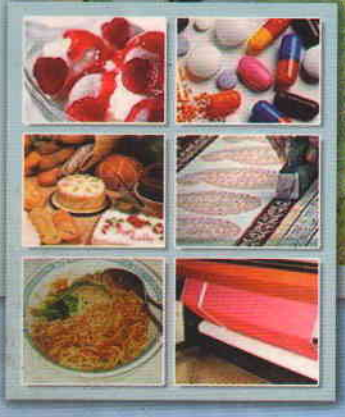



वार्षिक प्रतिवेदन
ANNUAL REPORT
2008-2009

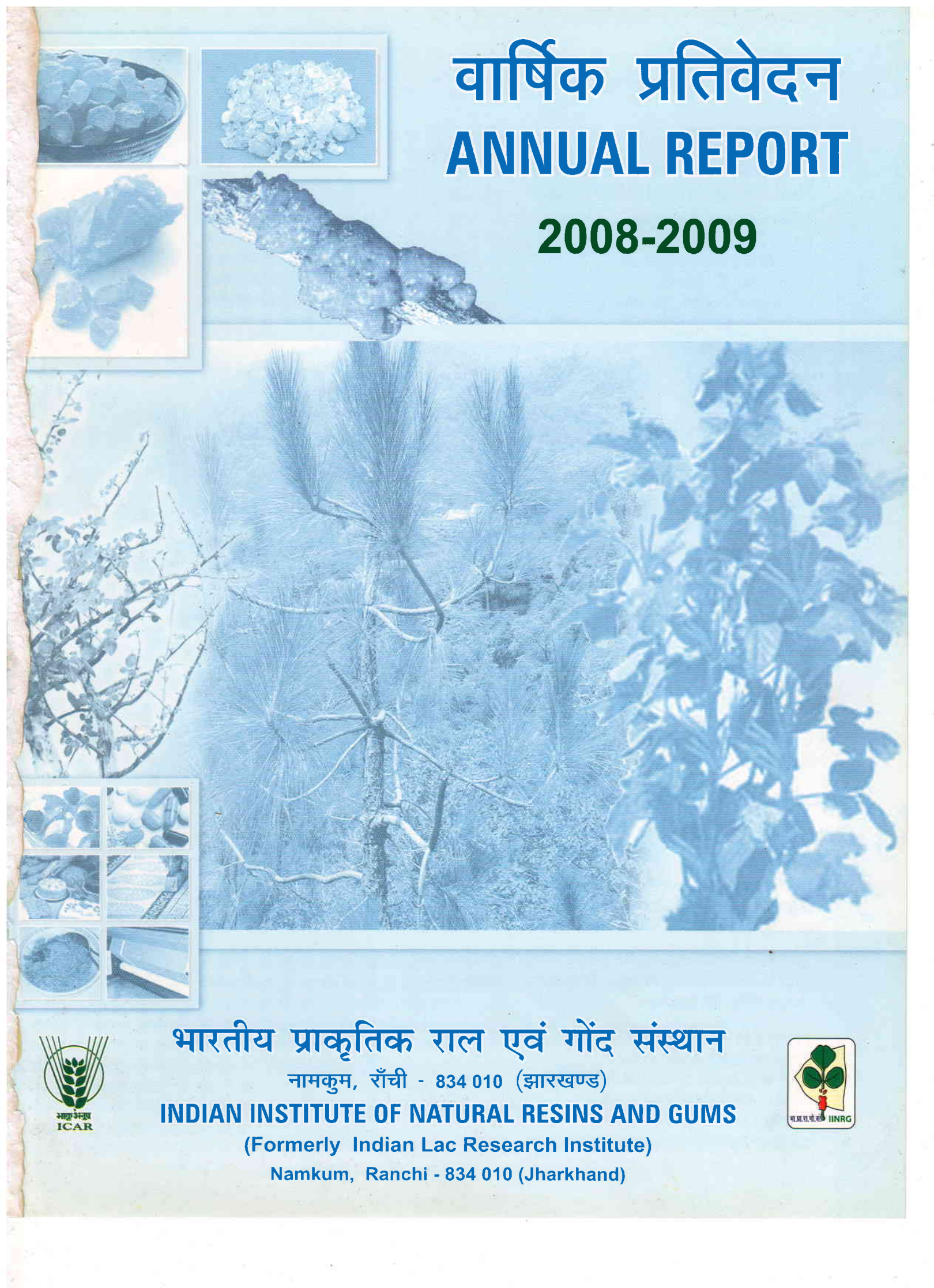


भाकृअनुप
ICAR

भारतीय प्राकृतिक राल एवं गोंद संस्थान
नामकुम, राँची - 834 010 (झारखण्ड)

INDIAN INSTITUTE OF NATURAL RESINS AND GUMS
(Formerly Indian Lac Research Institute)
Namkum, Ranchi - 834 010 (Jharkhand)

भा.प्रा.रा.गो.सं. IINRG



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Gum arabic, Gum karaya, Rosin, Sticklac
Pine tree, Guggul plant, Guar plant
Application areas of natural resins and gums

Back Cover:
Administrative building of the Institute

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Annual Report 2008-09
Indian Institute of Natural Resins and Gums

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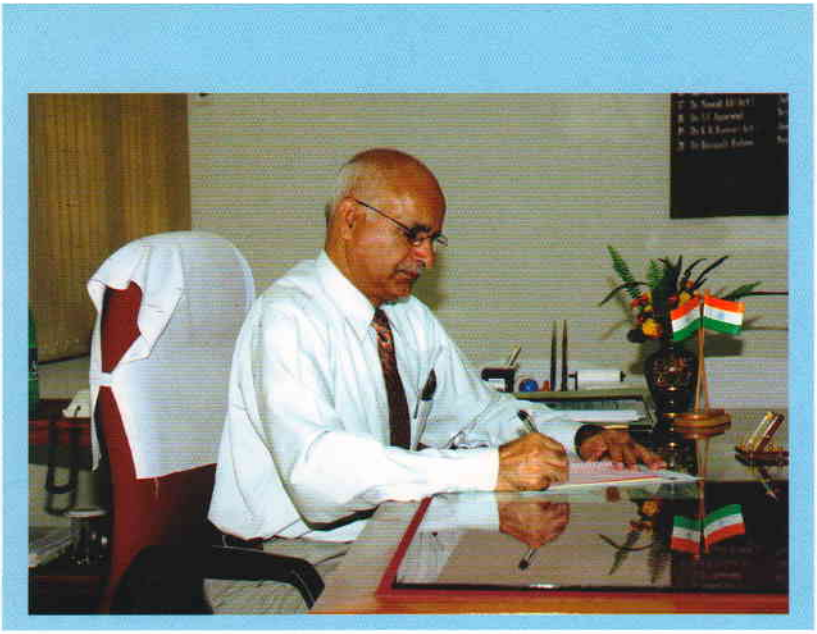


Preface

At a time when agriculture sector in India is passing through a difficult phase and impact of global recession is seen everywhere all over the world, the Institute in devoting greater attention to the goal of achieving and ensuring livelihood security for the country's poorer section of the society particularly forest and sub-forest dwellers by contributing to higher lac production, productivity and value addition of natural resins and gums. In the process, the protection of environment and natural resources also received due attention. The year 2008- 09 was historical for expanding the network of the Institute by taking some new initiatives. As in the past, the Institute continued to provide emphasis on building the desired human resource through various training programmes. The infrastructure development and resource generation of the Institute was commendable. The annual report presents a glimpse of the various activities, research efforts and accomplishments of the Institute.

Lac Production

More than 1000 lac cultures of 65 lines of lac insect which include 14 cultivated, 28 natural population, 22 crossbred / inbred / selected, one exotic and six uncoded lines are being maintained live in the Field Gene Bank of National Lac Insect Germplasm Center (NATLIGEC) of the Institute on potted plants of Flemingia macrophylla. Twelve collections were added to field gene bank during the year to the existing 67 collections. A collection of wild population of Flemingia macrophylla from Amarkantak, Madhya Pradesh has been registered (IC No.-558405 from Zone No.9) at NBPGR, New Delhi. Genetic diversity of thirty-five collections of Ziziphus spp. including 26 fruit varieties, 6 geographic collections of Z. mauritiana as lac host and three different species (Z. rotundifoila, Z. nummularia and Z. xylopyra) were characterized through RAPD technique. Thirty combinations of cytokinins and auxins were tried for in vitro axillary bud initiation in kusum. Two treatment combinations consisting of (i) BAP (1.0 mg/l) + NAA (0.05 mg/l) and (ii) BAP (1.0 mg/l) + Silver nitrate (1.0 mg/l) produced highest axillary bud break after 21 days. A Lac- Integrated Farming System (LIFS) has been laid out in IRF on about

1.7 ha of land, which contains about 1.0 ha upland (tanr) and about 0.7 ha low / medium land (doan). The cropping systems have been chosen in the light of existing farmer's practices and interests as well as recommended varieties / technologies.

Processing and Product Development

The bio-active compounds thiosemicarbazide and its derivative 4-ethylphenyl thioseicarbazide, 4-bromophenyl thiosemicarbazide and thiadiazole were synthesized from aleuritic acid for their evaluation as antifungal and antidiabetic activities. Gum acacia and gum karaya were purified and recrystallized for their modification and preparation of hydrogel to be used in slow drug release system. Shellac based dental plates have been prepared and got tested from a private firm in Delhi and the quality has been assessed as very good. The firm has expressed its desire for purchasing the technology of dental plate. A centrifugal drier of 10 kg/batch capacity has been designed, fabricated and tested for its suitability to fit in the package of machines of small scale lac processing unit (100 kg/day). The drier was able to bring down moisture content from 35% to 10% in 2 minutes at 570 rpm drum speed. ***Aleuritic acid (technical grade) was successfully produced in the pilot plant with a yield of approximately 19 % of the weight of seedlac.*** *The melting point and acid value of aleuritic acid was found to be 92-93°C and 178.6, respectively and it's purity was around 96.5% (based on acid value).*

Transfer of Technology

Immense training programmes organized on and off campus for the farmers, housewives, extension cadre, NGO staff, students, entrepreneurs etc and more than ten thousand persons besides many more through orientation programmes from Jharkhand, Chhattisgarh, Orissa, Madhya Pradesh, West Bengal, Andhra Pradesh, Gujarat and Maharashtra states have been benefited under the various training activities conducted by the Institute. Ten lac based product technologies were transferred to entrepreneurs from Mumbai, Kolkata, Sikohabad, Raipur and Wardha. An exhaustive survey was carried out on lac production, marketing and processing by evolving separate schedules / questionnaires for collection of lac related information and data. The estimated national production of sticklac during 2008-09 was approximately 17,175 tons and 27,110 tons of sticklac were processed during 2007-08, which also included the amount of imported lac in India. The total export of lac and its value added products during the year 2007-08 was 7,906.33 tons valued Rs.124.27 crores. The total import of different kind of lac during the year 2007-08 was 5797 tons valued Rs.34.62 crores. For the management of two key lepidopteran lac insect predators viz., Eublemma amabilis and Pseudohypatopa pulverea and neuropteran predator, Chrysopa spp on lac crop, some IPM based newer chemical insecticides and Bt formulations of indigenous origin have been identified as promising pesticides which are safe to lac insect and found effective in reducing the incidence of lac insect predators. Linkages have been established with the several Government and Non-Governmental Organizations in the states of Jharkhand, West Bengal, Maharashtra, Madhya Pradesh, Orissa and Chhattisgarh.

Infrastructure Development

Pilot plant for preparation of pure lac dye has been completed and a pilot plant of bleached lac of 40 kg/batch capacity has been installed. Construction of new scooter shed in factory campus, enhancement of the height of the boundary wall, foundation stone pillar and deep bore well in factory campus were carried out. Organic chemistry laboratory No. 2, Estate section, some staff quarters were renovated. Upgradation of internet connectivity to 512 kbps from ERNET India was initiated.

I would like to express my gratitude to Dr Mangala Rai, Director General ICAR & Secretary, Department of Agricultural Research and Education, Dr Nawab Ali, DDG (Engg) and Dr Pitam Chandra, ADG (PE) for their guidance and support. I am also thankful to the Chairman and members of various committees for their efforts in reviewing and suggesting new initiatives in research and their monitoring, evaluation and refinement. The cooperation extended by the scientific, technical, administrative and supporting staff of the Institute for all that Institute was able to achieve during the year is duly acknowledged.

