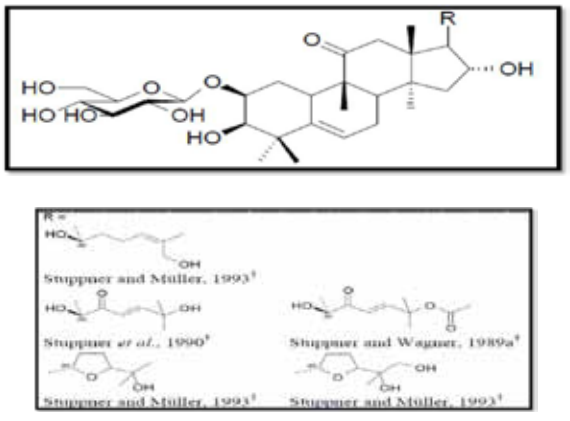
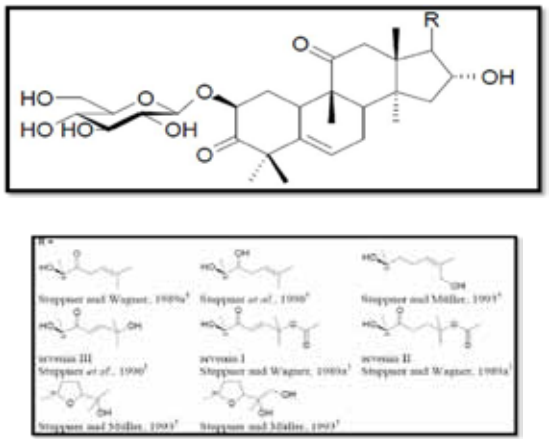


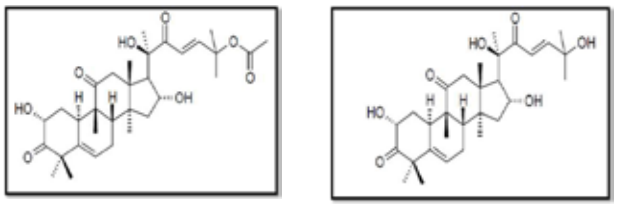
26



*** Constituent of *P. kurrooa* ; ** *P. scrophulariiflora***

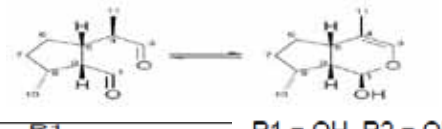
27

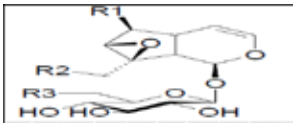
<< Back to contents



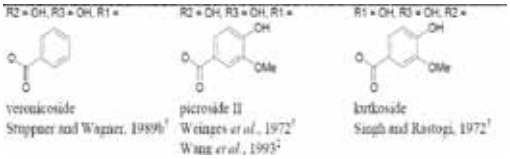
28

Iridoid glycosides

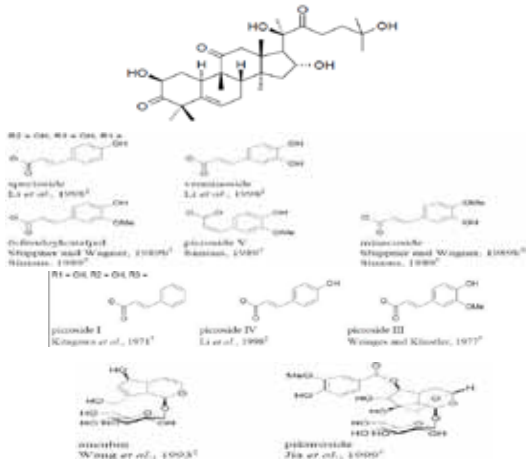




R1 = OH, R2 = OH, R3 = OH
catalpol
Wang *et al.*, 1993‡



29



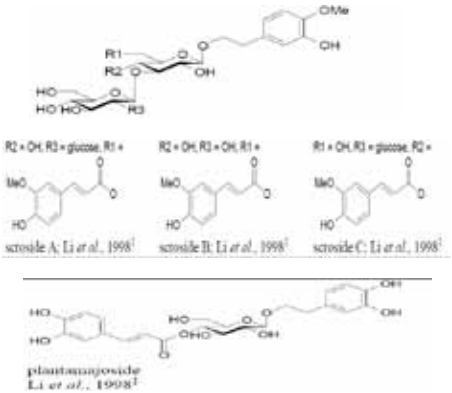
30

Biological activities of iridoid glycoside

- cardiovascular, antihepatotoxic, choleretic, hypoglycemic, hypolipidemic, antiinflammatory, antispasmodic, antitumor, antiviral, purgative, immunomodulatory, antioxidant, anti-phosphodiesterase, neuritogenic, molluscicidal, and leishmanicidal activities (Ghisalberti, 1998).

31

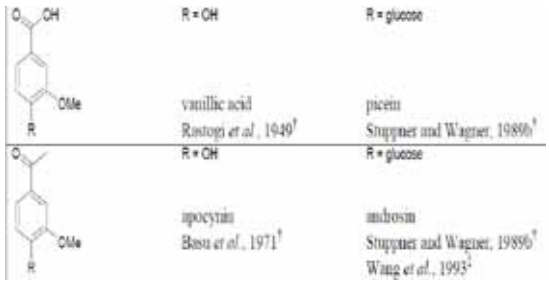
Phenylethanoids



32

Phenolics

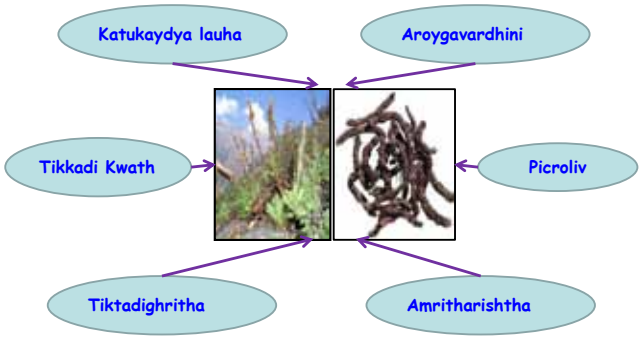
Phenolic compounds isolated *from P. kurrooa* and *P. scrophulariflora*



33

<< Back to contents

Commercial products of *P. kurrooa*

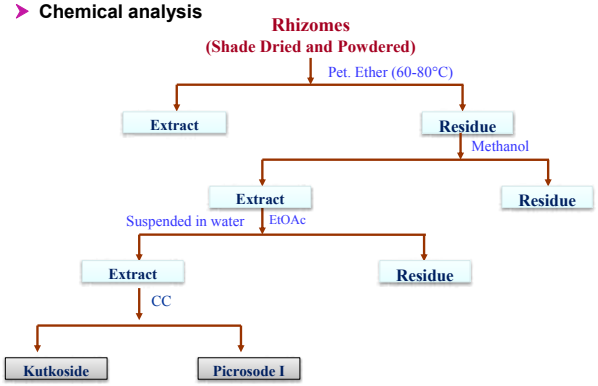


34

S.No.	Name of the Preparation	Manufacturer
1	ACILVAN	Acis Lab., Kanpur, India
2	HEPEX	The Anglo- French Drug Co. (Eastern) Ltd. Bom
3	LIVAREN	Patuda Ayurvedic Pharm., Sehnol, Indi
4	LIERIN	Herbs Era Pharm., Udairajpur, W.B., Ind
5	LIVERTONE	Gambers Lab., Bombay, India
6	LIVOKEN	Herbonard, Calcutta, India
7	LIVOL	Vedic Pharma, Calcutta, India
8	LIVOTRIT	Zandu Pharmaceutical Works Ltd. Bombay,
9	VIMLIV	Solumiks, Bombay, India
10	LivRx	MRM, USA
11	Picrosil	Vita Net Health Foods, Hartville, OH
12	Ayur-Picrorhiza	Nutrition Dynamics, Texas
13	Picroliv	Sabinsa Corporation, USA
14	Liver Formula	GNC Preventive Nutrition , Pittsburgh
15	Ayurvedic Bronchial Formula (BRN-AV)	Nature's Sunshine Products Provo, Utah
16	Picrorhiza extract powder	Hunan Kanglong Bio-resource Co .Ltd Hong
17	GNC Preventive Nutrition Liver Formula Dietary Supplement	GNC Preventive Nutrition , Pittsburgh
18	Livfit	Dabur Pharma Limited, India

Plan of work

- Collection of samples
- Chemical analysis



36

MeoH extraction and HPTLC Analysis

- Extraction of the rhizomes with petroleum ether (60-80°C) followed by methanol using Soxhlet extraction technique was completed
- Sample preparation

  10 mg dried of MeOH extracts were dissolved in 5 ml of HPLC grade methanol for HPTLC analysis
- Standard Solution

  10mg of standard of picroside I and II were dissolved in 10ml of HPLC grade of methanol. For analysis the solution was diluted with methanol 1:10.

37

Sample applications

6mm bands using the automatic sampler 4, application volume 150-750nl for the samples and standards, track distance 11.6mm, first application position 15mm, distance from the lower edge of plate 8mm

Chromatography

Picroside I and II: in twin chamber with two step gradient elution is solvent system (75%$CHCl_3$:25%MeOH), pre saturated (filter-paper) for 20 min with 10 ml of mobile phase. Migration distance 80 from the lower plate edge.