Bangali Baboo

August, 2009
Namkum, Ranchi

(Bangali Baboo)
Dircetor

The Mandate of the Indian Institute of Natural Resins and Gums

- **To plan, conduct and promote researches on lac production technologies.**
- **To conduct basic and applied researches on processing natural resins (including lac), natural gums and gum-resins for farmers and industries.**
- **To develop value added products of commercial use from natural resins, gums and gum-resins, leading to pilot plant demonstration.**
- **To act as repository and provider of information on lac production and processing, product development, utilization of all natural resins, gums and gum-resins.**
- **To transfer the technologies to farmers, entrepreneurs and processors.**

कार्यकारी सारांश

1. कीट सुधार

- पूर्वी उत्तर प्रदेश के छः जिलों के चुने हुए क्षेत्रों में लाख कीट की उपलब्धता एवं लाख की खेती की स्थिति का पता लगाने के लिए सर्वे किया गया। लाख कीट की आबादी मुख्यतया पीपल (फाइकस रेलिजिओसा), बेर (जीजीफस मॉरीसियाना), पाकुर (एफ. ल्यूसेन्सी) एवं पुत्रंजीवा रॉक्सवर्धी पर पाया गया। संस्थान के फिल्ड जीन बैंक में मूल्यांकन एवं रख रखाव के लिये आगरा से लाख कीट का संग्रह किया गया। संस्थान के राष्ट्रीय लाख कीट जनन द्रव्य केन्द्र (एन ए टी एल आई जी इ सी) के फिल्ड जीन बैंक में गमले में लगे फ्लेमिंजिया मैक्रोफाइला पर 14 कृषि जन्य, 28 प्राकृतिक आबादी, 20 संकर प्रजात अन्तःप्रजात। चयनित, एक विदेशज एवं छः गैर संहितावद्ध वंशक्रम समेत 65 वंशावली के 1000 से भी ज्यादा लाख संवर्द्धन का रख रखाव किया जाता है।
- बेखंडी, मध्य प्रदेश से कुसुम एवं बेर पर होने वाली रंगीनी की तरह का जीवन चक्र एवं कुसमी की तरह का राल उत्पादन करने वाली एक पुर्नसंयोजी लाख कीट आबादी का संग्रह किया गया।
- केरिया चीइनेन्सीस के दो वंशक्रम के लिए दो नये आशाजनक परिपालक पौधे जैसे कैलिएन्डा कैलाथायरस एवं डलवर्जिया असमिका (जीमोनेन्सीस) की पहचान की गई है। संस्थान अनुसंधान धाम प्रक्षेत्र में फिल्ड परिस्थितियों में वर्षा ऋतु मे इन परिपालकों से लाख कीट वंशक्रम एल आइ के 031 एवं एल आइ के 023 से क्रमशः 25 एवं 6.7 अनुपात मे बीहनलाख पाया गया।
- पुरूलिया (पश्चिम बंगाल) जिले के झालदा एवं जम्मु (जम्मु एवं कश्मीर) जिले के अखनूर के दो रंगीनी लाख कीट वंशक्रमों का वर्षा ऋतु में बेर के पौधे पर मुल्यांकन किया गया। दोंनो संग्रहों से 20 (झालदा) एवं 18 (अखनूर) के निवेश–उत्पाद के अनुपात से बहुत अच्छा बीहनलाख प्राप्त किया गया।
- शरद ऋतु की फसल के लिए सेमियालता एवं बेर पर पाँच कुसमी लाख कीट स्टॉक– कुसमी किरमिजी अगात, कुसमी पीला, कुसमी किरमिजी पछात तथा कुलजंगा एवं नावाडीह नामक दो उत्पादक नस्ल का तीन वर्ष तक मूल्यांकन किया गया। एफ सेमियालता के लिए जनवरी–फरवरी में परिपक्व होने वाला कुसमी अगात स्टॉक का परिणाम बेहतर रहा जबकि बेर के लिए मार्च–अप्रैल में परिपक्व होने वाला कुसमी पछात स्टॉक (कुलाजंगा, नवाडीह, कुसमी पीला एवं कुसमी किरमिजी पछात) का परिणाम ज्यादा उपयुक्त पाया गया।

2. परिपालक सुधार

- पश्चिम बंगाल, झारखण्ड, मध्य प्रदेश के दो–दो जिले तथा राजस्थान के एक जिले में लाख परिपालक पौधों के संग्रह के लिए सर्वे किया गया। पश्चिम बंगाल, झारखण्ड, गुजरात एवं

राजस्थान से छः कूलों (फैमिलीज) से संबंधित बाइस नये संग्रह किये गए एवं कुसुम, बेर एवं फाइकस के कुछ उच्च उत्पादकता वाले पौधे रिकॉर्ड किये गए। संस्थान अनुसंधान प्रक्षेत्र में फिल्ड जीन बैंक के लाख परिपालकों का सुदृढ़ करने के लिए एक नया प्लॉट (प्लॉट सं. 70 बी) विकसित किया गया है। वर्ष के दौरान फिल्ड जीन बैंक में वर्तमान 67 संग्रह मे 12 और संग्रह जोड़े गए। अमरकंटक, मध्य प्रदेश से संग्रह की गई फलेमिंजीया मैक्रोफाइला की जंगली आबादी एन बी पी जी आर, नई दिल्ली में पंजीकृत (क्षेत्र संख्या–09 का आइ सी सं – 558 405) किया गया है।

- आर ए पी डी तकनीक द्वारा 26 फलदार किस्म, लाख परिपालक के रुप में जेड. मॉरीसियाना के 06 भौगोलिक संग्रह एवं 03 विभिन्न प्रजाति (जेड रोटुन्डीफोइला, जेड न्युमुलोरिया एवं जेड जाइलोपाइरा) समेत जीजीफस प्रजाति के पैंतीस संग्रहों के आनुवंशिक विविधता का अभिलक्षण वर्णन किया गया। जाँच किये गए बीस आर ए पी डी प्रारंभक में 11 एवं 12 प्रारंभकों को आर ए पी डी द्वारा क्रमशः कुसुम एवं पलास के अभिलक्षण वर्णन के लिए संतोषजनक पाया गया।

- ग्रीष्मकालीन लाख में उपयोगिता के लिए चुने गए फ्लेमिंजीया सेमियालता की ऊँचाई 88 से. मी. से 205 से.मी. मध्यम रुप से 146.45 ± 26.5 रही जबकि नियंत्रण वालों में यह 129. 22 ± 26.7 मध्यम के साथ 121 से 170 तक रही। चुने हुए संतति के प्रति पौधे में पतवार की संख्या 6.9 ± 2.6 के औसत से 2 से 14 के बीच होता है जबकि नियंत्रण में 5.1 ± 2.5 के औसत के साथ यह 3 से 10 तक होता है। अगले वर्ष से पौधे ग्रीष्मकालीन कुसमी लाख की फसल उगाने के लिए तैयार हो जाएंगे। वृंतक गुणण के पश्चात शरद ऋतु में कुसमी लाख की उपज एवं विशिष्ट पौध अभिलक्षण के आधार पर पुटीडीह में एक उच्च उत्पादक पौध के साथ बेर के पच्चीस पौधों की जाँच की गई। उन पौधों का लक्षण वर्णन उनकी प्रकृति, प्ररोह एवं पत्र मानदंडों के आधार पर किया गया।

- साइटोकाइनीन्स एवं ऑक्सीन्स के तीस संयोजन का अक्षीय कली निकलने के लिए अन्तःपात्र परीक्षण किया गया। 21 दिन के बाद (1) बी ए पी (1.0 मि. ग्रा./1) + एन ए ए (0.05 मि. ग्र./1) एवं बीएपी (1.0 मि.ग्रा./1) + सिल्वर नाइट्रेट संयोजन के दो उपचार के पश्चात अक्षीय कली का निकलना उच्चतम रहा। उपरोक्त दोनों उपचारों के लिए अक्षय कलि निकलने की औसत संख्या 5.0 ± 1 देखी गई। प्रचूर मात्रा में उत्पन अक्षीय कलियों को बाद मे एम एस माध्यम में विभिन्न पी जी आर संयोजन रहित या उसके साथ सह संवर्द्धन किया गया, जिसके कारण फॉलिएज गिरावट देखी गई जिससे लगभग सभी एक्सप्लांट मर गए। तरल एम एस मिडिया में सुखाए गए सफेद फिल्टर कागज बीज पर प्रचूर मात्रा में उगे अक्षीय कलियों के सहसंबर्द्धन से समस्या का निवारण किया गया।

3. फसल उत्पादन

- पलवार एवं अर्द्धचन्द्रवेदिका / अर्द्धबलय से विशेष रुप से नमी संरक्षण की दृष्टि से चार अन्य उपचारों से बेहतर देखा गया एवं परिणामस्वरुप बेर के पौधे की कायिक वृद्धि अच्छी रही। पलवार के अर्न्तगत बेर मे अधिकतम संग्रहित बायोमास रिकॉर्ड किया गया (22.9 कि./हे.) तथा 861% वृद्धि के साथ नियंत्रण के अन्तर्गत न्युनतम रहा। फरवरी के मध्य से एकल तना के साथ बेर के सभी पौधों को जमीन के सतह से एक समान 1.25 मीटर की ऊँचाई तक छंटाई की गई। पलवार की स्थितियों में छंटाई के सात माह बाद पौधों की ऊँचाई को रिकार्ड किया गया जिसमें नियंत्रण की तुलना में 51.9 से (17.6%) वृद्धि देखी गई। नियंत्रण की तुलना मे पलवार मे घेरे की कुल वृद्धि में 31.5% बढ़ोतरी दर्ज की गई।

- तीन वाणिज्यिक लाख परिपालक पलास, बेर एवं कुसुम तथा एक आशाजनक परिपालक फ्लेमिंजीया सेमियालता पर रोग की उत्पत्ति संबंधी सर्वे किया गया। संस्थान अनुसंधान फार्म में पलास पर देखे गए मुख्य रोग जैन्थोमोनस बूटी एवं फोमोप्सीस बूटी के कारण लीफ स्पॉट, बेर पर इरीस्फी जिजीफ के कारण पावडरी मिल्डयू तथा क्लैडोस्पोरियम जिजीफी के कारण प्ररोह का मुड़ना एवं कुसुम पर बहुत कम पावडरी मिल्डयू तथा सेमियालता पर बोट्रियोस्फेरिया के कारण मध्यम सघनता का स्टेम कैन्कर पाया गया।

- कुसुम की ग्रीष्मकालीन फसल एवं बेर की शरदकालीन फसल में प्ररोह के मुड़ने के प्रबन्धन के लिए आठ फफुंदनाशी सुत्रण की जाँच की गई। कुसुम की ग्रीष्मकालीन फसल में कार्वेंडाजीम (0.2ग्रा./1) (2.59) एवं ऐक्सा कोनाजोल (3.66) से उपज मे वृद्धि (बीहन/उपज अनुपात) देखी गई। बेर के शरदकालीन फसल में हेक्साकोनाजोल सर्वाधिक प्रभावी रहा तथा प्ररोह के मुड़ने मे कमी आई। बेर के शरदकालीन फसल पर फफुंदनासी के प्रयोग एवं उसके बिना भी लाख की पपड़ी में चीटियों के प्रवेश होने से प्ररोह के मुड़ने में उल्लेखनीय कमी देखी गई।

- अगस्त महीने में चूना डालने से केवल सी सी आई में उल्लेखनीय प्रभाव देखा गया। गैर उपचारित वृक्षों की तुलना में उपचारित वृक्षों से सी सी आई मान मे 18.1% वृद्धि पायी गई नियंत्रण की तुलना में नाइट्रोजन के 100 ग्रा. वृक्ष प्रयोग से आरंभिक लाख कीट मरणशीलता में 5% कमी आई। पोटैशियम के प्रयोग से नर अनुपात से उल्लेखनीय वृद्धि देखी गई जो सरसता में वृद्धि से संबंधित है।

- सेमियालता एवं बेर के बागान मे खरपतवार प्रबंधन के लिए पाँच घासनाशियों का मूल्यांकन किया गया। एफ सेमियालता के पौधों के लगाने के पूर्व एवं बाद में क्रमशः 80.51% एवं 77.54% खरपतवार नियंत्रण क्षमता (डब्ल्यू सी ई) के साथ ग्लाईफोसेट परीक्षण किये गए सभी घांसनासियों की तुलना में बेहतर पाया गया एवं बेर के बागान मे भी इसी तरह का परिणाम रहा। एक वर्ष पुराने एफ सेमियालता के बागान मे घासनाशियों के प्रयोग से परिपालक पौघों में 2.56–18.38% मरणशीता देखी गई। उच्चतम पौध मरणशीलता ग्लाइफोसेट एट्राजाइन के उपचार से देखा गया एवं खरपतवाररहित स्थितियों में 3.84% तथा खरपतवारमुक्त गैर उपचारित स्थितियों में कम रहा। लाख परिपालक पौधा राइजोस्फीयर में सूक्ष्मजैविक आबादी के अध्ययन से पता चलता है कि घासनाशी के प्रयोग के पाँच दिनों के अन्दर फफूंद आबादी पर प्रतिकूल प्रभाव पडा एवं उसके पश्चात एक आबादी का निर्माण हुआ। ग्लाइफोसेट (0.5 10/ग्राम पूर्ण शुष्क मृदा) से 5 डी ए एस पर फफूंद आबादी में उच्चतम प्रतिकूलता देखी गई।

- कुसमी लाख कीट की मरणशीलता पर घासनाशी के प्रभाव (संचारण के पूर्व एवं पश्चात) के मूल्यांकन के लिए फ्लेमिंजीया सेमियालता पर उगाए गए शरद कालीन (अगहनी) कुसमी लाख की फसल पर एक प्रयोग किया गया। ग्लूफोसिनेट (9.77%) से न्युनतम मरणशीलता रिकार्ड की गई, उसके बाद ग्लाइफोसेट (11.14%) का स्थान रहा, जब कि नियंत्रण में 11.79% मरणशीलता देखी गई जो सांख्यिकी की दृष्टि से एक दूसरे के बराबर थी। वर्षा ऋतु में पाँच लाख परिपालक बागानों (बेर, पलास, कुसुम, भालिया एवं खरपतवार पौधों) का अध्ययन किया गया तथा खरपतवार की पहचान, श्रेणीकरण एवं सापेक्ष संख्या का निर्धारण किया गया।

- संस्थान अनुसंधान प्रक्षेत्र के उपयुक्त क्षेत्र मे लाख समेकित कृषि प्रणाली (एल आइ एफ एस) आरम्भ की गई। इसके लिए 1.7 हे. भूमि चिन्हित की गई है जिसमें लगभग 1.0 हे. उपरांउ भूमि (टाड़) तथा लगभग 0.7 हे. नीची मध्यम भूमि (दोन) है। किसानों के प्रचलित तरीके एवं रुचि के साथ–साथ अनुशंसित प्रौद्योगिकी किस्मों को देखते हुए फसल प्रणाली का चयन किया गया है। खाद्य फसल एवं सब्जियाँ, चावल (खरीफ), चावल (रोपण एवं उपराँऊ भूमि), मक्का, रागी एवं कंदिल फसल (खरीफ); नाइगर, जौ एवं बी ग्राम (रबी), सब्जिया (जैव), फलदार वृक्ष; ऑवला, अमरुद एवं नीबूंवर्गीय फल/पपीता; लाख बेर, पलास, कुसुम एवं एफ सेमियालता; मानसून के दौरान अल्पावधि मत्स्यपालन। लाख बागवानी को समेकित करने के लिए फल वाले वृक्षों के अन्तर स्थान से लाख परिपालक पौधों को सुसंगत तरीके से लगाया गया। इस उद्देश्य के लिए 2500 वर्ग मीटर का क्षेत्र लिया गया तथा फल के वृक्ष एवं लाख परिपालक पौधे लगाए गए।

4. संश्लेषण एवं उत्पाद विकास

- संश्लेषण एवं उत्पाद विकास प्रतिक्रिया चरण के बाद लाख के प्रमुख घटक अम्ल एल्यूरिटीक अम्ल के जैव सक्रिय यौगिकों थायो सेमिकार्बाजाइड (द्रब्णांक 122–123.) एवं उत्पादन 90% एवं इसका ब्युत्पन्न 4– इथिलफेनाइल थायोंसे

कार्बोजाइड, 4– ब्रोमोफेनाइल थायोसेमिकार्वा जाइड (द्रवणांक, 14%–42,147–148^{0}से.) एवं थाइडायजोल (उत्पादन 40%) का संश्लेषण किया गया जिनका फफूंदरोधी एवं मधुमेहरोधी गतिविधियाँ के लिए मूल्यांकन किया गया।

- सामान्यतः गैर ध्रुवीय कार्वनिक विलायक (इथाईल एसिटेट) के साथ जबलपुर (मध्यप्रदेश) से प्राप्त बोस्वेलिया सेराटा एवं अंजार (गुजरात) के कॉमिफोरा मुकुल के निःस्रवण से 66% राल का उत्पादन हुआ। यह जल में घुलनशील हल्का भूरा रंग का पावडर है। इस उत्पादक का द्रवणांक 108^0–110^0 से, नमी प्रतिशत 0.7, राख प्रतिशत 0.42, अम्ल मान 52.82 है।
- एकेशिया गोंद एवं कराया गोंद के रुपान्तरण एवं हाइड्रोजेल, जिसे औषधि के मंद मोचन प्रणाली में उपयोग किया जाएगा, की तैयारी के लिए परिष्करण एवं पुनर्रवाकरण किया गया।

5. सतह लेपन एवं उपयोग विविधता।

- द्रवण तापमान पर चपड़ा को गंधराल के साथ मिलाया गया तथा उसके भौतिक रासायनिक गुणों का अध्ययन किया गया। यह देखा गया कि शुद्ध चपड़ा से चपड़ा एवं गंधराल के मिश्रित यौगिकों के ताप के अन्तर्गत वहाव (तरलता) एवं टिकाउपन में क्रमशः लगभग 65% एवं 115% की वृद्धि हुई। चार महीने की अवधि मे चपड़ा (शुद्ध) के बहाव में 17% कमी आई जब कि चपड़ा : रोजीन (70:30) मिश्रण के बहाव में 26% कमी देखी गई।
- चपड़ा आधारित दंत पट्टियां तैयार की गई एवं दिल्ली के निजी प्रतिष्ठान में परीक्षण किया गया। इसकी गुणवत्ता को अच्छा माना गया। भंडारण के अंतर्गत अध्ययन प्रगति पर है। प्रतिष्ठान ने इस प्रौधोगिकी के क्रय की इच्छा प्रकट की है।
- अमोनियां, मॉर्फोलीन, ट्राईइथेनालएमीन एवं बोरैक्स का उपयोग कर तथा यूरिया के साथ–साथ थायो–यूरिया के साथ उपचारित कर जल में घुलनशील लाख वार्निश तैयार किया गया। बोरैक्स आधारित वार्निश के अतिरिक्त सभी वार्निशों में यूरिया या थायो–यूरिया (चपड़ा के वजन पर 3%) मिलाने से फिल्म के गुणों मे सुधार देखा गया।
- कराया गोंद एवं गोंद घट्टी के आसंजन गुण बबूल गोंद, खैर गोंद, ईमली गोंद एवं सलाई गोंद (ओलिओ. गोंद राल का गोंद घटक) की तुलना में प्रारंभिक अध्ययन में बेहतर पाये गए। 65% आर. एच. पर कराया गोंद में भी तुलनात्मक रुप से उच्च नमी के अंश दिखे तथा सुखने पर कमी आई। गोंद के विस्तृत कोण एक्स रे डिफ्रैक्टोग्राम से लगभग 20–40^0 पर धेरा नजर आता है जो रवाहीन रचना का संकेत देता है। गोन्द की परावैधुत शान्ति (ब्रेकडाउन वोल्टेज) मान चपड़ा से कम थी।

6. प्रसंस्करण एवं भंडारण

- लधुस्तरीय लाख प्रसंस्करण इकाई (100 कि. ग्रा./दिन) के मशीनों के साथ समुचित रुप से उपयोगी होने के लिए 10 कि. ग्रा./बैच की क्षमता के एक सेन्ट्रीफ्यूगल ड्रायर की अभिकल्पना एवं निर्माण किया गया। सुखाने वाली यह मशीन 570 धु. प्र. मि. ड्रम गति के साथ 02 मिनट के अन्दर नमी के अंश को 35% से 10% कर देता है।
- एक वर्ष तक भंडारण की अवधि में विभिन्न परिस्थितियों एवं तरीकों से रखे गए यष्टि लाख, चौरी एवं चपड़ा नमूने का मूल्यांकन किया गया। यष्टि लाख के मामले में परिणामों से पता चलता है कि प्लास्टिक के थैले एवं मिट्टी के फर्श पर रखे गए नमूने में गर्म एवं ठंढ़ा अल्कोहल अधुलनशील उच्चतर थे। भंडारण के विभिन्न तरीकों के बीच बहाव मान में बहुत कम अन्तर देखा गया। मिट्टी के फर्श पर रखे गए यष्टि लाख में रंग एवं टिकाउपन बेहतर रहा। सीमेंट के फर्श पर भंडारित किये गए चौरी में एक वर्ष बाद अधिकतम गुण बने रहे। धातु के बर्त्तन मे रखने से गुणों में अधिकतम क्षति देखी गई। भंडारण के एक वर्ष बाद कोल्ड स्टोरेज में जूट के बोरे (सूती लाइनिंग के साथ) रखे गए चपड़े के नमूने में अन्य नमूनों की तुलना में बहाव एवं टिकाउपन थोड़ा उच्चत्तर पाया गया।
- एल्यूरिटीक अम्ल के पाइलट संयन्त्र के कार्य के मूल्यांकन के लिए परीक्षण किया गया। संयंत्र मे चपड़ा के वजन के लगभग 19% एल्यूरिटीक अम्ल (तकनीकी कोटि) सफलता पूर्वक तैयार किया गया। एल्यूरिटीक अम्ल का द्रवणांक एवं

अम्ल मान क्रमशः 92–93^0 से एवं 178.6 पाया गया एवं इसकी शुद्धता लगभग 96.5% (अम्ल मान पर आधारित) थी।

- शुद्ध लाख रंजक की तैयारी के लिए पाइलट संयंत्र पुरा किया गया एवं 200 कि० ग्रा० कुसमी यष्टिलाख एवं 430 ग्रा० तकनीक कोटि का लाख रंजक (यष्टिलाख की वजन का 0.21%) लेकर परीक्षण प्रचालन किया गया। रंजक डाईमिथाइल फॉर्मेमाइड (डी एम एफ) मे घुलनशील है। इसमे राख का अंश 0.87%,130^0 से पर वाष्पशील पदार्थ, रंजक अंश 87%, 0.13/100 ग्र०. जल मे 35^0 से पर जल में घुलनशीलता, जलाने पर द्रवणांक 238^0 से एवं जल मे 291.2 एवं 489 नैमी पर अवशोषण अधिकतम है।

7. लाख उत्पादन, प्रसंस्करण एवं मूल्यवर्द्धन मे क्षमता निर्माण के लिए मानव संसाधन विकास

- संस्थान द्वारा किसानों, गृहिणियों, एक दिवसीय अभिविन्यास कार्यक्रम, प्रक्षेत्र प्रशिक्षण, क्षेत्र शिक्षण एवं प्रोत्साहन प्रशिक्षण, प्रशिक्षक प्रशिक्षण एवं प्रक्षेत्र स्तरीय प्रदर्शन जैसे नियमित प्रशिक्षण कार्यक्रम आयोजित किये जाते हैं। संस्थान द्वारा संचालित विभिन्न प्रशिक्षण गतिविधियों में दस हजार से भी ज्यादा व्यक्तियों को लाभ मिला है।
- झारखंड, छत्तीसगढ़, उड़ीसा, मध्य प्रदेश, प० बंगाल, आंध्रप्रदेश एवं महाराष्ट्र के 1186 किसानों, प्रसार कर्मियों एवं स्वयंसेवी संगठनों के स्टाफ के लिए एक सप्ताह अवधि का लाख का वैज्ञानिक उत्पादन, प्रसंस्करण एवं उपयोग संबंधी बत्तीस प्रशिक्षण पाठ्यक्रम आयोजित किये गए।
- 130 लाभुकों के लिए एक सप्ताह की अवधि का कृषि प्रसार अधिकारियों के लिए लाख की वैज्ञानिक खेती, प्रसंस्करण एवं उपयोग पर दो प्रशिक्षक प्रशिक्षण कार्यक्रम एवं बी० एससी० कृषि के छात्रों के लिये पाँच शैक्षणिक कार्यक्रम आयोजित किये गए।
- मुबई, कोलकाता, शिकोहाबाद, रायपुर एवं बर्धा के उधमियों को लाख आधारित दस उत्पाद प्रौधोगिकी का हस्तांतरण किया गया।
- झारखण्ड, छतीसगढ़, उड़ीसा, मध्य प्रदेश, गुजरात, आन्ध्र प्रदेश एवं महाराष्ट्र के किसानों, गृहिणयों के लिए 53 प्रक्षेत्र प्रशिक्षण शिविर, 45 प्रक्षेत्र प्रोत्साहन/पूरक शिविर, 14 परिसर के अन्दर अभिविन्यास कार्यक्रम आयोजित किये गए।
- विभिन्न स्वयंसेवी संगठनों द्वारा प्रायोजित तथा झारखंड के जनजातिय परिवारों की आजिविका विकल्प मे वृद्धि की योजना के अन्तर्गत 09 प्रसारकर्मियों के लिए एक बैच मे एक सप्ताह का प्रशिक्षण आयोजित किया गया एवं 1995 लाभुकों के लिए 22 प्रक्षेत्र प्रशिक्षण आयोजित किये गए। स्वयंसेवी संगठन (सीड्स) के सहयोग से खरसीदाग ग्राम में सेमिलायता के 1200 पौधों पर शरदकालीन कुसमी लाख की खेती का प्रक्षेत्र प्रदर्शन किया गया। सीड्स के माध्यम से राँची जिले के मांगोबांध गाँव मे तथा स्वयंसेवी संगठन (प्रदान) के माध्यम से खूंटी जिले के गुटवा ग्राम मे बेर पर शरदकालीन फसल के लिए तीन उत्पादक कुसमी किस्मों का प्रक्षेत्र प्रर्दशन किया गया।
- गुजरात मे प्रशिक्षण एवं प्रदर्शन के द्वारा लाख की खेती संबंधी दक्षता विकास एवं क्षमता की परियोजना पुरी की गई। गुजरात मे जीजीफस मॉरीसियाना (बेर) पर कुसमी लाख की खेती के लिए प्रौद्योगिकी का परिष्करण, प्रोसोपीस जूलीफ्लोरा (गंदा बबूल) कुसमी लाख की खेती, वन विभाग में बीहनलाख उत्पादन एवं प्रदर्शन के लिए लाख परिपालक संसाधन विकास, प्रशिक्षण सुविधा की स्थापना, कुसमी लाख उत्पादन का सफलता पूर्वक प्रक्षेत्र प्रदर्शन, 73 बन अधिकारियों एवं 13 प्रशिक्षण शिविरों द्वारा 500 से अधिक किसानों को लाख की खेती के लिए मानव संसाधन विकास प्रशिक्षण इत्यादि महत्वपूर्ण योगदान है।

8. प्रौधोगिकी समीक्षा, परिष्करण एवं प्रसार

- लाख कीट के एक न्यूरोप्टेरन परभक्षी क्राइसोपा लैसीपेर्डा के प्रबंन्धन के लिए उपरी छिड़काव एवं कीटनाशियों के अवशेष फिल्म पर कीटों को रखकर सात कीटनाशियों का प्रयोगशाला

बायोएसे किया गया। लैम्डासाइहैलोथ्रीन, (0.005 एवं 0.008%), अल्फामेथ्रीन (0.005 एवं 0.01%), इन्डोक्साकार्व (0.02%) कार्बोसल्फान (0.03%), स्पाइनोसेड (0.01 एवं 0.02%), फिप्रोनील (0. 005 एवं 0.01%) एवं इथोफेनप्राक्स (0.02%) स्पीनोसाड के उपरी छिड़काव से उपचार के 24 घंटों के अन्दर सी लैसीपेर्डा की शत प्रतिशत मरणशीलता देखी गई। उपरी छिड़काव एवं कीटनाशी के अवशेष फिल्म पर रखने से कार्वोसल्फान एवं स्पाइनोसेड भी समान रुप से प्रभावी है।

- कुसुम वृक्ष का एक नाशक जीव पैंटाटोमिड बग टेसाराटोमा जेवनिका के प्रबन्धन के लिए कीटनाशियों के मूल्यांकन हेतु प्रयोगशाला बायोएसे किया गया। कार्बोसल्फान (0.02 एवं 0.03%) इन्डोक्साकार्व (0.01 एवं 0.02%), स्पाइनोसेड (0.01 एवं 0.02%) लैम्डासाइहैलोथ्रीन (0.005 एवं 0.008%) अल्फा मे थ्रिन (0.005 एवं 0.01%) एवं इन्डोसल्फान (0.05%) बहुत प्रभावी पाया गया एवं उपचार के 24 घंटे के अन्दर शत प्रतिशत कीट मरणशीलता देखी गई।