Evaluation

TLC scanner 3 in UV 254 using D2 and W lamp, slit size 5x 0.45

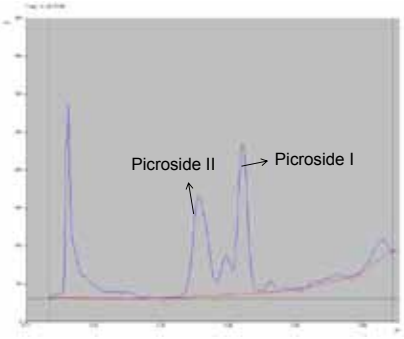
38

Method validation

- Method developed for picroside I and II and validated for specificity, linearity, instrument precision, and accuracy and as per guide lines of International Conference Harmonization (ICH 2003, 2005).
- Chemical assay: HPTLC analysis of samples using validated method
- Methanol extract solution used
- Mobile phase chloroform and methanol (75%:25%) used

39

<< Back to contents



HPTLC chromatogram of samples

40

Results and discussion

Table 1. Method validation parameters for quantification of picroside I and II by HPTLC densiometric method

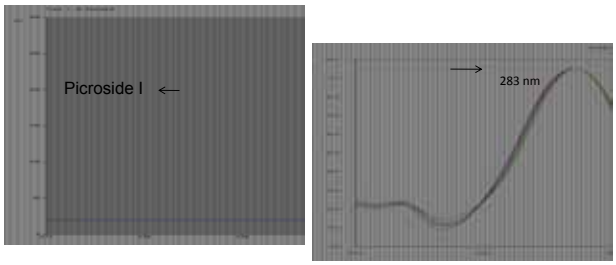
Parameter	picroside I	picroside II
Specificity	specific	specific
Dynamic range (nl/spot)	150 -750nl	150 -750nl
Instrumental precision (% RSD), n=3	0.55	0.41
R_f value	0.55±0.02	0.41±0.02
Regression equation	y= 468.6	y= 411.6
Linearity (correlation coefficient)	0.9943	0.9914

Table 2. Quantification of picroside in *Picrorhiza kurrooa*

Marker compound	Concentration (nl/spot)
picroside I	250, 350 and 450
picroside II	250, 350 and 450

41

Picroside I

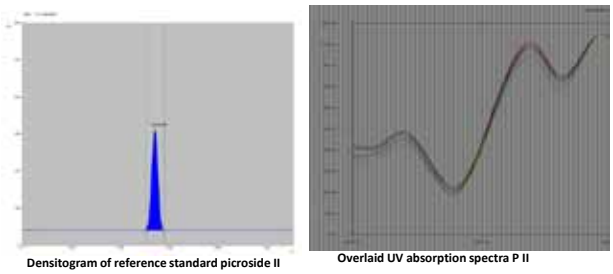


HPTLC densitogram of reference standard P I

UV absorption spectra of picroside I

42

Picroside II

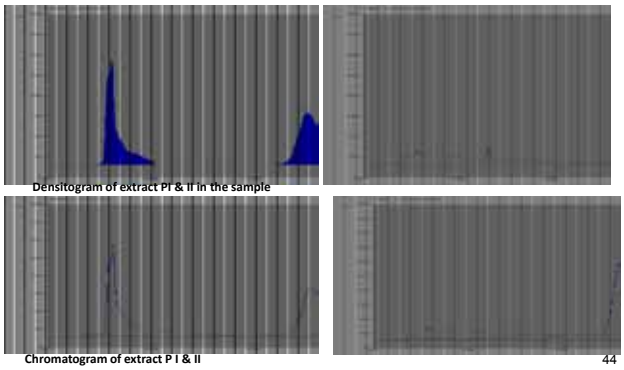


Densitogram of reference standard picroside II

Overlaid UV absorption spectra P II

43

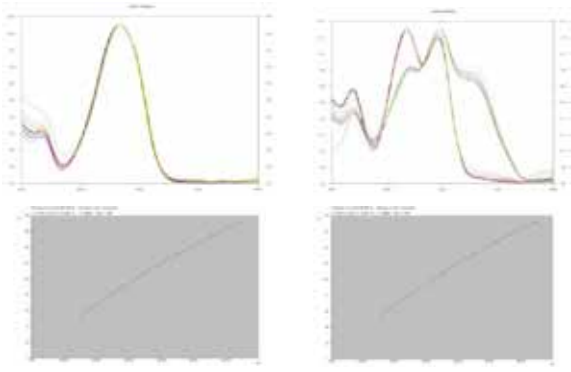
HPTLC chromatogram of standard P I and II



Densitogram of extract PI & II in the sample

Chromatogram of extract P I & II

44



Linear Calibration curve picroside for 6 points

45

<< Back to contents

The observation on the basis of altitude variation of different districts

Dolpa	picroside I and II	Yield	Altitude
D1	0.3826x1o-3 gm	0.0383%	3944
D2	0.3456x10-3 gm	0.0346%	3962
D1	0.3780x10-3 gm	0.038%	3944
D2	0.2687x10-3 gm	0.037%	3962
Dolkha picroside I and II			
D3	0.3253x10-3 gm	0.0325%	4175
D3	0.3193x10-3 gm	0.0319%	4175

Conclusions

- Iridoid glycosides mainly to protection of liver against damage and subsequent inflammation, phenylethanoid glycosides exhibit anti-inflammatory effects by inhibiting pro-inflammatory response. Acetophenones contribute to the anti inflammatory effects by interfering with the formation and enhancing physiological antioxidant
- The study indicated the higher quantity of picroside present in Dolpa than Dolkha district
- The used HPTLC method is simple, specific, precise and accurate
- The study reveled that of Dolpa district prefer for plantation and collection of seedling for any further study

47

Acknowledgement

- **Director General, ICFRE**
- **Director, Forest Research Institute**
- **Head, Chemistry Division, FRI**
- **Dr. V. K. Varshney, Supervisor**
- **DoF of Dolpa, Bajhang, Mugu, Myagdi, Gorkha, Rasuwa, Mustang and Dolkha districts**

48

<< Back to contents

Economic Contribution of resin collection in livelihood of forest dwellers of Uttarakhand

H. P. Singh and Sarvesh Singhal

Resource Survey & Management Division
Forest Research Institute
Dehradun

Uttarakhand

Salient features

- Geographical Area- 53483 Km^2
- Recorded Forest Area- 34651 Km^2 (64.78 % of GA)
- Area under forest department- 24415 km^2
- Area under chir pine – 3944 Km^2 (16.15 % of AFD)
- Resin extraction work carried out by state forest department.

Chir Pine Resin Production Area

- Total No. of Divisions – 17
- Selected Divisions – 3
- Name of three selected Divisions
  - Uttarkashi Division
  - Chakrata Division
  - Lansdowne Division

<< Back to contents

Uttarkashi Forest Division

Activity	Name of Ranges			
	Barahat	Mukhem	Dharashu	Dunda
No. of Marked Channels	49950	58650	84000	62050
Expected Quantity(Quintal)	1748.25	2052.75	2940	2171.75
Rate of Extraction (Rs/Qt)	1220-1432	1253-1550	1250-1550	1300-1350
Person employed	37	52	73	51
No. of Villages	5	7	17	4

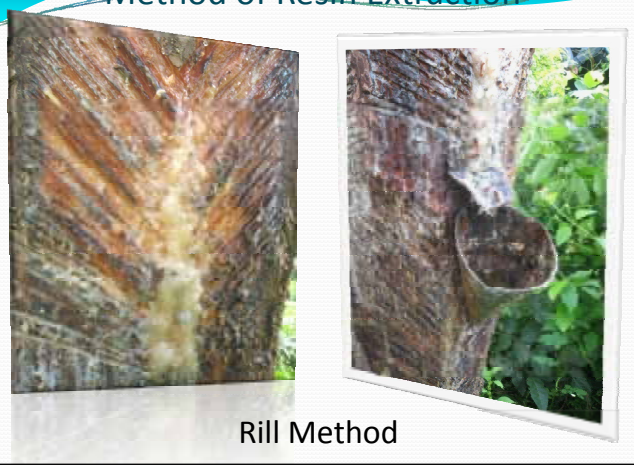
Chakrata Forest Division

Activity	Name of Ranges		
	Molta	Devdhar	Bhabar
No. of Marked Channels	27500	14500	17800
Expected Quantity(Qt)	880	464	520
Rate of Extraction (Rs/qt)	980	900	900
Person employed	15	24	12
No. of Villages	5	4	5

Lansdowne Forest Division

Activity	Name of Beat		
	Jariyana	Barswar I	Barswar II
No of channels	4000	3500	4500
Expected Quantity (Qt.)	80	70	90
Rate of Extraction (Rs/qt)	800	800	800
Person employed	3	2	3
No of villages	1	1	1

Method of Resin Extraction



Rill Method

Resin production in Barahat Range of Uttarkashi Forest Division

S.No.	Name of village	Target production (Qt)	Extraction rate (Rs/qt)	No. of worker involved	No. of contractor involved	Total person
1	Uttron	848.75	1432	15	2	17
2	Bonga	122.5	1220	2	1	3
3	Nald	211.75	1352	4	1	5
4	Sald	329	1334	6	1	7
5	Ganeshpur	236.25	1340	4	1	5

Annual income of contractors and workers engaged in resin extraction in Barahat Range

S.No.	Name of village	Total no. of family	Income of contractor				Income of worker			
			No. of contractor	Resin extraction (rs.)	Other source (Rs.)	Total income (Rs.)	No. of worker	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)
1	Uttron	185	2	245040	56000	301040	15	636563	81000	717563
2	Bonga	188	1	30937	32000	62937	2	79624	10400	90024
3	Nald	181	1	70841	30000	100841	4	148224	24800	173024
4	Sald	131	1	55088	31000	86088	6	220758	36600	257358
5	Ganeshpur	140	1	76203	34000	110203	4	165372	26000	191372

<< Back to contents

Per family annual income of contractors and workers engaged in resin extraction in Barahat Range

S.No.	Name of village	Contractor				Worker			
		Resin extraction (Rs.)	other source (Rs.)	Total income	Income from resin extraction (%)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Income from resin extraction (%)
1	Uttron	122520	28000	150520	81.40	41489	5400	46889	88.48
2	Bonga	30937	32000	62937	49.16	39812	5200	45012	88.45
3	Nald	70841	30000	100841	70.25	37056	6200	43256	85.67
4	Sald	55088	31000	86088	63.99	36793	6100	42893	85.78
5	Ganeshpur	76203	34000	110203	69.15	41343	6500	47843	86.41

Contribution of Resin extraction work in annual income of engaged family in Barahat Range

S.No.	Name of village	Total no. of family	Family involved in resin extraction (No.)	Percentage of family involvement	Annual income			Per family Income			Per family income through resin extraction in percentage
					Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	
1	Uttron	185	17	9.19	881603	137000	1018603	51859	8059	59918	86.55
2	Bonga	188	3	1.60	110561	42400	152961	36854	14133	50987	72.28
3	Nald	181	5	2.76	219065	54800	273865	43813	10960	54773	79.99
4	Sald	131	7	5.34	275846	67600	343446	39407	9657	49064	80.32
5	Ganeshpur	140	5	3.57	241575	60000	301575	48315	12000	60315	80.10

Contribution of Resin extraction work in annual income of engaged family in Uttarkashi Division

Name of range	Total no. of family	Family involved in resin extraction (No.)	Percentage of family involvement	Annual income			Per family Income			Per family income through resin extraction in percentage
				Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	
Barahat	825	37	4.48	1728650	361800	2090450	46720	9778	56499	82.69
Mukhem	770	52	6.75	2155007	623400	2778407	41442	11988	53431	77.56
Dharasu	1518	73	4.81	3198169	856900	4055069	43811	11738	55549	78.87
Dunda	865	51	5.90	2181482	610900	2792382	42774	11978	54753	78.12

Contribution of Resin extraction work in annual income of engaged family in Chakrata Division

Name of range	Total no. of family	Family involved in resin extraction (No.)	Percentage of family involvement	Annual income			Per family Income			Per family income through resin extraction in percentage
				Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	
Devdhar	148	15	10.14	362704	212400	575104	24180	14160	38340	63.07
Molta	128	24	18.75	692808	295600	988408	28867	12317	41184	70.09
Babar	182	12	6.59	290004	121200	411204	24167	10100	34267	70.53

Contribution of Resin extraction work in annual income of engaged family in Lansdowne Division

Name of Beat	Total no. of family	Family involved in resin extraction (No.)	Percentage of family involvement	Annual income			Per family Income			Per family income through resin extraction in percentage
				Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	
Barswar	70	5	7.14	104000	71000	175000	20800	14200	35000	59.43
Jariyana	62	3	4.84	51999	45000	96999	17333	15000	32333	53.61

Contribution of resin extraction income in the economy of the family engaged in study area

Name of Division	Total no. of families	Families involved in resin extraction (No.)	Percentage of family involvement	Annual income			Per family Income			percentage of Per family income through resin extraction
				Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	Resin extraction (Rs.)	Other source (Rs.)	Total income (Rs.)	
Uttarkashi	3978	213	5.35	9263308	2453000	11716308	43490	11516	55006	79.06
Chakrata	458	51	11.14	1345516	629200	1974716	26383	12337	38720	68.14
Lansdowne	132	8	6.06	155999	116000	271999	19500	14500	34000	57.35
Total	**4568**	**272**	**5.95**	**10764823**	**3198200**	**13963023**	**39576.56**	**11758.09**	**51334.64**	**77.09**

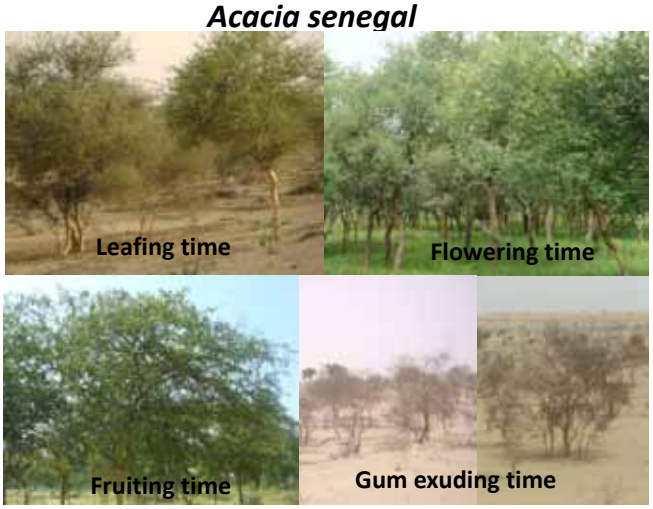
<< Back to contents

Improved Gum Production from *Acacia senegal*: Management for Livelihood

J. C. Tewari

Central Arid Zone Research Institute, Jodhpur-342003

Acacia senegal



About *A. senegal*

- Deciduous shrub/tree
- Growing upto 15 m tall
- Trunk diameter up to 30 cm
- Usually branched, bark is greyish-white
- Leaves bipinnate
- 2 stipular spines strongly recurved with a 3rd pseudo-stipular between them
- Flowers yellowish-white and fragrant
- The pods shortly stipitate and oblong (7.5 x 2 cm), seeds 3-6, smooth

Distribution

Dry rocky hills of Sind, the south east Punjab, the Aravali and other hills of north east part of Rajasthan, Western Rajasthan, Gujarat, Madhya Pradesh, Punjab and Haryana

Growth & tree density range of *A. senegal* in different districts of Rajasthan

Districts	Height (cm)	DBH (cm)	Crown diameter (cm)	Density per ha
Fatehpur Shekhawati (Sheep & Wool Dept.)	400-650	24-28	460-500	1900-1925
Fatehpur Shekhawati (RAU)	500-550	40-45	700-750	45-60
Dhabla point – Churu (Forest Area)	300-600	60-70	900-950	250-280
Ratangarh – Churu	400-750	110-140	1000-1100	260-280
Bassi range (Forest Dept.), Jaipur	350-700	45-60	800-900	800-900
Puskar (Forest Dept, Ajmer)	400-600	35-45	600-625	1950-2000
Jhunjhunu	280-500	25-30	500-530	180-220
Ajmer	300-500	35-40	550-580	350-390
Barmer	300-700	40-60	500-520	35-55
Jodhpur	400-750	40-60	500-530	30-50

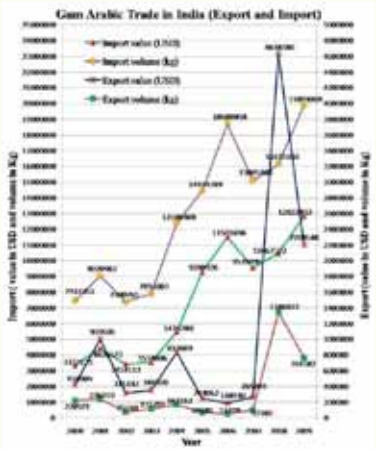
<< Back to contents

Gum Arabic : Global Scenario

- Current worldwide consumption of gum Arabic is around 25,000 tonnes, of which about 20,000 tonnes comes from Sudan. The remaining 5,000 tonnes originates from other African nations, the majority of which, between 3000 and 4000 tonnes, comes from Nigeria.
- Nigeria currently produces about 20,000 MT of gum Arabic annually ranking second in the world with Sudan as the leading producer and Chad after Nigeria as the third largest producer of the product whose world production as been estimated at 70,000 MT annually.
- Africa alone produces about 98% of the world requirement of gum Arabic.
- The United States is the largest single market for gum arabic annual consumption, accounting for 25 percent of the world market.
- The European Community, Switzerland and Scandinavia collectively account for 40 percent of the world purchases of gum arable.

Gum Arabic Trade in India : Export & Import

- In India, the total annual output is only 800 Million ton compared to world production and consumption of 60,000-70,000 Million ton.
- The domestic production is insufficient even for domestic consumption and more of it is imported from Sudan and Nigeria to meet country's requirements.
- The import of gum Arabic has increased from 33,32,125 kg in 2000 to 1,28,22,492 kg in 2009

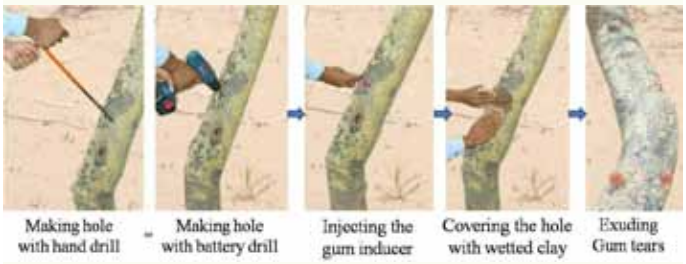


Traditional Method of Gum Exudation

- Traditionally farmers harvest gum Arabic from *A. senegal* trees by making injury at certain points on tree trunk and in the process they collect only 15-25 g gum/tree.

CAZRI Technique of Gum Exudation

- The *Acacia senegal* trees of more than 8 years old having more than 6" diameter are selected for treatment. Generally trees growing on sand dunes, sandy plains and water courses are most suitable.
- A hole of about 1.5 to 2 cm diameter with 1 to 1.5" deep is made at one feet above the collar of the tree with the help of hand drill or mechanized drill.
- The tree is then injected in the hole with a 3.5 to 4.0 ml CAZRI gum inducer solution. The dose varies from species to species (2 ml to 4 ml per tree).
- The tree hole is patched up with the help of bee wax or clay or pond silt.
- It is observed that the tree starts exuding gum tears after 8-10 days of the treatment.
- The best period of the treatment for *Acacia senegal* is March to May.

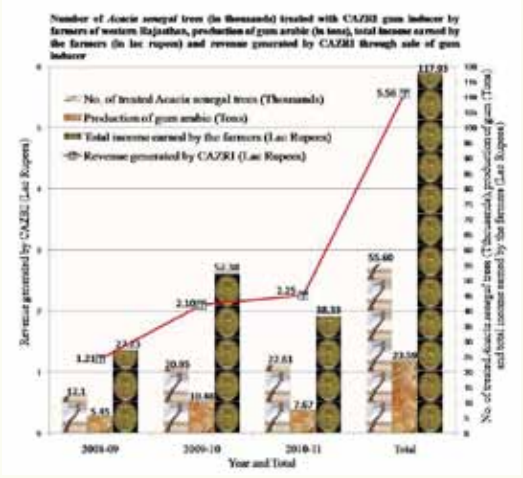


Gum yield with this technique is on an average 500g per tree which is 25 times higher than traditional method. The consistent and systematic efforts in India towards sustainable Gum production can lead the country to tap the considerable chunk of the International Gum Exports. If all the trees producing gum are explored in an organized manner, it can reduce the import bill of India to a considerable extent. The CAZRI gum inducer can be obtained from Silva section, Division-II of CAZRI during February to June @ Rs. 10/dose. For more deatil one can contact in CAZRI, Silva Section or visit the website www.npnrg-cazri.jimdo.com.