- छः आइ पी एम अनुशंसित नये रायायनिक कीटनाशी लैम्डासाइहैलौथ्रिन, अल्फामेथ्रिन, इन्डोक्साकार्व, कार्बोसल्फान स्पाइनोसेड एवं फिप्रोनिल के साथ अनुशंसित इथोफेन प्रॉक्स को पलास पर लगाए गए वर्षा ऋतु (कतकी) के रंगीनी लाख की फसल पर लाख कीटो की सुरक्षा तथा लाख परभक्षियों पर विषाणुता संबंधी मूल्यांकन किया गया। लैम्डासाइहैलोथ्रिन को छोड़कर सभी छः कीटनाशियों का उच्च डोज लाख कीट की सुरक्षा की दृष्टि से आशाजनक पाया गया एवं लगातार दूसरे फसल में संपुष्टि परीक्षण मे लाख कीट परभक्षी की उपस्थिति को कम करने में प्रभावी रहा।

9. संपर्क, सूचना एवं परामर्श सेवाएं

- राष्ट्रीय स्तर पर लाख से संबंधिक सूचना एवं आंकड़ा संग्रह करने के लिए प्रयास किये गए है। वर्ष 2008–09 के दौरान यष्टि लाख का अनुमानित राष्ट्रीय उत्पादन लगभग 17,175 टन था। वर्ष 2007–08 के दौरान 27, 110 टन यष्टि लाख का प्रसंस्करण किया गया जिसमें भारत में आयात किया गया लाख भी शामिल है। लाख के प्रसंस्करण की दृष्टि से बंगाल का स्थान प्रथम (40.13%) तथा उसके बाद छत्तीसगढ़ (32.65%) झारखंड (21.01%), महाराष्ट्र (5.11%) एवं मध्य प्रदेश (1.09%) का स्थान रहा। वर्ष 2007–08 के दौरान लाख एवं इसके मूल्य वर्द्धित उत्पादों का कुल निर्यात 7,906.33 टन था जिसका मूल्य रु० 124.27 करोड़ था। इस अवधि मे विभिन्न प्रकार के लाख का कुल आयात 5797.22 टन था जिसका मूल्य रु० 34.62 करोड़ था।

- संस्थान ने पलामू, गुमला, लोहरदगा, गढ़वा एवं कोडरमा के पाँच कृषि विज्ञान केन्दों से संपर्क स्थापित किया तथा लाख की खेती आरम्भ करने के लिए 105 कि. गा. रंगीनी तथा 100 कि. ग्रा. कुसमी बीहनलाख प्रदान किया। पौध सुरक्षा संबधी उपायों के लिए आवश्यक सलाह भी दिये गए। फलेमिंजीया सेमियालता पर लाख की खेती के लिए नैट, बांकुरा को आवश्यक सलाह दिये गए। लाख रंजक एवं लाख आधारित वार्निशों की तैयारी से संबंधित समस्याओं के समाधान के लिए भी आवश्यक सलाह दिये गए। झारखंड, पश्चिम बंगाल एवं उड़ीसा राज्यों मे विभिन्न परिपालक पौधों पर लाख फसलों की जाँच की गई तथा परिपालक, फसल, नाशकजीव एवं रोगों के प्रबंधन के लिए आवश्यक सलाह दिये गए।

- संस्थान के अधिदेश से जुड़ी गतिविधियों से संबंधित सूचनाओं के प्रसार के लिए हिन्दी और अंग्रेजी में संस्थान से कई नियमित एवं तदर्थ प्रकाशन प्रकाशित किये गए।

EXECUTIVE SUMMARY

1. Insect Improvement

- A survey of selected areas in six districts of Eastern Uttar Pradesh were undertaken to know the availability of lac insects and status of lac cultivation. Lac insect populations were observed mainly on *pipal* (*Ficus religiosa*), *ber* (*Ziziphus mauritiana*), *pakur* (*F. luscence*) and *Putranjiva roxburghii.* Lac insects were collected from Agra for maintenance and evaluation at the Field Gene Bank of the Institute. More than 1000 lac cultures of 65 lines of lac insect which include 14 cultivated, 28 natural populations, 22 cross bred / inbred / selected, one exotic and six uncoded lines are being maintained live in the Field Gene Bank of National Lac Insect Germplasm Center (NATLIGEC) of the Institute on potted plants of *Flemingia macrophylla.*
- A recombinant lac insect population from Bankhedi showing *rangeeni* type life cycle pattern and *kusmi* type resin production with good survival on *kusum* and *ber* host plants has been collected from Bankhedi, Madhya Pradesh for further evaluation .
- Two new potential plant hosts *viz.*, *Calliandra calothyrsus* and *Dalbergia assamica* (= *szemaoensis*) have been identified for two lines of *Kerria chinensis*. Brood yield ratios of 25 and 6.7 were obtained during rainy season on these hosts with lac insect lines LIK031 and LIK023, respectively on one plant under field conditions of Institute Research Farm.
- Two *rangeeni* lac insect lines, one from Jhalda of Purulia district, West Bengal and another from Akhnoor of Jammu district (J&K) were evaluated on *ber* plants during rainy season. A very good input-output broodlac ratio of 20 (Jhaldah) and 18 (Akhnoor) was obtained from both the collections.
- Five *kusmi* lac insect stocks *viz.*, *kusmi* crimson early, *kusmi* yellow, *kusmi* crimson late and two productive breeds namely *Kulajanga* and *Nawadih* were evaluated for three years on *semialata* and *ber* for production of winter crop. For *F. semialata, kusmi* early stock, which matures in January - February performs better. While for *ber*, performance of *kusmi* late stocks (*Kulajanga, Nawadih, kusmi* yellow and *kusmi* crimson late) which mature in March - April were found more suitable.

2. Host Improvement

- A survey was undertaken in two districts each of West Bengal, Jharkhand, Madhya Pradesh and in one district of Rajasthan for collection of lac host plants. Twenty-two new collections were made from West Bengal, Jharkhand, Gujarat and Rajasthan belonging to six families and some high yielding plants of *kusum*, *ber* and *Ficus* have also been recorded. A new field plot of 0.25 ha has been developed for strengthening the field gene bank of lac hosts at the IRF. Twelve new collections to the existing 67 collections were added to field gene bank during the year. A collection of wild population of *Flemingia macrophylla* from Amarkantak, Madhya Pradesh has been

registered (IC No.-558405 from Zone No.9) at NBPGR, New Delhi.

- Genetic diversity of 35 collections of *Ziziphus* spp. including 26 fruit varieties, 6 geographic collections of *Z. mauritiana* as lac host and three different species (*Z. rotundifoila*, *Z. nummularia* and *Z. xylopyra*) were characterized through RAPD technique. Out of twenty RAPD primers screened, 11 primers were found satisfactory for characterization of *kusum* and 12 for *palas* accessions through RAPD.
- The height of *Flemingia semialata* selected for summer lac sustainability ranged between 88 cm to 205 cm with a mean of 146.45 ± 26.5, whereas those in control varied from 121 to 170 with a mean of 129.22 ± 26.7. The number of tillers per plant in selected progenies varied from 2 to 14 with a mean of 6.9 ± 2.6 whereas that in control varied from 3 to 10 with a mean of 5.1 ± 2.5. Plants will be ready for raising summer season *kusmi* lac crop from next year. Twenty-five *ber* plants including one high yielding plant in Putidih were screened out on the basis of their winter season *kusmi* lac yield and distinct plant characteristics for evaluation after clonal multiplication. These plants were characterized on the basis of their habit, shoot and leaf parameters.
- Thirty combinations of cytokinins and auxins were tried for *in vitro* axillary bud initiation in *kusum*. Two treatment combinations consisting of (i) BAP (1.0 mg/l) + NAA (0.05 mg/l) and (ii) BAP (1.0 mg/l) + Silver nitrate (1.0 mg/l) produced highest axillary bud break after 21 days. The mean number of axillary bud break observed was 5.0±1 for both the above treatments. The proliferated axillary buds were further sub-cultured on MS media with or without different PGR combinations, which resulted into foliage drops leading to death of almost all the explants. The problem was tackled by sub-culturing of freshly proliferated axillary buds on white filter paper bridge soaked in liquid MS media.

3. Crop Production

- Mulching and half moon terracing/half basin ring, in particular, showed significant superiority over other four treatments tried in terms of moisture conservation and consequently vegetative growth of the *ber* plants. The maximum harvested biomass of *ber* was recorded under mulching (22.9 q/ha) and the lowest in control (12.3 q/ha) with an increase of 86.1%. All the *ber* plants were pruned uniformly at 1.25 m height from the ground level maintaining a single stem during mid February. Plant height recorded seven months after pruning under mulching condition showed an increase of 51.9 cm (17.6 %) over control. An increase of 31.5% in absolute growth of basal girth was also recorded in mulching as against 23.9% in control.
- Three commercial lac hosts *palas*, *ber* and *kusum* and one potential host *Flemingia semialata* were surveyed for the occurrence of diseases. The major diseases recorded on *palas* were: leaf spots caused by *Xanthomonas butae* and *Phomopsis butae;* on *ber* - powdery mildew caused by *Erysiphe zizyphi* and sooty mould caused by *Cladosporium zizyphi.* Very low incidence of powdery mildew was observed on *kusum* at IRF and stem canker caused by *Botryosphaeria* sp was recorded with moderate intensity on *semialata*.
- Eight fungicide formulations were evaluated for management of sooty mould in summer crop on *kusum* and winter crop on *ber*. Carbendazim (0.2g/l) and hexaconazole (2.5 ml/lt) showed increased yield (brood / yield ratio) of 2.59 and 3.66, respectively in summer crop on *kusum*. Hexaconazole was the most effective fungicide in reducing the sooty mould growth in winter crop on *ber*. Results indicate that visit of ants to lac encrustation resulted in statistically significant reduction in sooty mould growth with and without application of fungicide on the winter crop raised on *ber*.
- Chlorophyll Content Index (CCI) was significantly affected due to liming in the month of August. An increase in CCI values to the tune of 18.1% was observed in treated trees as compared to untreated. Nitrogen application at 100 g/ tree significantly reduced

initial lac insect mortality by 5% as compared to control. Potassium application significantly increased male proportion (2%), which may be related to increased succulence.

- Five herbicides were evaluated for weed management in *semialata* and *ber* plantations. *Glyphosate* was found to be superior to all the tested herbicides with 80.51% and 77.54% weed control efficiency (WCE) at pre and post planting of *F. semialata,* respectively and similar results were also obtained in *ber* plantation. Application of herbicides in one-year-old *F. semialata* plantation, resulted in 2.56-18.38% mortality of the host plants. The highest host plant mortality was observed with *glyphosate / atrazine* treatment and least with weed free untreated, whereas 3.84% under unweeded condition. The study on microbial population in lac host plants rhizosphere indicated that all the herbicides had a depressive effect on the fungal population within 5 days of herbicide application and there was a population build-up thereafter. The highest depression of fungal population at 5 DAS was recorded with *glyphosate* ($0.5x10^{-6}$/g oven dry soil).
- Effect of herbicides (pre and post inoculation) on mortality of *kusmi* lac insect was studied on winter season (*aghani*) *kusmi* lac crop raised on *Flemingia semialata*. Lowest lac insect mortality was recorded with *glufosinate* (9.77%) followed by *glyphosate* (11.14%) while in control 11.79% mortality was observed which were statistically at par with each other. Study on weed flora of five lac host plantations (*ber*, *palas*, *kusum*, *bhalia* and *semialata*) were also carried out during rainy season and weeds were identified, categorized and their relative frequency was determined.
- A Lac- Integrated Farming System (LIFS) has been laid out in a suitable area of IRF. About 1.7 ha of land has been earmarked, which contains about 1.0 ha upland (*tanr*) and about 0.7 ha low/medium land (*doan*). The cropping systems have been chosen in the light of existing farmers' practices and interests as well as recommended varieties/ technologies. Food crops and vegetables: Rice (transplanted and upland); Maize, Ragi and Tuber crop (*kharif*); Niger, Barley and B. Gram (*rabi*); Vegetables (*zaid*); Fruit trees: Aonla, guava and citrus/papaya; Lac: *Ber*, *Palas*, *Kusum* and *F. semialata;* Fisheries: short-term, during monsoon. For lac-horticulture integration, lac host plants were introduced in the inter spaces of fruit trees, in a compatible mode. An area of 2500 sq. m. was taken for this purpose and the fruit trees and the lac hosts have been raised.

4. Synthesis and Product Development:

- The bio-active compounds thiosemicarbazide and its derivative 4-ethylphenyl thiosemicarbazide, 4-bromophenyl thiosemicarbazide and thiadiazole were synthesized from aleuritic acid, the major component acid of lac, following the sequential reaction steps which would be evaluated for their antifungal and antidiabatic activities.
- Extraction of exudates of *Boswellia serrata* obtained from Jabalpur, Madhya Pradesh and *Commiphora mukul* from Anjar, Gujarat with polar organic solvent (ethyl acetate) yielded 66% resin. It was a light brown coloured powder, soluble in alcohol. The product has melting point 108-110^{0}C, moisture per cent 0.7, ash per cent 0.42 and acid value 52.82.
- Gum *acacia* and gum *karaya* were purified and recrystallized for their modification and preparation of hydrogel, to be used in slow drug release system.

5. Surface Coating and Use Diversification

- Shellac was blended with rosin at melt temperature and their physico-chemical properties were studied. It was observed that flow (fluidity) and life under heat of blended compositions shellac and rosin increased to about 65% and 115% respectively to that of pure shellac. Over a period of four months, flow of shellac (pure) was decreased by 17% while 26% decrease was observed in case of shellac : rosin (70 : 30) blend.

- Shellac based dental plates have been prepared and tested by a private firm in Delhi. The quality has been assessed as very good. Study on quality during storage is under progress. The firm has expressed its desire for purchasing of technology.
- Water soluble lac varnishes were prepared using ammonia, morpholine, triethanolamine and borax and treated with urea as well as thio-urea. Addition of urea or thio-urea (3% on the wt. of shellac) was found to improve the film properties of all the varnishes except borax based.
- Preliminary measurements indicated that the adhesive properties of karaya gum and gum ghatti were better as compared to babul gum, khair gum, tamarind gum and salai gum (gum component of oleo-gum-resin). Also karaya gum at 65% R.H. showed comparatively high moisture content and loss on drying. Wide angle x-ray diffractograms of the gums showed halos around 20~40^0 indicating their amorphous structure. The dielectric strength (breakdown voltage) values of the gums were lower than that of shellac.

6. Processing and Storage

- A centrifugal drier of 10 kg/batch capacity has been designed and fabricated and tested for its suitability to fit in the package of machines of Small Scale Lac Processing Unit (100 kg/day). The drier was able to bring moisture content from 35% to 10% in 2 minutes at 570 rpm drum speed.
- Quality parameters of sticklac, seedlac and shellac samples stored under different methods and conditions were evaluated during storage up to one year. Results indicated that in case of sticklac, hot and cold alcohol insolubles were higher in samples stored in plastic bags and on earthen floor. Very little difference in the value of flow was observed between different methods of storage. Better life and colour were observed in sticklac stored on earthen floor. Seedlac stored on cemented floor retained maximum properties after one year of storage. Storage in metal container resulted in maximum loss in properties. In case of shellac, flow and life of samples stored under cold storage and inside gunny bags (with cotton lining) were found slightly higher than other samples after one year of storage.
- Aleuritic acid (technical grade) was successfully produced in the pilot plant of aleuritic acid with a yield of approximately 19 % of the weight of seedlac. The melting point and acid value of aleuritic acid was found to be 92-93^{o}C and 178.6, respectively and it's purity was around 96.5% (based on acid value)
- Pilot plant for preparation of pure lac dye has been completed and a trial run of the pilot plant has been carried out taking 200 kg *kusmi* sticklac and 430g of technical grade lac dye (0.21% on the wt. of sticklac). The dye is soluble in Dimethyl formamide (DMF). Its ash content is 0.87%;volatile matter at 130^{0}C is 11.37%; dye content is 87%, solubility in water at 35^{0}C is 0.13g/100g water; melting point 238^{0}C with charring and absorption maxima is at 291.2 and 489 nm in water.

7. HRD for Capacity building in Lac production, Processing and Value addition

- The Institute conducted regular training programmes for the farmers and the housewives, one day orientation programme, on-farm training, field educational and motivational training, trainer's training and field level demonstrations. Over ten thousand persons have been benefited under the various training activities conducted by the Institute.
- Thirty two training cources on *Scientific lac production, processing and uses* of one week duration were organized for 1186 farmers, extension cadre and NGO staff of Jharkhand, Chhattisgarh, Orissa, Madhya Pradesh, West Bengal, Andhra Pradesh and Maharashtra.
- Five educational programmes for B.Sc. (Ag) students and two trainer's training programmes for Ag Extension Officers on *Scientific lac production, processing and uses* of one week duration were organized for 130 beneficiaries.

- Ten lac based product technology were transferred to entrepreneurs from Mumbai, Kolkata, Sikohabad, Raipur and Wardha.
- Fifty three On-farm training camps, 45 On-farm motivational / supplementary camps, 14 In-campus orientation programmes were conducted for the farmers and housewives of Jharkhand, Chhattisgarh, Orissa, Madhya Pradesh, Gujarat, Andhra Pradesh and Maharashtra.
- Under the scheme of enhancing livelihood options for tribal families of the Jharkhand, one-week training has been conducted in one batch for 9 extension cadres sponsored by different NGOs and 22 on-farm trainings have been organised for 1995 beneficiaries. A field demonstration for winter *kusmi* lac cultivation was arranged on 1200 *semialata* plants in Kharsidag village, in collaboration with NGO (SEEDS). Field demonstrations of three productive *kusmi* breeds was done for winter crop raised on *ber* at Mangobandh village of Ranchi district through SEEDS and Gutwa village of Khunti district through NGO (PRADAN).
- The project on 'skill development and capacity building in lac culture through training and demonstration in Gujarat' has been completed. The significant contributions include: technology refinement for *kusmi* lac cultivation on *Ziziphus mauritiana* (*ber, bordi*) in Gujarat and *kusmi* lac cultivation on *Prosopis juliflora* (*ganda babul);* lac host resource development in the Forest Department for brood lac production and demonstration, establishment of training facility, successful field demonstrations of *kusmi* lac production, HRD on lac cultivation to 73 forest officers and more than 500 farmers through 13 training camps.

8. Technology Assessment, Refinement and Dissemination

- For the management of neuropteran predator, *Chrysopa lacciperda* of lac insect, a laboratory bioassay of seven insecticides was carried out by direct application and by exposing the insect on residual film of insecticides. Direct application of lambdacyhalothrin (0.005 and 0.008%), alphamethrin (0.005 and 0.01%), indoxacarb (0.02%), carbosulfan (0.03%), spinosad (0.01 and 0.02%), fipronil (0.005 and 0.01%) and ethofenprox (0.02%) exerted cent per cent mortality of *C. lacciperda* within 24 hrs of treatment. Carbosulfan and spinosad were found to be equally effective as direct application and exposure on residual film of insecticides.
- For the management of pentatomid bug *Tessaratoma javanica* – a pest of *kusum* tree, laboratory bioassay was carried out to evaluate eight insecticides by topical application of insecticides. Application of carbosulfan (0.02 and 0.03%), indoxacarb (0.01 and 0.02%), spinosad (0.01 and 0.02%), lambdacyhalothrin (0.005 and 0.008%), alphamethrin (0.005 and 0.01%) and endosulfan (0.05%) were found to be very effective and resulted into cent per cent insect mortality within 24 hrs of treatment.
- Six IPM recommended newer chemical insecticides *viz.*, lambdacyhalothrin, alphamethrin, indoxacarb, carbosulfan spinosad and fipronil along with recommended ethofenprox, were evaluated for their safety to lac insect and toxicity to predators of lac insect on *rangeeni* rainy season (*katki*) lac crop raised on *palas*. All the six chemical insecticides except lambdacyhalothrin at higher dose were found to be promising as far as safety to lac insect is concerned and effective in reducing the incidence of lac insect predators for the second consecutive crop season also in confirmatory trials.

9. Liaison, Information and Advisory Services

- Efforts have been made at national level for collection of lac related information and data. The estimated national production of sticklac during 2008-09 was approximately 17,175 tons. Total amount of sticklac processed during 2007-08 was 27,110 tons which also included the imported lac in India. In processing of lac West Bengal ranked 1st (40.13 %) followed by Chhattisgarh (32.65

%), Jharkhand (21.01 %), Maharashtra (5.11 %) and Madhya Pradesh (1.09 %). The total export of lac and its value added products during the year 2007-08 was 7,906.33 tons valued at Rs.124.27 crores. The total import of different kind of lac during the year 2007-08 was 5797.22 tons valued Rs.34.62 crores.

- The Institute has established linkages with five KVKs *viz.*, Palamau, Gumla, Lohardaga, Garhwa and Koderma facilitated 105 kg rangeeni and 100 kg *kusmi* broodlac for initiating lac cultivation. Necessary advice has been given for taking plant protection measures. Necessary advice has also been provided to an NAT lac cultivation on *Flemingia semialata* bushes. Necessary advise was provided for the solution of problems related to preparation of lac dye and lac based varnishes. Monitoring of lac crop on different host plants were carried out in the states of Jharkhand, West Bengal and Orissa and necessary advice related to host, crop, pest and disease management were provided.
- Institute brought out several regular and *ad-hoc* publications, both in English and Hindi, to disseminate information on the Institute's mandated activities.

IINRG : AN INTRODUCTION

Historical Development

Lac, a natural resin, is a Non-Timber Forest Produce is cultivated and collected by tribals inhabiting the sub-hilly tracts of Jharkhand, Chhattisgarh, West Bengal, Madhya Pradesh, Maharashtra, Orissa and Uttar Pradesh. Before the advent of synthetic plastics and resins, lac was invaluable in moulding and insulating industries, and India, then under British rule, had an unparalleled global monopoly over the lac trade. Realising the strategic importance of this commodity, the then Imperial Government of India constituted the *Lindsay-Harlow Committee* in 1920, to look into all aspects of the country's lac trade and its development. On the suggestions of this Committee, lac merchants organized themselves into the *Indian Lac Association for Research*, under the aegis of which, the foundation stone of the Indian Lac Research Institute was laid on September 20, 1924 at Ranchi.

Initially, the Institute consisted of an Entomological Section as the principal unit supported by a Biochemical Section which started functioning from 1925. Then, in 1927, a Physico-chemical Section was added to take up applied research. Later, these two chemical sections were combined to form a Chemical Division. The scope of this Institute was thus, widened to cover both the entomological and chemical aspects. Subsequently, on the recommendations of the *Royal Commission on Agriculture*, the *Indian Lac Cess Committee* was constituted, which took over the reigns of the Indian Lac Research Institute in 1931. The ILCC also organized and maintained the (1) *London Shellac Research Bureau, UK* and (2) *Shellac Research Bureau, Polytechnique Institute of Brooklyn, USA*. As a result of reorganization of agricultural research and education within the country, the ICAR took over the administrative control of the ILRI from April 1966. This Institute is thus, one of the oldest, within the ICAR system, having completed more than 84 years of fruitful service to the Nation. It has immensely contributed towards all round development of lac besides maintaining India's leadership in production, installed processing capacity and export. The Governing Body of ICAR Society in its 206th meeting held on 19.3.2007 have approved revised mandate and new name of the Institute as ***Indian Institute of Natural Resins and Gums*** with effect from September 20, 2007.

A Unique Institute

The IINRG is unique and only one of its kind in the world, being devoted exclusively to all aspects of lac cultivation, processing and utilization. It employs a multidisciplinary approach of researches, encompassing all areas related to lac production, refinement and utilization. The areas covered include lac insects and their biota; their host plants (both trees and bushy species); lac insect and host management; refinement/isolation of commercially important products from raw lac; lac based product diversification and other areas such as economics, marketing etc. It has the world's richest and the oldest books and literature on lac, a well-organized lac museum depicting all aspects of lac and a collection of a wide range of lac host plants and lac insects collected from different parts of the country.

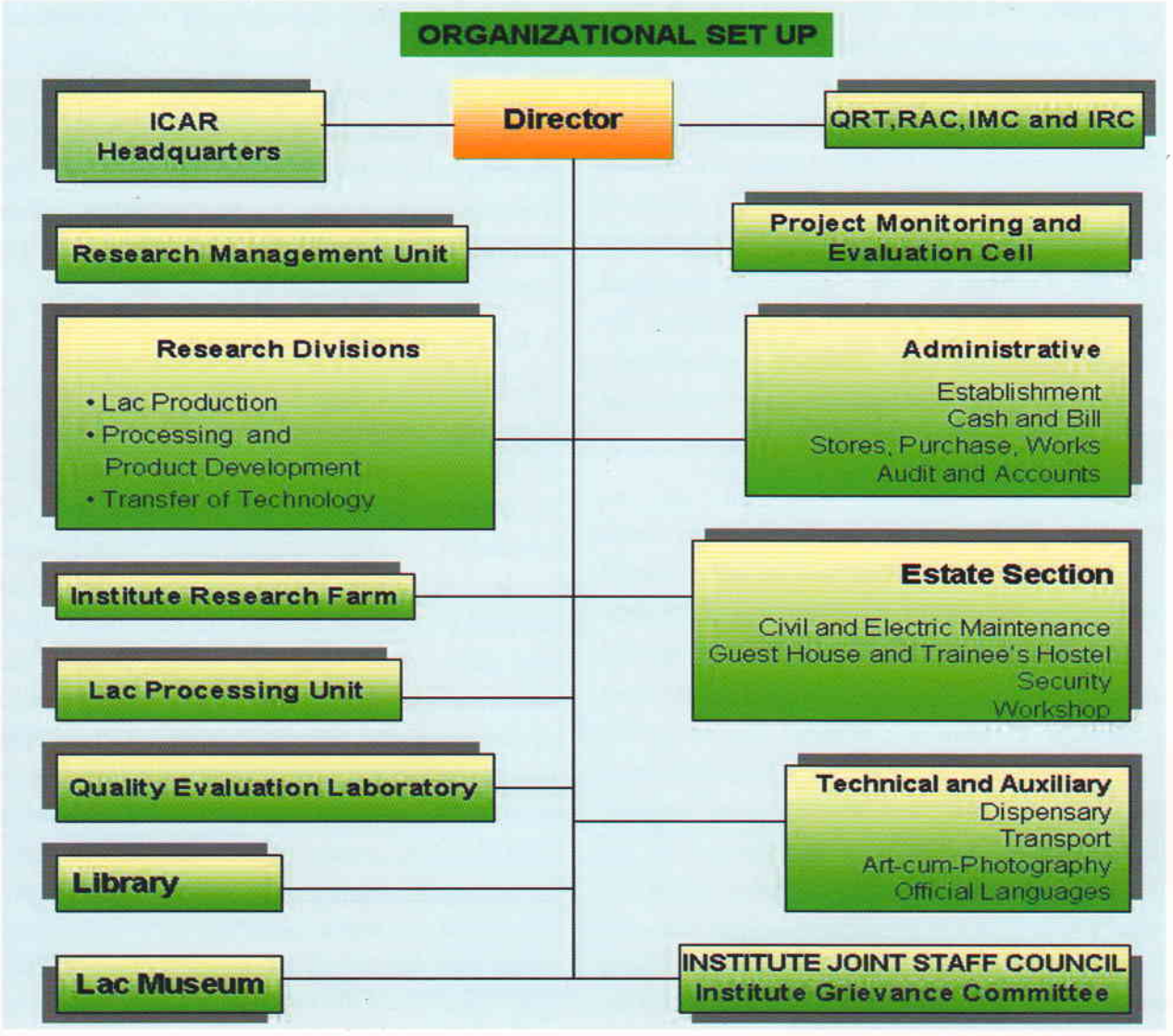
Location and Agro-Climate

The Institute is located 9 km. south-east of Ranchi city, on the Ranchi – Jamshedpur highway NH 33, at an altitude of 650 m above mean sea level, 23°23' N latitude and 85°23' E longitude. The soil status of the Institute indicates advance weathering on granitic genesis. The soil of the experimental farm is of lateritic type. The area experiences mild, salubrious climate with a rather heavy rainfall pattern of about 1400 mm average, of which about 1250 mm is during the monsoon. During the year highest mean maximum temperature (39.9°C) was observed in the month of April and the lowest mean minimum temperature (8.7°C) during January. May 1st and December 1st were recorded as the hottest and the coldest day of the year with a temperature of 42.5° C and 2.2° C, respectively. The total rainfall during the period was 1477.8 mm of which the monsoon rainfall was 1386.6 mm which is nearly 98.3% of the total yearly rainfall.