Exuded Gum from *Acacia senegal*

<< Back to contents

Adoption of the Technology by Farmers of Western Rajasthan



Temperation variation during March-April and gum production

Gum Arabic Production by Farmers of Western Rajasthan using CAZRI Gum Exudation Technique

Gum Arabic Uses

- ***(1) As a non toxic food constituent***
  - *Confectionary*
  - *Diary products*
  - *Bakery products*
  - *Flavour fixative*
  - *Beverages*
- ***(2) Pharmaceuticals***
  - *Emulsifying agent*
  - *Antiseptic preparations*
  - *Component in medicienes*
  - *Cosmetics**Xgcjgj***
- ***(3) Industrial***
  - *Adhesives*
  - *Paints*
  - *Inks*
  - *Textiles*

Conclusion

- ***Acacia senegal*** **is distributed abundantly in India particularly, in arid western Rajasthan on forest land, farmers' fields and CPRs. Gum Arabic production potential of the area is immense. However, the potential was untapped so far. After CAZRI's technique of gum exudation came into operation, within no time the gum production attained appreciable heights.**
- **This technology has national importance as it compliments very well in employment & income generation in drought prone areas. In drought like situations when crops are total failure and farmers have no other means to survive, *Acacia senegal* can provide a good value of income by way of gum production through improved technology.**
- **Thus, CAZRI technology of gum tapping has potential to change the scenario of income and service provided by gum yielding trees in arid land farming system.**

<< Back to contents

Wood based industry in India: past, present and future prospects

by

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Present scenario

•Forest Products industry is witnessing rapid changes

•Consumer choices are shifting towards design, quality, trendiness and smart products

•Fusion of traditional richness and modernity is providing opportunity unlimited

Present scenario

•Enlargement of products attributes by diversification and innovation catering to environment is a challenge to scientists and technologists together

•Global challenges of open economy is also experienced by wood based industry

•Indian economy is growing, construction sector is on rise, furniture sector is booming

•Domestic consumption is increasing

<< Back to contents

Growth of Forest Products Industry

- The Forest Products industry is at present growing at a rate of 5-6% with contribution of Panel products in the range of 17-20% (Pandey et al. 2011)
- Two National level events are held every year – India Wood and Panel Expo
- Wood based national and international seminars on the rise

Slowdown of Forest Products Industry

- Wood products industry had negative growth rate of -8.6% in February, 1998
- Pulp and paper industry had 11% growth in 1995-96, registered a sharp fall in growth rate of 3% in January 1998

Pravez Ahmed, Ind. For. 2005

Historical perspective of Forest Products Industry

- India's Forest Products Industry evolved through ages, traditionally remained in unorganized sector and is still so – do not attract talent
- Skills and development achieved through experience and practice – new developments are hardly adopted
- At the micro level – artisan and macro level – pulp and panel are the extreme cardinal points
- Unorganized – fragmented knowledge acquired through generations
- Carpenter, artisan, saw miller and architects are advisors to the society

Historical perspective of Forest Products Industry

- Large no. of units are in small and medium scale sector e.g. 23,000 saw mills, 450 plywood units, 660 pulpwood units, number of furniture units and so on – innovation and technological development is affected
- Only 128 large industries registered with Director General of Technical Development (DGTD) in different types of wood and agro based panel products. This figure is much less compared to China (472) and USA (448)
- Quality of products is still poor – improvement is very slow
- Artisan – at the bottom of the ladder has hardly any support: financially weak, low level of education and technical skills

Scientific development in wood Science

- Scientific developments in wood science primarily started at Forest Research Institute with its inception in 1906 – acquired pioneering status in systematic research on Wood based Forest Products
- Contribution in building up national standards is significant. More than 300 BIS specifications on wood and wood products are based on the work of FRI
- Subsequently new Institutes like IWST and IPIRTI created

Scientific development – Wood quality

- Initial R and D at FRI was aimed for defence, railways, ship-boat building and other government and public sector units
- Utilization of natural timber species was the prime objective : resulted in generation of voluminous data on number of timber and bamboo species which formed the basis of many national standards on utilisation and grading
- Data on specific gravity on more than 500 species is now used for estimation of carbon in wood by researchers

<< Back to contents

Scientific development – Wood quality



•Strength properties data on 500 species: helped in recommendation of species for various end uses

•Researchers worked out an algorithm to predict various strength properties on the basis of specific gravity of small samples

•Standardization, grading and quality control of products was one of the major activities. Period until 1970 was marked by timber from natural forests

Scientific development - preservation


•Wood preservation: Dominated by development of world class preservatives and evaluation of natural durability of more than 300 species.

•Bigger consumers of timber took full advantage of the world class developments; small units, though large in number could not harness the benefits.

•With shifting of material base of large consumers from timber to other products, utilisation of the development declined over the years in India

•An important field of research having world class notable achievements and which can save large volumes of timber, development in this field are underutilized

Scientific development – timber seasoning


•Drying schedules of a number of timbers (250 species) and kilns to dry them were developed: kilns development reduced the down time and lock up period of financial resources

•Utilization of research remained under utilized - understanding and absorption was better compared to preservation

•Energy costs involved and absence of hand holding mechanism for addressing the societal needs hampered the adoption of technology

•Further development in the field also remained stagnated as far as reducing the energy cost is concerned

Scientific development – composite wood products



•Panel products are reconstituted products.

•Raw material base for such products is large (utilizes non-conventional sources: plantations wood and lignocellulosic residues): Skewed development for many decades - full utilization of raw material available could not be made

•Products consisting of maintaining original form of timber (veneer, wood panels, plywood, block boards and flush doors): Well developed with sufficient R & D

•Sector of particle board utilizing small particles (size 420-840 µm) from wood and other sources - fairly developed with some level of R & D available

•Sector using even smaller particle size i.e. fibers (Medium density fiberboards -MDF): R & D inputs are minimum. Some industries established with foreign collaboration

•Sector of other products (oriented strand boards - OSB, extruded & other materials): R & D inputs are nil: No work on OSB at industrial level.

Scientific development - handicraft


•Wooden handicraft in India evolved through tradition and though generates large scale employment, is the most unorganized

•Due to economic and societal problems benefits of R & D has not reached the grass root levels

•With the change in traditional raw material base and emergence of plantation timber, this sector is at the cross road as adaptation to new material is full of struggles: ability to harness scientific and technical knowledge of this sector is poor

•Traditional knowledge acquired through ages is not applicable to new material base

•Forest and Forest Products Certification aimed at sustainable development has potential impact on the sector

•Common facility centre set up by governmental organizations have hardly yielded results

Way Forward

•Wood science research in the country had made significant progress but absorption of wood technologies had been very slow.

•Therefore their importance in tree diversity conservation, enhancement of carbon sink has not been fully recognized

•In the rapid changing global economy, human resource, technology development, its adaptation and preparedness for new challenges and emerging issues have become key to success

•Environmental issues are important today and promotion of environmental friendly technology will have long term viability

•Forest products is an industry which provides large scale employment – should be utilized to foster growth

•Raw material sustainability is to be addressed

<< Back to contents

Recommendations for future (I-VI)

National Wood Use Policy
Non-availability of raw material
Slow absorption of technologies
Shortage of technical trained manpower
Consumer friendly "product standards"
Some suggested areas for future research

I- National Wood Use Policy

•Need to setup special commission / task force for Wood Science and Technology at Government of India level in a two tier system (on the line of Agricultural commission)

- •One may be for discussing and formulating the "National wood use policy" and the other on technical aspects for setting up goals for technological development

•Perspective planning of 20-30 years on forestry and Wood Use issues

II- Non-availability of raw material…

•Industries like pulp & paper have made their own arrangements for raw material with the farmers

•Mechanical wood processing, plywood and panel industries sectors are facing shortage of raw material

•Majority of wood industries are in or small/ medium scale sector: unable to take up captive plantations

•TOF cannot fully support industry: real estate prices are high: growing trees on costly land is uneconomical

•Resources available in the form of agro-based material, forest waste and bamboo should also be included

•Indigenous trees domestication and development of their improved varieties

II- Non-availability of raw material

•Integration of wood science and technology in tree improvement programs to be scaled up for producing high yielding varieties of desired characters

•Strategy to develop the technology for total bio-resource utilization for value addition and reduction in pollution is required.

•Cross sectoral policy and institutional frame works that support agro-forestry at National and State levels needs to be devised

•Tree improvement research in USA is funded by consortium of Industries which take up large scale tree improvement program. Similar mechanism needs to be evolved in India also

•Countries like Germany and New Zealand have taken a conscious decision of having separate areas under permanent protection and production forestry

III- Slow absorption of technologies…

•R and D initiatives in lab are not widely adopted by the industry: not going through up scaling process which requires lot of funding

•Technology needs to be developed as a complete package consisting of raw material, machinery, process and training of manpower

•For this, R and D organizations should have complete and state of the art infrastructure in terms of machinery/ pilot plants / testing facilities well supported by matching manpower

•Need for the technology is seldom spelt out by industries

•Research organization/ industry based collaborative projects taking research from the laboratory to the industry till it is finally accepted in the market

III - Slow absorption of technologies...

•No effective mechanism for transferring research findings from lab to end users: Need to evolve a new mechanism to market technological developments made by wood science research organizations

- •Creation of intermediary marketing organisation/ mechanism to transfer technology as a complete and holistic package having inbuilt scaling up mechanism with substantial funding grant

•Improving/development of risk assessment methodologies/ modeling in wood based products, processes and related aspects

•Transfer of scientific know-how to the artisans who are at the bottom of ladder of stake holders to be strengthened

<< Back to contents

III- Slow absorption of technologies

•Wood based industries associations in India should devote sufficient time in prospective planning (for 20-30 years) with well targeted goals and objectives

•These goals and objectives are to be flagged off to wood based Institutions in India for inclusion in their future R and D and training programs

•Interactions between the government agencies and industries: linkages between the research oriented units and industries should be strengthened

•Grant-in-aid or funding in the field of wood science: strengthening of wood science Institutes is of prime urgency looking at the global competition and scenario

•International exposure to scientists for skill up gradation with International collaboration and sufficient funding support.