Present Status

Organizational Structure

The IINRG has responded to the globalization of industries and agricultural enterprises of the country as well as functional reorganization of ICAR. The Institute also has undergone structural changes and the priorities have been redefined. In 1995-96, the erstwhile Divisions and Sections were abolished and the scientific manpower divided into three divisions, *viz.*, Lac Production, Processing and Product Development, and Transfer of Technology. The Institute is headed by a Director.



Staff

Institute has a sanctioned strength of 1 RMP, **46** scientific, 62 technical, 36 administrative and 89 supporting grade with Total of **234** sanctioned posts, out of which 30 scientific including RMP, 57 technical, 29 administrative and 72 supporting posts with Total of **188** staff are in position.

Infrastructure

Manned by a strong band of dedicated scientists from various disciplines including entomology, plant sciences, organic chemistry, physics, engineering, bio-technology, etc., the Institute has about 188 staff in scientific, technical, administrative and supporting categories. The Institute has several prestigious labs, *viz.,* High Voltage Laboratory, Biotechnology, Bio-control Laboratory, Instrument Laboratory, Quality Evaluation Laboratory etc. Besides these, the DTP and publications facilities are also available. A number of modern and sophisticated laboratory equipment, including DSC, FT-IR, Insect Activity Meter, Environmental Growth Chamber etc. are available for research on all aspects of lac production, processing and product development. There are several well-organized and equipped service sections to support research management of the Institute. The administrative wing comprises of Director's Office, Administrative Section, Finance and Accounts Section, Purchase and Central Stores. The following sections provide the technical support: Library, Research Management Unit, Institute Research Farm and Maintenance and Workshop Unit. The Auxiliary units are: Hindi Cell, Security, Medical and Estate Maintenance services.

The Institute Research Farms are spread over in an area of 36 ha has all conventional and cultivated lac host plants. The Institute is responsible for the collection and maintenance of germplasm of lac insect lines as well as lac host trees. Presently, the IINRG is maintaining more than sixty five lines of the lac insect, which include collection from different parts of the country, inbred and crossbred lines. Similarly, the Institute Research Farm has 1540 host trees of S. *oleosa (kusum),* 2480 trees of *B. manasperma (palas),* 1351 Z. *mauritiana (ber)* and 8695 minor host plants. The field gene bank of the Institute has 16 genera and 33 species covering tree, medium and bushy type of lac host plants. The collection include 6 species of *Ficus*, 4 species each of *Acacia* and *Albizia*, 3 each of *Flemingia* and *Zizyphus*, 2 each of *Prosopis* and *Dalbergia* along with each of *Cajanus*, *Croton*, *Desmodium*, *Garuga*, *Pithecolobium* and *Peltoforum*. Altogether 64 collections collected from different agro - climatic regions for 33 species of lac hosts have been planted in the field gene bank.

The IINRG Library has holdings of more than 30,000 volumes of scientific journals, 2000 rare books, including back volumes of research periodicals in the field of lac and surface coatings. Since the holdings of back volumes of certain journals date back to *circa* 1760, the library has been catering to the document supply services of INSDOC, New Delhi. Besides catering to the scientists and staff of the Institute, the library also attracts researchers of neighboring educational and research institutions, including BIT, RU, BAU and HARP, Ranchi, IIT, Kharagpur, RAU, Samastipur, PU, Patna, NIT, Jamshedpur etc.

The Quality Evaluation Laboratory of the Institute has recently been accredited ISO 9001 : 2000 and it caters to the quality control needs of the lac processing / lac product industries as well as exporters of lac / lac products. The QEL analyses, on an average, about 150 samples per annum. The lab has facilities for carrying out testing of lac / lac products as per BIS requirements.

The Research Management Unit (RMU) provides the Scientists, access to Internet and e-mail facilities for communication and information retrieval. The Institute website is a valuable source of information on IINRG as well as lac.

The Institute has attained international recognition for its contribution in cultivation and utilization aspects of lac.

Budget

During 2008-09, the non-plan expenditure was Rs. 699.65 lakhs, against a revised estimate of Rs. 701.20 lakhs; the plan expenditure was Rs. 199.98 lakhs against a revised estimate of Rs. 200.00 lakhs. The detailed figures are shown in the table given below.

Budget during 2008-09

(Rs. in lakhs)

SI. No.	Head	Plan		Non- Plan	
		R. E. 07-08	Expr.	R. E. 07-08	Expr.
I.	Establishment charges	00.00	00.00	590.00	589.02
2.	Wages	00.00	00.00	00.00	00.00
3.	O.T.A.	00.00	00.00	00.20	00.18
4.	Traveling allowances	05.50	05.49	03.00	02.99
5.	H.R.D.	01.50	01.49	00.00	00.00
6.	Other charges	98.00	97.98	70.00	69.44
	Equipments	00.00	00.00	00.00	00.00
	Furniture & Fixure	00.00	00.00	00.00	00.00
7.	O/C Information Technology	00.00	00.00	00.00	00.00
8.	Works	85.00	84.99	00.00	00.00
	Special Repairs: (a) Office	00.00	00.00	00.00	00.00
	(b) Office building	00.00	00.00	38.00	37.99
	(c) Residential building	00.00	00.00	00.00	00.00
	(c) Minor works	00.00	00.00	00.00	00.00
	(d) Major work (Plan)	00.00	00.00	00.00	00.00
9.	Other items: Publicity (Library)	10.00	09.99	00.00	00.00
	TOTAL	**200.00**	**199.98**	**701.20**	**699.65**
(B)	Loans & Advances	04.00	03.96	00.00	00.00
(C)	Pensions	80.00	79.96	00.00	00.00
(D)	Revenue Generation target	38.00	Revenue Receipt Generate		33.68
	Net work Project (Plan)	100.00	99.99	00.00	00.00
	IPR	04.50	00.57	00.00	00.00

Revenue Generation

During the period under report, a sum of Rs. 33.68 lakhs was earned as revenue, through different programmes of various divisions and sections of the Institute.

RESEARCH ACCOMPLISHMENTS

Lac Production

1.1. Insect improvement

1.1.1 Collection, conservation, characterization and documentation of lac insect biodiversity

A. Survey of Western Uttar Pradesh for collection of lac insects

Extensive survey of selected areas in six districts of Eastern Uttar Pradesh *viz.* Kanpur, Lucknow, Shahjahanpur, Agra, Mathura Meerut and of New Delhi was done during November 2–13, 2008 for availability of lac insects and their host plants. Though, lac insects were observed at all the places visited except Shahjahanpur, but frequency of occurrence of lac insects in nature was very low. Lac insects were observed mainly on *pipal* (*Ficus religiosa*), *ber* (*Ziziphus mauritiana*) and *pakur* (*F. luscence*). Lac was also seen on *Putranjiva roxburghii* (Fig.1) and *Ficus benjamina* (Fig. 2) for the first time during the surveys undertaken, although both of these are known hosts. At most of the visited places lac cultures were either in advanced stage of emergence or the larvae had already emerged (Table 1). Lac insect was collected from Agra for maintenance and evaluation at the Field Gene Bank of National Lac Insect Germplasm Centre (NATLIGEC) of the Institute. Dead lac cultures were also collected from all other places for preservation.

Fig. 1. Lac on Putranjiva roxburghii in Kanpur

Table 1. Occurrence of natural lac insect population at different places in Eastern Uttar Pradesh

Place	Lac insect stage	Host plant
Kanpur	Freshly settled lac larvae, crimson	*Ber, Pakur, Pipal, Putranjiva roxburghii*
Lucknow	Freshly settled lac larvae, crimson	*Pipal*
Shahjahanpur	Lac insect was not observed	-
Agra	Emerging lac insect, crimson and yellow	*Ber, Pakur, Pipal, Ficus benjamina*
Mathura	Freshly settled lac larvae, crimson	*Pipal*
Meerut	Freshly settled lac larvae, crimson	*Pipal*
Delhi	Freshly settled lac larvae, crimson	*Pipal*

Fig. 2. Lac on Ficus benjamina in Agra

New recombinant population of Kerria lacca

A new recombinant population of *Kerria lacca* has been discovered from Bankhedi Block of Hosangabad district in Madhya Pradesh. It follows *rangeeni* life cycle of 4 + 8 months and productivity similar to *kusmi* with survival on *kusum* (*Schleichera oleosa*). This population showed a similar behaviour at Tajpur in Gujarat during the rainy season crop (July-Nov). The yield ratio (brood obtained/ brood used) on ten *ber* trees ranged between 12-21. The yield of sticklac/meter shoot length was found to be 110g in 123 days as compared to 30-40g sticklac/meter on *ber* by the *rangeeni* strain and 120-130 in 180-200 days in case of *kusmi* strain of lac insect.

B. Evaluation of lac insects

New potential hosts identified for Kerria chinensis

Two new potential plant hosts *viz.*, *Calliandra calothyrsus* (Fig. 3) and *Dalbergia assamica* (= *szemaoensis*) (Fig. 4) have been identified for *Kerria chinensis*. Summer season crop was satisfactory whereas rainy season crop has given very good results and 2.5 kg broodlac was harvested by inoculating100 g of broodlac (LIK031) from *C. calothyrsus*. While about 1.0 kg broodlac was harvested from *D. assamica* by inoculating 150 g of broodlac (LIK023) during rainy season crop at Institute Research Farm (IRF).

Fig. 3. K. chinensis (LIK031) on C. calothyrsus at IRF

Fig. 4. K. chinensis (LIK023) on D. assamica at IRF

Evaluation of five lac insect lines

Five lac insect stocks collected from Maharashtra (Ahmednagar and Aurangabad) and West Bengal (Bankura, Midnapore and Purulia) have been multiplied in sufficient quantity on *Flemingia macrophylla.* These stocks are being evaluated for economic parameters. Five cultures of each stock have been raised on *F. macrophylla* during October-November for evaluation. Observations on density of settlement and initial mortality have been recorded after 21 days of inoculation. The initial mortality varied between 12-15% among the stocks and did not show significant difference. The density of settlement varied among the stocks. Bankura stock showing higher (90/sq. cm.) settlement density compared to other Midnapore (71) and Purulia (75) stocks from West Bengal. The settlement density of Ahmednagar and Aurangabad (Mahrashtra) was similar to that of Bankura stock (93 and 86, respectively).

Yellow trivoltine insect developed through cross breeding of *kusmi* yellow bivoltine and crimson trivoltine insect has been multiplied on *ber* in the field during rainy season (Fig. 5). The harvested crop has been inoculated on *ber* and *kusum* in the field and is progressing well.

Fig. 5. Yellow trivoltine lac culture on ber at IRF.

C. Maintenance and conservation of lac insects in National Lac Insect Germplasm Center

More than 1000 lac cultures of 65 lines of lac insect which include 14 cultivated, 28 natural populations, 22 cross bred / inbred / selected, one exotic and six uncoded lines are being maintained live in the Field Gene Bank of National Lac Insect Germplasm Center (NATLIGEC) of the institute on potted plants of *Flemingia macrophylla* (Fig 6). One new lac insect stock collected from Agra, Uttar Pradesh during November, 2008 has been added to the Field Gene Bank.

A survey was made in various places of Rajasthan *i.e.*, Tabiji, Jawaja, Bewar, Kekri, Sarwar, Ajmer and Pushkar during July 2008 to collect wild populations of *rangeeni* lac insect for mass multiplication and evaluation at IRF, Namkum, Ranchi. Lac insect was recorded in all locations but their frequency varied among the places surveyed and the host species. The infested host species were *Ficus religiosa* (*pipal*), *F. bengalensis* (*bargad*) and *Zizyphus mauritiana* (*ber*). At some of the places, like Ajmer and Pushkar lac insects were more abundant, especially on *pipal* trees. Some *F. bengalensis* trees in Pushkar were found heavily infested with lac insects having very thick encrustation (Fig. 7a). Few *ber* trees were also found moderately infested at Ajmer and the population comprised of yellow mutants (Fig. 7b). Very low occurrence of crimson lac was observed in all these places on all host species. Survival of lac insects and thickness of encrustation at these places and the preference of host plant during summer cycle (*baisakhi*), could be rated in order as *F. bengalensis* > *F. religiosa* > *Z. mauritiana*. The most interesting observation was the survival of lac insects on *Z. mauritiana* (though sparse). The observation indicated that better survival of yellow insects in hot areas as compared to crimson, which might be due to their suitability in hot climate and gene flow in this direction. Sufficient quantity (5.7 kg) of broodlac were collected and brought to the institute for further multiplication and evaluation.