IV- Shortage of technical trained manpower

•Shortage of manpower (there is a need to expand training and education courses in wood science and Technology)

- Shortage in R and D organizations (Specialized training of trainers is vital)
- •Hardly 5 to 10% of the manpower in the industry is trained.
- •Shortage of manpower is also in managing these industries (Properly trained people with skills in Wood Science Technology and Management to manage at top and middle levels)
- •Trained engineers

Policy for financial support to Wood Science Institutes to formulate demand driven training courses for different sectors

V- Consumer friendly "product standards"

•Enhancing consumer awareness for wood products with longer service life. Development of standards to the level of ISO standards: India needs to develop adhesives which complies with international emission norms

• Development of formaldehyde and VOC emission free binder; bio adhesive and fire resistant panel products

•**Energy and Cost efficiency** in wood and wood product processing

VI- Some suggested areas for future research...

•Creating scientific evidence through LCA studies on carbon-sequestering potential of wood products

- •Contribution to efforts in "ameliorating climate" and "Greening India", and Establishing a national database covering entire range of "wood and processed wood products' for the benefit of all stakeholders
- •Enough focus may be on developing accounting system for carbon sequestration potential in wood products: Life cycle analysis studies of wood and wood products are required.
- •India will not be able to export its wooden handicraft after 2012: steps to be taken for forest certification and chain of custody

VI- Some suggested areas for future research…

•**Improved and New products** through Modification for dimensional stability / aesthetic appearance and durability by applying physical, chemical and thermal means

•Development of Glulam, Parallam, OSB, wood/lingo-cellulosic polymer composite and wood lingo-cellulosic reinforced composites. Use of lingo cellulosic based material from wood and non-wood sources including agro-waste and weeds

•**Nanotechnology:** Application of nano-particles in developing smart material/product (sensor based bio-composites), wood protection (through nano- biocide), wood coating (nanocoating systems) and many other applications

•**Green Building:** systematic effort to create, sustain, and accelerate changes in practice, technology, and behaviour to reduce building-related environmental impacts while creating places that are healthier and more satisfying

<< Back to contents

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<< Back to contents

Indian Forestry Congress, 2011
22-25 November, 2011, New Delhi

Utilization of tree derived carbonyl compounds as Schiff bases for fragrance and flavor composition: a literature appraisal

by

PRASOON KUMAR KAUSHIK

Chemistry Division
Forest Research Institute, Dehra Dun

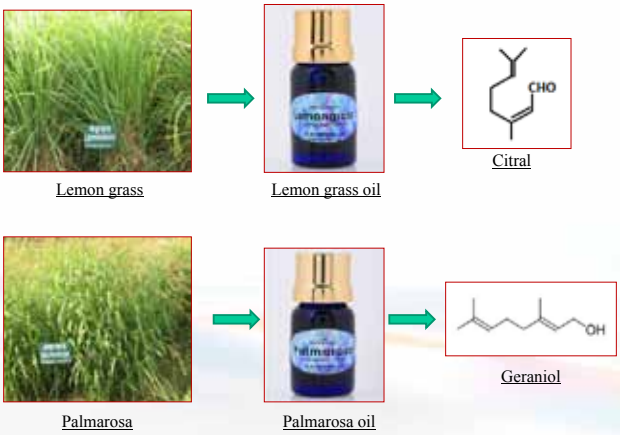
OUTLINE

- Introduction
- Objective
- literature appraisal
- Conclusion
- Acknowledgement

<< Back to contents

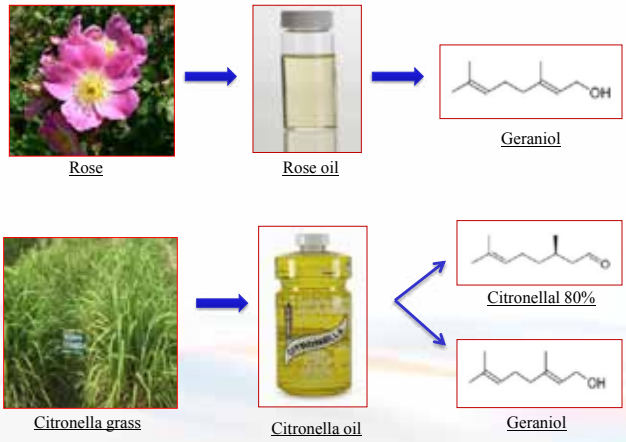
Introduction

- From very early times, trees have so intimately associated with man and his activities which provided numerous goods and services to support his life.
- The trees manifest their scents in the form of highly volatile aroma chemicals produced in their different parts.
- A fragrance is not a single material of clearly defined properties but rather mixture of individual chemical, each behaving according to its own unique attributes.



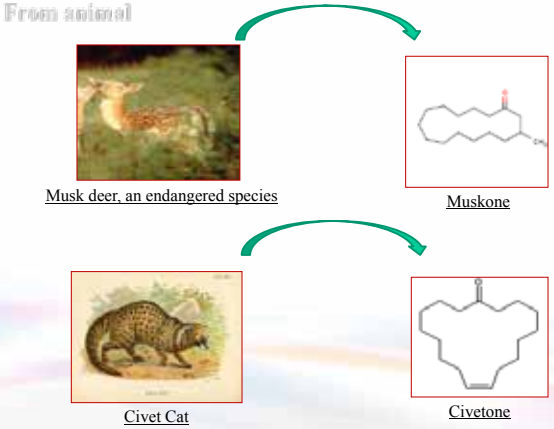
Lemon grass — Lemon grass oil — Citral

Palmarosa — Palmarosa oil — Geraniol



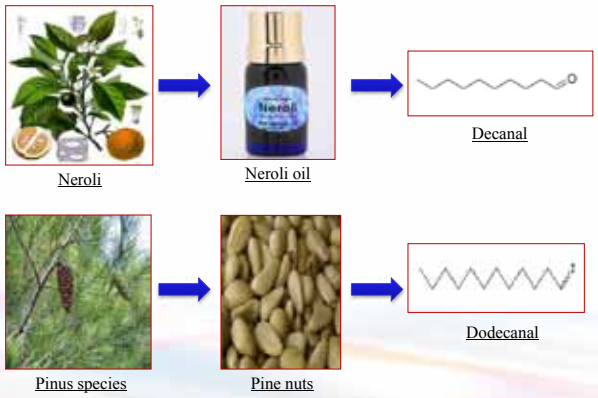
Rose — Rose oil — Geraniol

Citronella grass — Citronella oil — Citronellal 80% — Geraniol



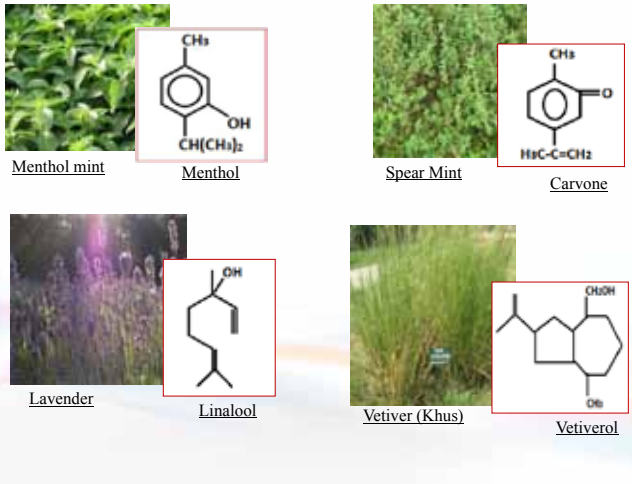
Musk deer, an endangered species — Muskone

Civet Cat — Civetone



Neroli — Neroli oil — Decanal

Pinus species — Pine nuts — Dodecanal



Menthol mint — Menthol

Spear Mint — Carvone

Lavender — Linalool

Vetiver (Khus) — Vetiverol

<< Back to contents

During 1850s, the first few tree derived fragrant chemical were used as perfume ingredients.

- ✓ 1855 - First Synthesis of Cinnamaldehyde.
- ✓ 1868- Commercial Production of Coumaric, the first synthetic fragrance chemical.
- ✓ 1874- Chemical structure Vanillin production starts.
- ✓ 1850-1900- Significance advances in elucidating major chemicals in essential oils.

Naturals

Vanilla Flower

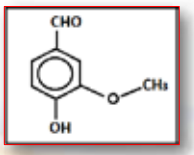
Fresh Vanilla pods

Dried Vanilla pods

Numerous chemicals used in modern perfumery were developed between:

1850 and 1910.

One example is vanillin



Synthetic

Objective

- ➢ For fragrance industries the biggest challenge was to isolate and identify the fragrant chemicals from natural products.
- ➢ Also the effort was directed towards the synthesis and commercial production of natural identical chemicals for growing perfume industries.
- ➢ The present study was focused on flavour and fragrances obtained from natural identical materials for the formation of Schiff bases that are generally regarded safe then chemically derived (synthetic).

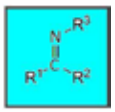
Schiff bases

➢ A number of tree derived aliphatic, aromatic and terpene (acyclic and cyclic) aldehydes and ketones have been transformed into Schiff bases for fragrance and flavor compositions.

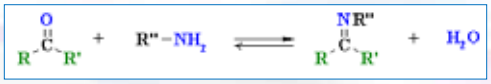
➢ The chemistry of carbon-nitrogen double bond plays a vital job in the progresses of flavor and fragrance chemistry and also known to be useful as an intermediates in producing other fragrance materials.

➢ Great majority of the Schiff bases are reported to possess floral, fruity odors, namely of the citrus type and, more particularly, reminiscent of the odor of the orange-flower.

➢ Schiff bases (or azomethines / anils / imines) was first discovered by Hugo Schiff.