Fig. 6. Conservation of lac insect germplasm in Field Gene Bank of National Lac Insect Germplasm Center of the Institute

A booklet entitled 'Descriptors of lac insects with special reference to *Kerria* spp.' has been published, which contains descriptors on accession and collection, lac culture management, collection and evaluation site, taxonomic and insect performance.

1.1.2 Field evaluation of promising lac insect races, lines and breeds for higher productivity and superior performance

Field collection of wild population of* rangeeni *lac insects from hot area

Fig. 7. Lac insect populations collected from Ajmer, Rajasthan a) bargad b) ber trees

Field multiplication of potential rangeeni lac insect lines/races

Three potential *rangeeni* lac insects, one race from Gujarat, a crossbred line of Rajasthan and a wild population from Jammu, showing good survival during rainy season 2007 were inoculated on *palas* trees to raise summer season lac crop during 2007-08. The crop progressed well till January 2008, thereafter mortality of lac crop started, leading to complete mortality by the end of February 2008, resulted in total crop failure.

Broodlac collected from Rajasthan were inoculated on various host trees to raise rainy season (*katki,* 08) crop, which yielded 12.7 kg against 5.5 kg of broodlac (Table 2). Besides, performance of rainy season *rangeeni* lac insects originated from Kanker and Local (lac insect at IRF survived during summer 2007-08) was also multiplied and their yield potential is given in Table 2. Some earlier collections from Rajasthan and Maharashtra (maintained in Field Gene Bank) were also multiplied on *ber* during rainy season in the field and about 5.6 kg broodlac were harvested against 0.5 kg broodlac from Rajasthan strain whereas, similar broodlac yielded 3.9 kg in case of Maharashtra strain. All these lines have been further re-inoculated on different hosts to raise summer season (*baisakhi*) crop 2008-09. One additional line of Putidih has also being raised side by side.

Comparative field performance of two rangeeni lac insect stocks at Jammu on ber plant

Two *rangeeni* lac insect lines one from Jhalda of district Purulia (West Bengal) and another from Akhnoor of district Jammu (J&K) were inoculated on *ber* plants, to raise rainy season crop. Each plant was inoculated with 0.5 kg broodlac, a very good ratio of broodlac used and broodlac harvested was a tune to 1:20 and 1: 18 for Jhalda and Akhnoor, respectively (Figure 8). 40 *palas* trees with Jhalda and 10 *palas* trees with local population of Jammu lac insects have been further re-inoculated to raise summer season (*baisakhi*) crop 2008-09.

Fig. 8. Rainy season rangeeni lac crop on ber trees at Jammu

Screening of lac insect germplasm on *Ziziphus mauritiana* (*ber*) and *Flemingia semialata* for improved productivity

Five *kusmi* lac insect stocks *viz*., *kusmi* crimson early, *kusmi* yellow, *kusmi* crimson late and two productive breeds namely *Kulajanga* and *Nawadih* were evaluated for three years on *semialata* and *ber*, the results of which have been presented in the previous Annual Reports. The following are the recommendations of the study:

For *F. semialata,* during winter season, *kusmi* early stock, which matures in January-February performs better. As the crop matures early, lac

Table 2. Performance of *rangeeni* lac insect population during rainy season *(katki)* lac crop 2008.

Source/Place of broodlac	Broodlac used	Host source of broodlac	Quantity of broodlac inoculated per plant, host(s)	Date of inoculation	No. of plant (s) inoculated	Date of harvesting	Broodlac produced (Input: output)	Remarks
Kanker, Chhattisgarh	6.00 kg	*Palas*	1.5 kg, *Ber*	8.7.08	2	31.10.08	12 kg (1:4.0)	1- *ber* and 9-*palas* tree(s) inoculated, 5 kg broodlac form *ber* and 1.5 kg broodlac form *palas* given to Mr. Anees & 1.5 kg sent to Jammu for experiment. 10 potted plants
			0.3 kg, *Palas*	8.7.08	10 (Medium size tree)	30.10.08	9.5 kg (1:3.2)	
Ajmer, Rajasthan	5.5 kg	*Ficus bengalensis* & *F. religiosa*	(1.5 kg x 2) & (2.0 kg x 1), *Ber*	10.7.08	3 (Big tree)	30.10.08	8.5 kg + 4 kg rejected, (1:2.5)	2- self, 1- *ber* inoculated, 7- *palas* trees
			0.3 kg, *Palas*	10.7.08	1 (Medium size tree)	No harvesting	Nil	Crop failed
			Bhalia (potted condition)	10.7.08	10	29.10.08	50 gm	10- potted *bhalia* plants
			20g, *Khair*	10.7.08	1	29.10.08	190 gm (1:9.5)	2- *ber* plants
Local (IRF)	20 cells	*Palas* (Surviving cell of *baishaki* 2007-08)	*Bhalia* (potted condition)	3.07.08	10	18.10.08	300 gm	4- small *palas* trees, 10- potted *bhalia* plants
Rajasthan (LIK 011) From Gene Bank)	0.5 kg	*Bhalia*	*Ber*	24.06.08	1	13.10.08	4.1 kg + 1.5 kg rejected (1:11)	4- *palas*
	20 cell		*Bhalia* (potted condition)	24.06.08	10	13.10.08	150 gm	15- potted plant
Maharashtra (LIK 0018 From Gene Bank)	0.5 kg	*Bhalia*	*Ber*	24.06.08	1	13.10.08	2.7 kg + 1.2 kg rejected (1:8)	2- *palas*

encrustation does not detach from the stem as is the case in late maturing varieties affecting quantity and quality of the broodlac produced.

While for *ber*, performance of *kusmi* late stocks (*Kulajanga, Nawadih, kusmi* yellow and *kusmi* crimson late) which mature in March / April are better, for the winter crop.

Initial settlement on *F. semialata* should not be more than 35% of the available shoot length.

Irrigation is required at least at one month interval from November onwards for getting good quality broodlac.

Analysis of data shows that continuous cultivation of *kusmi* lac especially of early maturing variety adversely affects the shooting response of the plants by i) drying up of pruned twigs, ii) delay in appearance of new shoots, iii) decrease in number of shoots and iv) stunted growth of the shoots (Fig. 9).

Fig. 9. Reduced pruning response of ber after continuous cultivation of kusmi lac

1. 2 Host Improvement

1.2.1 Collection, conservation, characterization and documentation of lac host biodiversity

Survey and collections of lac hosts

A survey was undertaken in two districts each of West Bengal, Jharkhand and Madhya Pradesh and in one district of Rajsthan for collection of lac host plants. One plant of *kusum* has been identified having 22.5 m height and 4.5m girth with potential of 5 q brood lac yield at Bankhedi (Hosangabad, Madhya Pradesh) and other at Otoda (Bandgaon, Jharkhand). Trees of *ber* in Gosaidih, Purulia and Jhalda of West Bengal have also been identified with broodlac yield potential of 50 kg.

An elite plant of *Ficus semicordata* has been identified as a host plant of *kusmi* strain of lac insect from Hesalejara, Angarha, Ranchi. Lac crop raised on this host plant was *at par* with that of *kusum*, the commercial lac host plant for *kusmi* lac cultivation.

Adansonia digitata, a host of exotic origin and seedlings of *palas* (white / yellow flower) has been collected from Himmat Nagar, Banaskanta, Gujarat.

Twenty-two new collections were made from West Bengal, Jharkhand, Gujarat and Rajasthan belonging to six families namely Papilionaceae, Urticaceae, Burseraceae, Malvaceae, Rhamnaceae and Sapindaceae. Out of which, six collections were from Jharkhand, eight from West Bengal, three from Gujarat, two from Rajsthan and three collections from Madhya Pradesh (Table 3). All these collections were brought for the further establishment and multiplication in the IRF, Namkum, Ranchi for evaluation studies.

Table 3. Details of collections of lac host plants made from different States.

Name of the plant	No. of collection	Type of plant material	Family of the host plant material	Location
Cajanus cajan	1	Seed	Papilionaceae	Bano, Jharkhand
Zizyphus mauritiana	7	Seed, bud,	Rhamnaceae	Bhawnagar, Gujarat; Gosaidih, Purulia and Rangamatya, Bankura, West Bengal
Ficus religiosa	3	Stem cuttings	Urticaceae	Hesalejara, Angarah, Palkot, Gumla, Jharkhand Ramganj area Ajmer , Rajasthan
Ficus bengalensis	1	Cuttings-30	Urticaceae	Akashardham Road, Ajmer , Rajasthan
Ficus semicordta	1	Seedlings	Urticaceae	Otoda, Bandgaon, West Chaibasa, Jharkhand
Butea monosperma (white flower)	3	Sucker; Seed	Papilionaceae	Himmatnagar, Sawarkanta, Gujarat; Morkucchu, Koderma, Jharkhand,
Butea monosperma (good lac yielder)	2	Suckers		Bankhedi,Hosangabad, Barghat, Balaghat, Madhya Pradesh; Rangamatya, Hirabandh, Bankura, West Bengal
Adansonia digitata	1	Seedling	Malvaceae	Himmat Nagar, Sabarkanta, Gujarat.
Schleichera oleosa	2	Seed/ Seedling	Sapindaceae	Bankhedi, Hosangabad, Madhya Pradesh, Katidiri, Bandgaon, West Chaibasa
Garuga pinnata (kondeyore)	1	Seed	Burseraceae	Thickpani, Simdega, Jharkhand

Conservation: Enrichment of field gene bank of lac hosts

Field gene bank of lac hosts at the IRF has been strengthened. A new field plot (plot no. 70B) of 0.25ha was developed for this purpose. Twelve collections were added to field gene bank during the year, to the existing 67 collections, as per details given in Table 4.

A collection of wild population of *Flemingia macrophylla* from Amarkantak, Madhya Pradesh has been registered (IC No.-558405 from Zone No.9) at NBPGR, New Delhi. Plants of the old collection of *F. macrophylla* and Amarkantak has been raised in a field plot for comparative evaluation. Fifteen plants of *arhar*, *Cajanus*

Table 4. Germplasm collections added to lac host gene bank during 2008.

Sl. No.	Host plant	No. of collections	Place of collection	Distinct character
Plot No. 70				
1.	*Kusum*	1	Malegaon, Gujarat	High fruit yielding, Narrow smaller leaves
2	*Palas*	1	Himmatnagar, Sabarkanta, Gujarat	Light yellow colour flower
Plot No. 70B				
4.	*F. benjamina* (Monk yellow)	1	-do-	Yellow leaves
5.	*F. panda*	1	-do-	Yellowish leathery leaves
6.	*F. nuda (= neveta)*	1	-do-	Whitish mixed yellow blotches leaves
7.	*F. benjamina starlite*	1	-do-	Whitish - green blotches on leaves.
8.	*F. benjamina variegata*	1	-do-	Green mixed with light yellowish coloured leaves
9.	*Ficus lacor*	1	Ghatsila, Jharkhand	Good *rangeeni* lac bearing
10.	*Ficus religiosa*	1	Palkot, Gumla, Jharkhand	Good *rangeeni* lac bearing
11.	*Albizia lebbek*	1	Belgahana , Korba, Chhattisgarh	Good lac bearing
12.	*Adansonia digitata*	1	Himmatnagar, Banaskanta, Gujarat	Lac bearing (including stalk of the fruit)

cajan, collected from Amarkantak (Madhya Pradesh), 45 plants each of *Flemingia bracteata* and *Desmodium pulchellum* were raised for evaluation. Broodlac was inoculated on the plants of *arhar*. The insects were growing well till December, 2008.

Molecular characterization of ber collections through RAPD profiling

Genetic diversity of thirty five collections of *Ziziphus* spp. including 26 fruit varieties, 6 geographic collections of *Z. mauritiana* as lac host and three different species (*Z. rotundifoila*, *Z. nummularia* and *Z. xylopyra*) were characterized through Random Amplified Polymorphic DNA (RAPD) technique (Table 5). The objective was to determine the genetic relatedness between the fruit quality *ber* varieties, other *Ziziphus* spp. and wild type *ber* used as lac host plants. A total of fifteen out of 58 RAPD primers screened from previous year were employed to analyze all the 35 experimental *ber* collections. The 15 primers produced a total of 169 loci with an average number of 11.27 loci per primer. The polymorphism recorded was very high 98.82% indicating about a wide genetic diversity among the *ber* collections probably due to cross pollinating reproductive behaviour (Fig. 10A). The average number of loci amplified per *ber* genotype was 66.83 for the 15 RAPD primers and average number of amplified products obtained per loci across the 35 *ber* collections was 13.84. The RAPD data helped in clustering of the 35 *ber* collections into six major groups (Fig. 10B). The similarity coefficient range in the dendrogram was 0.22–0.82. The dendrogram also revealed B14 (*Chhuahara*) and B17 (*Jogia*), both fruit variety, are most genetically similar with a similarity coefficient of 0.82. While B35 (*Ziziphus xylopyra*) is most distantly related collection from B4 (Illaichi), B8 (Kali), B22 (Sanaur-5) and B27 (Wild *Z. mauritiana* from IINRG, Research Farm) with a similarity coefficient of 0.18 for all. The closest genetic similarity between a wild type *ber* collection as lac host plant and fruit variety was between the *ber* collected from Purulia (West Bengal) and *Jogia* variety with a similarity coefficient of 0.70.

Table 5. List of *ber* collections used in the RAPD experiment.