➢ Schiff bases are the products of condensation reaction between a carbonyl (an aldehyde or ketone) compound with a primary amine. Structurally these compounds are distinguished by the >C=N- linkage.



Carbonyl compound Primary amine Schiff base water molecule

The chemistry, physico-chemical and odor properties of schiff bases have been reviewed, compiled and discussed as follows:

SN	Schiff base	Description	Applications	References
1	Acetophenone with Methylanthranilate	Heavy, sweet-floral, somewhat animal odor. The odor picture varies according to the quality of the reaction product. Preferred are the types in which the Acetophenone component is not the conspicuous note.	Very rarely used in perfumery.	Arctender, 1969.
2	alpha – Amylcinnamic aldehyde with Methylanthranilate	Sweet floral, predominantly orangeblossom like odor with oily herbaceous undertones, reminiscent of Honeysuckle, Gardenia, Tuberose, remotely of Jasmin and other heavy florals.	Used mainly for its highly fixative purposes. Its tenacity being one of its greatest assets.	Arctender, 1969.
3	Anisaldehyde with Methylanthranilate	Heavy sweet, intensely floral odor with fruity undertones. Resembling the odor of the flowers of Robinia pseudoacacia, remotely resembling notes in Gardenia (fruity Peach like notes).	Used in perfumes of the heavy floral type, and the "powdery" floral type Acacia, Mimosa, Honeysuckle, Jasmin, Gardenia, etc. Probably not used in flavors.	Arctender, 1969.

<< Back to contents

4	Canthoxal with Methylanthranilate	Fruity, Flowery, Green, Aldehydic of good tenacity,	Used in perfumery	IFF, 2002
5	Citral with Methylanthranilate	Sweet orangeblossom to fresh orange peel like or Grapefruit peel like.	Does not contribute any highly interesting notes to fragrance compositions.	Arctender, 1969.
6	Citronellal with Methylanthranilate	Very tenacious, sweet floral, orange peel and orangeblossom complex odor.	Rarely used in perfumery	Arctender, 1969.
7	Cuminaldehyde with Methylanthranilate	Herbaceous sweet very tenacious odor.	As most of the conventional Schiff bases.	Arctender, 1969.
8	Cuminaldehyde with Ethylanthranilate	Green herbal spicy floral	used in perfumery	IFF, 2002

9	C_8 Aldehyde with Methylanthranilate	Powerful, Harsh, Fruity, Fatty odor of good tenacity	Used in Rose, Neroli, citrus, oriental, Bergamot, Jasmine, Fruity type of creations.	IFF, 2002
10	Cyclamenaldehyde with Methylanthranilate	Intensely sweet, fresh floral odor of great tenacity, somewhat reminiscent of the flowers of the Lemon tree.	Use in perfume compositions, probably ranking No.3 among Schiff bases after Aurantiol and Acaciol.	Arctender, 1969.
11	Decanal with Methylanthranilate	Powerful odor, mainly of Orangeblossom type, very tenacious.	Useful in perfume compositions for heavy floral types, such as Orange blossom Honeysuckle, Magnolia, etc. and, in general as a floralizer and sweetener.	Arctender, 1969.

12	Heptylidene with Methylanthranilate	Very sweet, green floral, herbaceous orangeblossom type odor of good tenacity.	Use in various heavy florals, including Jasmin, Mogra, Narcisse, Peony, Jonquil, Lavendar etc.	Arctender, 1969.
13	Hexenylidene with Methylanthranilate	Powerful and very sweet, but refreshingly citrusy, flora odor of good tenacity.	This "base" finds use in perfume compositions Mainly as a fixative in the lighter portion of modern Citrus-type colognes.	Arctender, 1969.
14	Hydroxycitronellal with Ethylanthranilate	Very sweet, heavy-floral and extremely tenacious odor of Honey orangeblossom Magnolia type.	Forms an excellent base for a Frangipanni (fantasy) fragrance, magnolia and naturally as a modifier In orangeblossom, Honey suckle, etc.	Arctender, 1969.

15	Hydroxycitronellal with Linalylanthranilate	Sweet, floral odor of great tenacity. Theodor type varies considerably according to origin (manufacturer and method) of the material.	It is mentioned as a typical example of the results of "theoretical" thinking in perfumery research.	Arctender, 1969.
16	Hydroxycitronellal with Methylanthranilate	Very sweet, heavy floral orangeblossom to Linden flower type odor of considerable tenacity.	This Schiff base is the most widely used of all Schiff bases known in perfumery. Its low cost and considerable strength, its tenacity and versatility are virtues that make the product Applicable in fragrances of all price level sand for numerous purposes.	Arctender, 1969.
17	Hydroxycitronellal with Indole	like floral animal	Fecal note useful in floral absolute types.	IFF, 2002

18	alpha- Ionone with Methylanthranilate	Heavy and very sweet-floral "'oriental" balsamic odor of excellent tenacity.	It is likely that the title material is marketed as chief component of perfume pecialties under trade name.	Arctender, 1969.
19	Lilial with Methylanthranilate	Sweet floral and very tenacious odor with Lily Linden blossom character and orangeblossom undertones.	The most common Schiff base. Used in perfume compositions as a modifier For Aurantiol	Arctender, 1969.
20	alpha-Methylcinnamylidene with Methylanthranilate	Deep sweet, floral balsamic odor of interesting possibilities.	The base is used in perfume compositions to lend depth and warm powdery undertones in heavy florals, even in certain types of Rose.	Arctender, 1969.

21	Lyral with Methylanthranilate	Very sweet and extremely tenacious floral odor of Magnolia orangeblossom Acacia type.	Used in perfume compositions. (Flowery, Sandal, Woody)	IFF, 2002.
22	Methylnaphthylketone with Methylanthranilate	This material was obviously prepared in the Hope that a combination of two well established orangeblossom materials would give something really outstanding. It did not.	There is no Indication that the title material works better in a perfume than the two parent materials separately introduced in the perfume com- position. And there is no reason to go through all the trouble to make the two materials condense into one.	Arctender, 1969.
23	Methyl Nonyl acetaldehyde with Methylanthranilate	Powerful and very sweet, warm-floral and tenacious odor.	Attractive effects in fine fragrance, Blands well with citrus oils/fresh green chemicals etc. It has endless possibilities.	Arctender, 1969.

<< Back to contents

24	3,5,5 –Trimethyl hexanal with Methylanthranilate	Intensely sweet, floral citrusy and tenacious odor with a "metallic-fresh" topnote. It is a very powerful aldehyde but its odor is typically "unnatural".	This Schiff base has found a little use in perfume compositions, but since the base has not been offered commercially (it is generally made by the user himself) it has not achieved much popularity.	Arctender, 1969.
25	Musk ketone with Methylanthranilate	Intensely sweet, floral musky odor with variable notes of one or the other component.	Very little use if any interest to the creative perfume, but of some interest to the academic study of "Schiff bases" etc.	Arctender, 1969.

26	Hydroxycitronellal with Skatole	According to the origin of the material, Skatolene shows great variation in odor. The type of Skatolene showing an intensely warm animal odor, tenacious, sweet and uniform, with no traces of fecal note, is generally a preferred one. Skatolene is used for floral complexes, where animal notes are to lerableor desirable,	Concentrations up to several percent of this material can be experienced without any offensive effect. In Gardenia, Narcisse, certain types of Rose and in heavy exotic or oriental fragrance types, the title material can add very attractive character.	Arctender, 1969.
27	Vanillin-Methylanthranilate	Intensely sweet, balsamic floral odor of very good tenacity. The odor varies considerably from one sample to another, a fact which is often observed in "Schiff bases".	The title material has very little use in perfumes, and is simply missing from most perfume laboratories.	Arctender, 1969.

28	Hydrocinnamaldehyde with Methylanthranilate	Aldehydic green floral ozone	For green floral Balsamic Undertones in modern perfumery	IFF, 2002
29	Hexyl cinnamic aldehyde with Methylanthranilate	Green Jasmine Petalic Balsamic, Aldehydic odor of good intensity.	For Use in Jasmine Bases, Gardenia, Tube -rose, and creative perfumer y.	IFF, 2002
30	3-Cyclohexene-1-Carboxaldehyde, 2,4-Dimethyl with Methylanthranilate	Harbal, Green, Citrus, Balsamic, Aldehydic odor of good intensity.	For Herbal, Green, Citrusy, Balsamic Undertones in creative perfumery	IFF, 2002
31	C_{12} Lauric aldehyde with Methylanthranilate	Fresh Floral Balsamic.	A good ingredient having application from pine notes to Violet, Floral, Citrus, Neroli, and Oriental Perfumes.	IFF, 2002

32	Ethyl Vanillin with Methylanthranilate	sweet, vanilla, bean-like and sassafras aroma profiles with sweet topnotes and which highly substansive and long lasting are highly desirable in the art of perfumery.	This Schiff base has unexpected, and advantageous utilities for its deodorancy properties in addition to having valuable properties as a fragrance material.	Mookharji et al, 1989(c)
33	Triplal with Ethylanthranilate	green leafy floral	Fine fragrance for spray perfumes	IFF, 2002
34	Cinnamic aldehyde with Methylanthranilate	Sweet, floral, honeysuckle, orangeb - lossom, herbaceous,	Increases the substantiality of the fragrance and provides fixation and floracy as well.	IFF, 2002

Summary

- Everlasting interest in development of novel flavors and fragrances in order to create new odorant molecules.
- Tree derived aroma chemicals containing a carbonyl functional group constitute an important group of raw materials for fragrance and flavor industries.
- Schiff bases derived from such natural sources have been the subject of numerous investigations from their chemical and odorant point of view.
- Such economically important natural resources are needed to be developed and managed to tap their full potential for employment generation.

Acknowledgement

With profound pleasure and gratitude, I would like to acknowledge Dr. S. S. Negi, IFS, Director, Forest Research Institute, Dehra Dun for his continuous encouragement and support.

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<< Back to contents

A new Approach for Licensing of Wood-based Industry - a case study from northern India

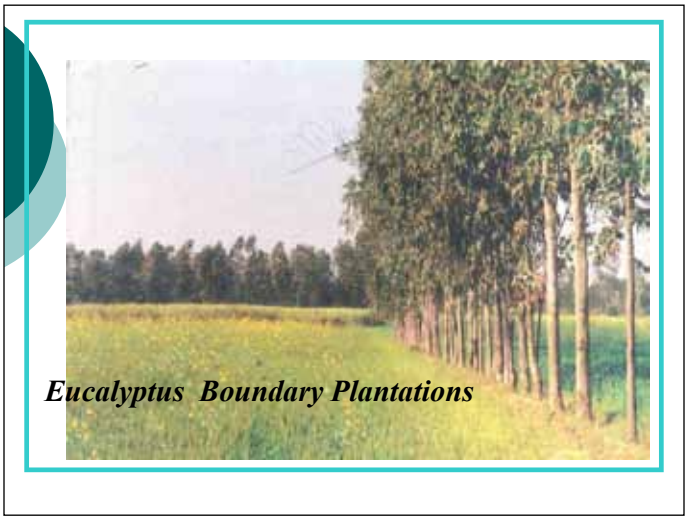
R.K. Sapra, V.R.R. Singh, Padam Parkash Bhojvaid

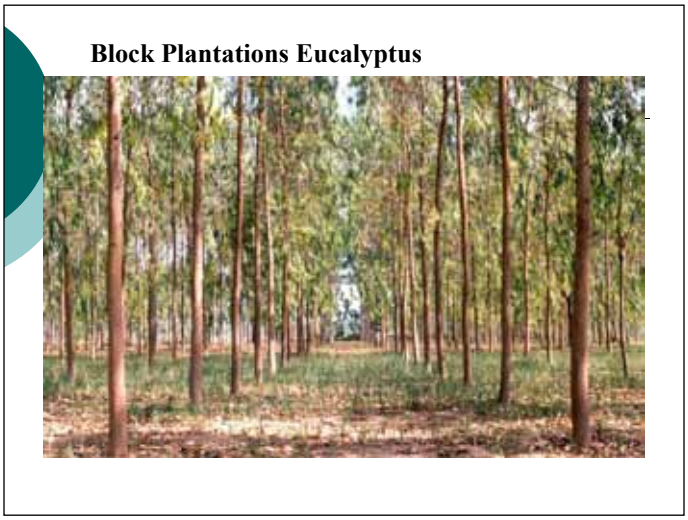
Trees Outside Forests

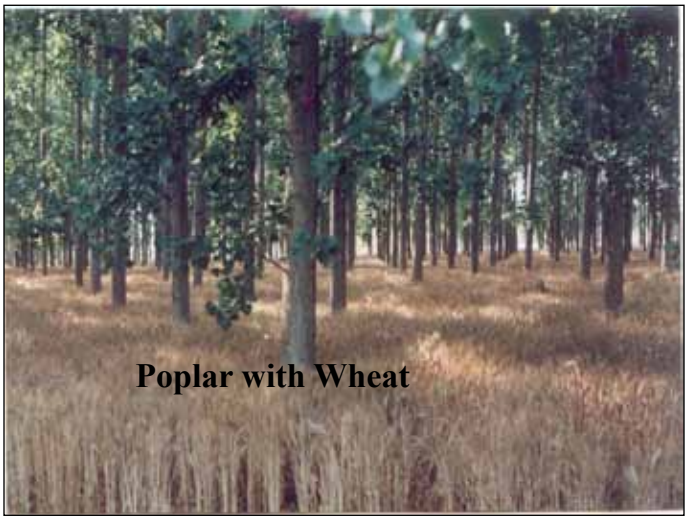
- Gained importance in the recent past
- Opined that source of most of wood in the country
- Some states have major share
- Haryana, Punjab, UP, Gujarat, Bihar, A.P, TN, Rajasthan
- Intensively managed plantations

Native Species

<< Back to contents







<< Back to contents

Lessons continued

Change in patterns

1. Earth work
2. Planting time

Improvisation in interventions

Plantations created in April put on incremental growth

Higher success

Five year old plantation

Haryana

	Classified	TOF	Total
Area (Km^2)	1517 (1558)*	1415	2932
% of TGA	3. 43	3. 20	6. 63
Growing Stock million M^3	2. 37	15. 36	17. 33
Per ha Growing Stock M^3	15. 3	108. 5	62. 5

Trees per ha CNFA = 12.3 Total Tree= 50 million

Area TOF > 1 ha block = 834 KM^2

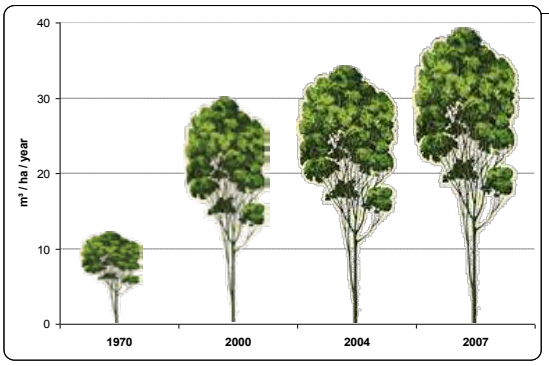
Based on SFR 2003,

PUNJAB	Classified Forests	TOF	Total
Tree cover (Km^2)	1580	1608	3188
% of Total Geographical Area	3.14	3.19	6.33
Growing Stock million M^3	11.08	17.90	28.98
Per ha Growing Stock M^3	35.20	110.70	-
Rotation age of tree species (years)	35	7	-
Mean annual increment M^3 ha^{-1} $Year^{-1}$	1.1	15.81	-

<< Back to contents

UP	Classified Forests	TOF	Total
Tree cover (Km^2)	14118	7715	21833
% of Total Geographical Area	5.86	3.20	9.06
Growing Stock million M^3	164	88	252
Per ha Growing Stock M^3	99	114	-
Rotation age of tree species (years)	80	27	-
Mean annual increment M^3 ha^{-1} $Year^{-1}$	1.2	4-5	-

Enhacement of Eucalyptus Productivity



Agroforests & Industries

- 1.6 million m^3
- Enabling environment
- Adequate Infrastructure

- 600 plywood units
- Purchase 1 million US$ day^{-1}
- Value added 3 million US$ day-1
- 60000 man days day-1
- 2.5 million $US as tax $month^{-1}$

Wood based industries

- Rich in resource (forests), Veneer in Assam
- Businessmen from other parts of India
- Expansion, Degradation, Regulation
- Apex court and ban
- Displacement and closure
- Import and search for new frontiers

Technology, ecology and economics

- Agroforestry plantations
- ICFRE research
- Displacement of veneer industry
- Enabling Legal policy regime
- Infrastructure
- People
- Industry

<< Back to contents

Distribution of Wood-based Units

S. No.	District/Division	Plywood	Veneer	Saw Mill	Others*	Total
1	Yamunanagar	273	297	331	37	938
	%	73	98	8	42	18
2	Rest of the state	103	6	3988	51	4148
	%	27	2	92	58	82
	Total (State)	376	303	4319	88	5086

600 veneer industries were closed

Requirement of Raw Material (in Lakhs cum) of Licensed Units

S. No.	District	Eucalyptus	Poplar	Other	Total	Av. Annual Requirement (cum)/unit
1	Yamunanagar	3.25	10.85	2.84	16.94	2019
	%	*77*	*92*	*64*	*83*	
2	Rest of 20 districts Of the state	0.98	0.98	1.6	3.56	124
	%	*23*	*8*	*36*	*17*	
Total (State)		4.23	11.83	4.44	20.50	551

Annual Wood Availability (in Lakh cum)

State / Source	Haryana	Punjab	U.P.	UKhand	H.P	Total
TOF	20.6	30.9	43.5	5.2	3.1	103.3
	1.5	1.0	2.0	3.0	1.5	9.0
Import	0	0	0	0	0.1	0.1
Total	22.1	31.9	45.5	8.2	4.7	112.4

Annual Wood Availability (in lakhs cum)

State / Species	Haryana	Punjab	U.P	Uttarakhand	H.P	Total
Eucalyptus (1)	9.6	16.1	14.6	1.0	0	41.3
Poplar (2)	3.8	6.6	7.5	3.5	0	21.4
(A) (3=1+2)	*13.4*	*22.7*	*22.1*	*4.5*	*0*	*62.7*
SRS (4)	6.5	6.8	3.9	1.9	0	19.1
LRS (5)	2.2	2.4	19.5	1.8	4.7	30.6
(B) (6=4+5)	*8.7*	*9.2*	*23.4*	*3.7*	*4.7*	*49.7*
Total (A+B) (7=3+6)	22.1	31.9	45.5	8.2	4.7	112.4

As per various reports of CEC

Annual Wood Requirement of Licensed Wood-based Units (in Lakhs cum)

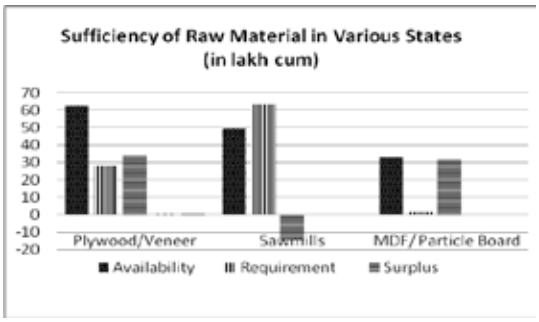
State / Industry	Haryana	Punjab	U.P	Uttarakhand	H.P	Total
Plywood (1)	8.3	5.4	5.8	1.7	0	21.2
Veneer (2)	4.8	2.5	0	0	0	7.3
(D) (3=1+2)	*13.1*	*7.9*	*5.8*	*1.7*	*0*	*28.5*
Sawmills (4)	6.5	16.7	34.1	2.2	3.5	63.0
Others (5)	0.4	0.1	0	0	0.3	0.8
(E) (6=4+5)	*6.9*	*16.8*	*34.1*	*2.2*	*3.8*	*63.8*
Total (D+E) (7=3+6)	20.0	24.7	39.9	3.9	3.8	92.3
MDF/Particle Board (F) (8)	0	0	0	2	0	2
G. Total (D+E+F) (9=7+8)	*20.0*	*24.7*	*39.9*	*5.9*	*3.8*	*94.3*

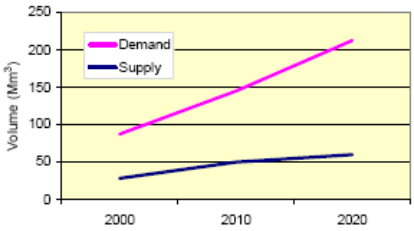
Status of Raw Material in Various States (in lakh cum)

S. No.	Industry	Haryana	Punjab	U.P.	Uttrakhand	H.P.	Total
1	PV (A-D)	0.3	14.8	16.3	2.8	0	34.2
2	Sawmills & Others (B-E)	1.8	(-) 7.6	(-) 10.7	1.5	0.9	(-)14.1
3	MDF/Particle Board (C-F)	6.6	9.5	13.6	0.5	1.4	31.6

<< Back to contents

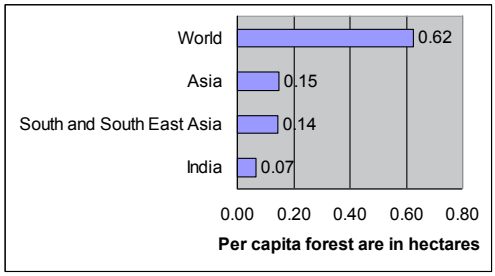
Status of Raw Material in Various Sectors of WBIs



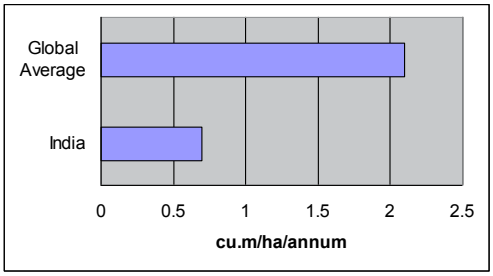


Demand and supply for industrial wood (Khanduri and Mandal 2005)

Per Capita Forest Area



Forest Productivity



Conclusions

- Regional approach and not the state
- Social, economic, environmental benefits
- Taken time to establish
- Ideally industry should have been initiated in all states
- Import/export is normal business
- Kandla???

Contemporary Agroforestry in Haryana

- **20 million seedling year^{-1}**
- **20,000 ha year^{-1}**
- **Eucalyptus and Poplar**
- **Quality planting stock**
- **Private Nurseries**

<< Back to contents

Discussion is required

- Ban on green felling
- 1000 meters
- Definition of forests
- WBI???

Thanks!

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<< Back to contents

Non- Timber Forest Products and Rural Livelihoods with special reference to the Policies & Markets in Orissa

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1/17/2013

Outline of the Presentation

- Introduction
- Extent of dependence on Forest
- Management of NTFPs and the Market Mechanism
- Problems of NTFPs trade in Orissa
- Policy Reforms (Post 2000 period)
- Conclusion & Suggestion

1/17/2013

Introduction

- Millions of people living in and around forest derives their livelihood from Collection & Sales of NTFPs.
- Beyond subsistence, fuelwood and fodder collection, there are a wide range of forest products which poor households depend on, particularly for consumption and generation of income in the lean season.
- Collection of NTFPs go largely unnoticed, and are not even accounted for in the national accounts & Gross National Product (GNP).

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<< Back to contents

NTFPs Based Livelihood in Orissa

1/17/2013

Factors effecting Livelihood

17 January 2013

Socio- Economic Profile of Orissa

Location	Eastern part of India
Total Geographical Area	15.57 million ha.
Total Population	36.71 million (3.6% of India) 85% Rural
Tribal Population	22.2%
Forest Cover	37.34% (Rank 4th among the Indian States)
Poverty Level (BPL)	47.1%
Human Development Index (HDI)	Rank 22nd as per the HDR 2011

17 January 2013

Extent of dependence on Forest

- In the absence of adequate resource endowment such as land and access to service sector the majority of poor households rely on forest and on labour market (Sarap & Sarangi, 2009).
- The dependence on income from NTFPs has been shown to be inversely related to the size of landholdings in Orissa as well as in India (Fernandes & Menon 1987, Sarap 2007).
- Sarap (2007) study has found...40 to 50% of the HH Income come from sale of forest Products in case of poor in Orissa. Similar finding by IIFM study 1996.

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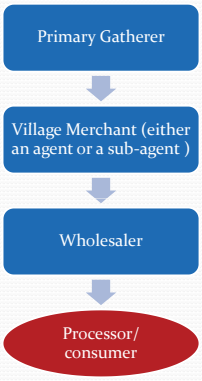
<< Back to contents

NTFPs in Orissa

- The State Government of Orissa has identified 85 items as NTFPs.
- Out of which 68 items has been transferred to Panchayats for procurement, processing and Marketing.
- 3 Nationalized products (Bamboo, Sal & Kendu Leaves)
- With the response of PESA 1996 the state has given ownership rights of NTFP to the *Gram Sabhas* in their area of jurisdiction.
- Minimum Procurement Price (MPP) has been vested with the Panchayat Samity.
- Due to Lack of capacity building in many cases the GP are not aware of their power.

1/17/2013

Market Arrangement for NTFPs



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NTFPs Management vis-à-vis market Mechanism

- In the process of commercialization of NTFPs, a number of agents, namely: middleman, businessmen and traders, government agencies etc. enter into the market network.
- Nationalized and commercially significant NTFPs, such as; Kendu leaves, Sal seeds & Bamboos restricts trade, and also limit number of legal buyers. It has reduce the free flow of goods, and delays payment to gathers. Thus it reduces the income that the forest dwellers might get.
- The structure of marketing channels vary depending upon number of agencies involved and nature of products.

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Terms of Trade and Modes of Exploitation

- Various mode of exploitation and deprivation arise owing to situations, where exchange take place between illiterate and the traders.
- In the absence of effective institution the Traders/Businessman exploit the primary gatherer.
- The mode of NTFP trade exhibits great variation by type, region, season etc. Barter is a common mode.
- Traders also make advance to the primary collector and later buy the NTFPs at very low rates and sell them in bigger market for huge profit.
- Poor communication and transportation facilities, highly segregated markets and unequal bargaining powers between buyers and sellers make the field more profitable for middlemen .

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Problems with NTFP Trade in Orissa

- Given the collection of forest produce, the income of the forest dwelling communities would depend on value addition to the products and their selling at reasonable prices.
- But the marketing structure for sale of NTFPs is exploitative to the tribals.
- Various reason like interlocking of credit & output market, limited surplus and lack of value addition at the village level are responsible for the low price of NTFPs for the primary gatherer.
- The state policy on NTFPs has mostly favored private business interests till 2000.

1/17/2013

NTFPs under Public Sector Monopoly

- The TDCC or the OFDC appointed agents formally or informally to purchase NTFPs from the village traders.
- Monopoly reduce the number of legal buyer and stop the free flow of goods, and delays payment to gatherer, as Govt. agencies find it difficult to make prompt payments.
- This results in contractors entering from the back door, but they must now operate with higher margins required to cover uncertain and delayed payments by government agencies, as well as to make the police and other authorities ignore their illegal activities. This all reduces gatherers' collections and incomes.

1/17/2013

<< Back to contents

Private Monopoly

- 1985 onwards, government of Orissa encouraged private parties to acquire monopoly rights over forest produce.
- The largest beneficiary was Utkal Forest Products Ltd (UFP), which was given long-term lease for 29 items for ten years in 1989.
- Its control was even extended to the designated forest products growing on private lands and non-forest government lands.
- Upto March 2000, there was no involvement of grassroots-level *Gram Panchayat* in NTFP trade.

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Case of KL & Sal Seed

- In Orissa, the share of NTFP revenue (particularly revenue from *kendu* leaf) in total forest revenue has increased from 43% in 1985-86 to 89.3% (share of *kendu* leaf is 85.1%) in 2001-02.
- About a million pluckers are engaged during the season to pluck *kendu* leaves, about 45 days in summer, at a rate fixed by the government.
- The wages paid to *kendu* leaf pluckers is much lower in comparison to the profits earned by the state. For every rupee paid to the pluckers, the State earns three rupees (in one year i.e. 1989-90 it went upto more than Rs.10).
- In case of Sal seed its around Rs 3 per kg and as daily collection is not more than 6–8 kg per day, a person can earn only about 20–25 rupees per day, which is just less then 50% of the minimum prescribed wage.
- State policies related to these items have been generally pro-rich and trader-oriented up to 2000

1/17/2013

Policy Reform for NTFP Marketing

- Due to concerted efforts by civil society, the state NTFP policy was changed in March 2000.
- The new policy seeks to give primacy to welfare of forest dependant poor over revenue objectives of the state.
- It also seeks to deregulate NTFP trade and encourages competition for NTFP procurement by conferring rights over 68 NTFP items to g*ram panchayat* as opposed to the earlier policies of monopoly leasing.
- In practice the panchyats have been provided with the responsibility and authority of manageing MTFPs but due to lack of capacity to exercise these powers and in many cases they are not aware of their power.
- Clearly the NTFPs have not improved the livelihood condition much in Orissa.

1/17/2013

Conclusion

- The overall impact of the polices and laws were depression of prices received by the primary collectors for NTFPs especially due to monopoly leases and high royalty fixed by the Forest Department, with a resultant deprivation of their livelihood.
- Clearly, although NTFPs form an integral part of the livelihood of the forest dependent communities, state policies related to these items have been generally pro-rich and trader-oriented until 2000. As a result the livelihood conditions of the poor, dependent on these produce, have been very precarious.

1/17/2013

Suggestions

- Measures should be taken urgently to enhance capacity to regulate and monitor the trade by the GP so that they can discharge their responsibilities and the primary gatherers will get the benefit.
- The effective involvement of GP in the price fixating system can be a first step towards this.
- Coordination and cooperation between the *Gram Panchayat*, Forest Department and other concerned departments involved in the process need to be stressed.

1/17/2013

<< Back to contents