Fruit varieties collected from CAZRI, Jodhpur, Rajasthan	**B1**: Sandan; **B2**: Aliganj; **B3**: Seb X Katha; **B4**: Bagwadi; **B5**: Illaichi; **B6**: Thornless; **B7**: Maharwali; **B8**: Kali; **B9**: CAZRI Gola; **B10**: Reshmi; **B11**: Katha; **B12**: F1 Seb X Gola; **B13**: BC1 Seb X Tikadi; **B14**: Chhuahara; **B15**: Umran; **B16**: Tikadi (CAZRI collection); **B17**: Jogia; **B18**: Banarsi Karka; **B19**: ZG3; **B20**: Seb; **B21**: Gola; **B22**: Sanaur-5; **B23**: Kaithli; **B24**: Banarsi pebandi; **B25**: Mundia; **B26**: Tikadi (IINRG collection)
Geographic collections of *Ziziphus mauritiana* used as lac host	**B27**: randomly seleceted plant from IINRG research farm, Ranchi; **B28**: Rania collection; **B29**: Simdega (Jharkhand) collection; **B30**: Gumla (Jharkhand) collection; **B31**: Banaskanta (Gujarat) collection, **B32**: Purulia (WB) collection;
Species	**B33**: *Ziziphus rotundifolia*; **B34**: *Z. nummularia*; **B35**: *Z. xylopyra*

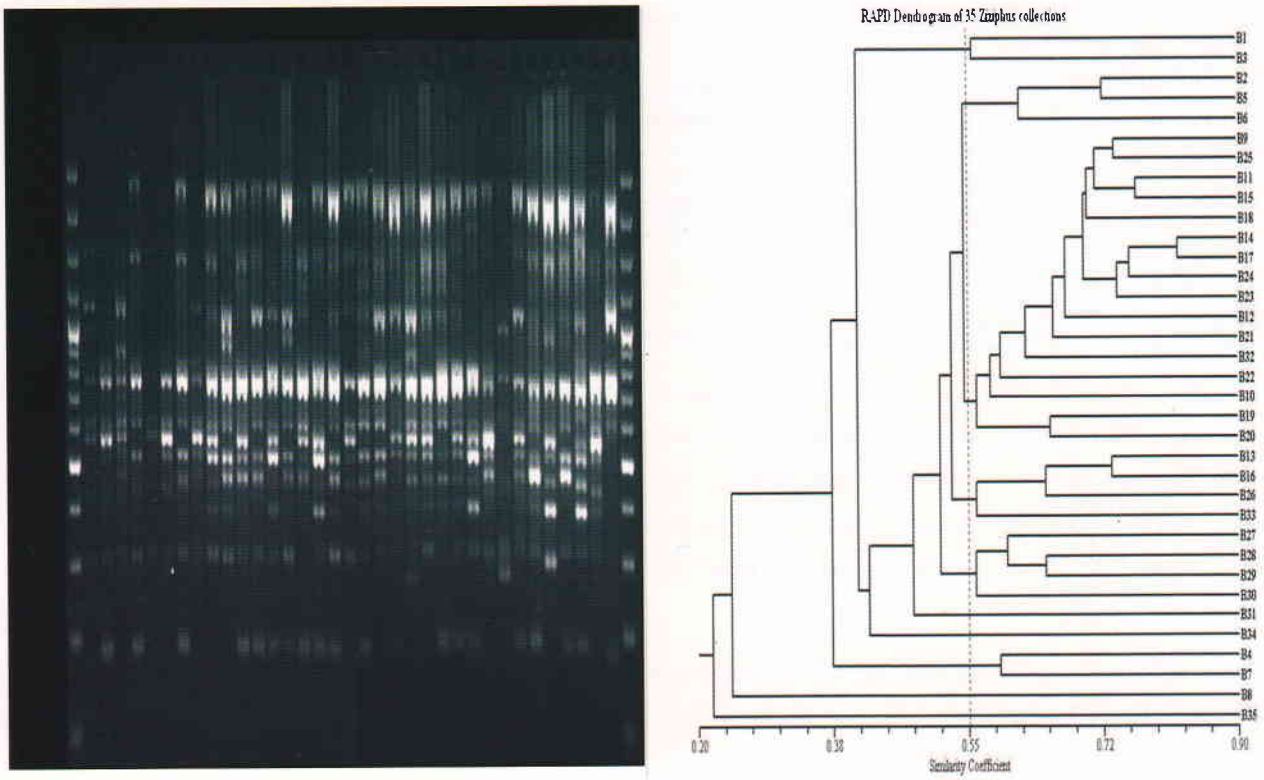


Fig.10. (A) Representative gel figure of RAPD amplification products showing polymorphic banding profiles as obtained with RAPD primer OPB17. (B) Clustering of 35 Ziziphus lines according to RAPD profiles generated through 15 RAPD primers

Molecular characterization of kusum and palas germplasm

The standardization of DNA isolation from highly polysaccharide and phenol rich *kusum* and *palas* leaves were carried out in previous year. The experiment was extended further for surveying of RAPD primers for both *kusum* and *palas*. Out of twenty RAPD primers screened 11 and 12 primers, respectively were found satisfactory for selection in order to carry out characterization of *kusum* (Fig. 11) and *palas* accessions through RAPD.

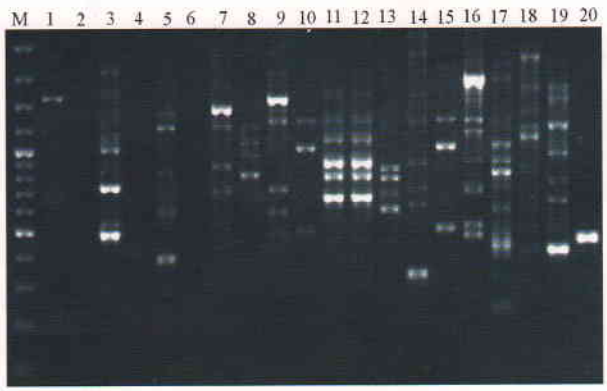


Fig. 11. Primary screening of RAPD primers OPS 1 - 20 in kusum.

1.2.2 Host plant evaluation and improvement for lac productivity and summer sustainability

To evolve a variety of Flemingia semialata for kusmi lac crop sustainability during summer

Progenies of selected *F. semialata* plants (90 plants) for summer lac crop sustainability, along with those from natural population (10 plants) raised last year were maintained. During the period under report, nine plants of selected

Table 6. Variation in plant characteristics of selected plants of local cultivar of *Z. mauritiana* at IRF and one high-yielding tree at Putidih, West Bengal

Tree no/plot no.	Habit	Thorniness *	Thorn shape	Shape of the leaf	Leaf apex	Leaf margin	No. Of pruned points / sprouts	Avg. length of shoots (cm)
RRZMAS 001/48	Spreading	Medium	Alternate curved	Ovate	Sub Acute	Entire	25/56	62.7
RRZMAS 002/47	Intermediate	High	All curved	Round	Oval	Entire	22/15	16.3
RRZMAS 003/57	Erect	Medium	Both curved	Round	Round And Wavy	Serrulate	35/85	87
RRZMAS 004/48	Spreading	Medium	All curved	Round	Round	Entire	10/15	10.3
RRJMAS 005 / 48	Intermediate	Medium	All curved [a]	Ovate[a]	Sub-acute	Serrulate	10/16	4.6
RRZMAS 006/48	Spreading	Medium	All curved	Ovate	Sub-acute	Serrulate	16/50	32.6
RRZMAS 007/48	Spreading [b]	Less	Alternate curved	Elliptical	Round	Serrulate	25/35	76.7
RRZMAS 008/48	Spreading	Medium	Alternate curved	Ovate Oblong	Sub-acute	Serrulate	9/25	60
RRZMAS 009/48	Spreading	Medium	Both curved	Oval	Round	Entire	8/45	63
RRZMAS 010/48	Erect	Medium	Alternate curved	Ovate	Round	Entire	10/30	21.7
RRZMAS 011/48	Spreading	Medium	Both curved	Ovate Oblong	Sub Acute	Entire	12/22	33.3
RRZMAS 012/48	Semi-erect[c]	Medium	Alternate curved	Round	Sub Acute	Entire	6/18	50
RRZMAS0013 / 48	Spreading	Medium	All curved	Oval	Round	Serrulate	10/30	64
RRZMAS 014/25	Semi-erect	Medium	Alternate curved	Oval	Obovate	Entire	8/13	80
RRZMAS 015/25	Erect	High	Alternate curved	Round	Round	Entire	5/8	85
RRZMAS 016/31	Spreading	Less	Alternate curved	Ovate Oblong	Round	Entire	8/38	60.7
RRZMAS 017/31	Erect	High	Both curved	Ovate	Round	Entire	7/15	61.7
RRZMAS 018/31	Spreading	medium	Both curved	Oval	Subovate	Subserrulate	15/60	63.7
RRZMAS 019/31	Spreading	High	Both curved	Round	Round	Subserrulate	6/28	92.5
RRZMAS 020/31	Spreading	High	Alternate curved	Oval	Round	Subserrulate	7/27	65.7
RRZMAS 021/31	Spreading	High	Alternate curved	Elliptical	Round	Entire	10/57	63.3
RRZMAS 022/33	Erect	Medium	Both curved	Oval	Sub Acute	Subserrulate	1/4	95.5
sRRZMAS 023/33	intermediate	Medium	Alternate curved	Ovate Oblong	Round	Entire	1/5	65.5
RRZMAS 026/ Near Dis.s	Intermediate	Medium	Alternate curved	Elliptical Oblong	Round	Entire	35/20	103.3
RRZMAS 027/ Putidih	Intermediate	Medium	Alternate curved[d]	Ovate (Boat Shaped)	Round	Serrulate, Wavy	-	62.1

* Visual which depends on internode length and branching

a : One thorn very close to branch; inner half of leaf lamina is bigger than outer

b : Drooping branching habit, thin branches

c : Branching at alternate node s

d : Thorn: small one straight forming 45^0 upwards

progeny and one of control died. Plants were pruned during July for inoculation of summer crop during January- February. Observations on plant height and number of tillers were recorded during December prior to inoculation. The plant height of selected group ranged between 88cm to 205cm with a mean of 146.45 ± 26.5, whereas those in control varied from 121 to 170 with a mean of 129.22 ± 26.7. The number of tillers per plant in case of selected progenies varied from 2 to 14 with a mean of 6.9 ± 2.6 whereas that in control varied from 3 to 10 with a mean of 5.1 ± 2.5. Plants are ready for raising summer *kusmi* lac crop from next year.

Screening of varieties/cultivars of Ziziphus mauritiana, Ziziphus spp. for lac productivity and plant characteristics

Regular maintenance activities were carried out for the 183 surviving plants and the 25 varieties of *ber* (*Z. mauritiana*) planted in 2007. In order to fill the gaps created by mortality of 67 plants due to frost in February 2008, budding of the respective varieties was done and sufficient number of budded plants has been obtained, which will be planted during the forthcoming monsoon. The plants exhibited spreading tendency and training operations will be taken up in 2009.

Twenty-five *ber* plants including one high yielding plant in Putidih were screened out based on winter *kusmi* lac yield and distinct plant characteristics for evaluation after clonal multiplication. These plants were characterized based on habit, shoot and leaf parameters, which have been summarized in Table 6. Patch budding was done in 400 plants (local *ber* root stock) using buds collected from 13 plants of this selection. Budding was successful in 124 plants. Large scale budding will be undertaken next year using more promising *ber* trees as well as those identified in farmers' field.

1.2.3 Clonal propagation of *Schleichera oleosa (kusum)* a major lac host plant through tissue culture

Axillary bud initiation and elongation in kusum

In continuation of identification of problems related to axillary bud culture establishment in *kusum* last year, 30 different combinations of cytokinins and auxins were tried for *in vitro* axillary bud initiation in *kusum*. Two treatment combinations consisting of (i) BAP (1.0 mg/l) + NAA (0.05 mg/l) and (ii) BAP (1.0 mg/l) + Silver nitrate (1.0 mg/l) produced highest axillary bud break after 21 days. The mean number of axillary bud break observed was 5.0±1 for both the treatments. The percentage of bud break calculated was 83.33% for either case as compared to 66.67% in control. The mean length of shoot bud recorded were 15.21±1.04 and 11.58±2.42, while the average number of fully expanded leaves observed were 1.54±0.71 and 1.17±0.17, respectively for the above two treatments.

Fig 12. Axillary bud culture initiation and elongation in kusum. (A) In vitro initiation of axillary bud-break from nodal explants of kusum. (B) Effect of agar solidified media versus liquid MS media soaked filter paper bridge on sub-culturing of proliferated axillary bud. Foliage drop on MS agar media is shown in the inset figure (C) Healthy ex-plant growth on white filter paper as compared on brown seed germination paper. (D) Shoot elongation of kusum axillary buds on liquid MS media soaked filter paper bridge.

The proliferated axillary buds were further sub-cultured on MS media with or without different PGR combinations, which resulted into foliage drops leading to death of almost all the explants. The problem was tackled by sub-culturing of freshly proliferated axillary buds on white filter paper bridge soaked in liquid MS media with

(low concentrations) or without cytokinins (0.5-1.0 mg/l). The process helped regeneration of 80-90% shoots. However in order to test the efficacy of low cost brown seed germination paper as a substitute for filter paper bridge for sub-culturing of axillary buds, resulted into browning followed by complete loss of explants. The results suggest white filter paper as ideal for sub-culturing of explants instead of brown paper bridge. Fig. 12 shows the results of axillary bud initiation and elongation in the *kusum* cultures.

1. 3 Crop Production

1.3.1 Studies on *in-situ* moisture conservation techniques for raising mixed plantation of *ber* and *kusum*

The soil moisture status and plant growth attributes of *ber* and *kusum* were recorded at monthly interval (25-30 days). Gravimetric method was used to estimate the soil moisture content at 105^{0}C till the constant weight was obtained. Moisture content of soil on weight basis was calculated and then it was converted on volumetric basis. Plant height, basal girth (5 cm above the ground level), crown spread and number of branches were the parameters under the plant growth. After head back pruning of *ber* plants at 1.25 m height from the ground level in February, recording of plant attributes was limited to basal girth and number of primary branches. For *kusum* plants plant height and crown spread were also recorded along with basal girth and number of primary branches.

Soil moisture status

During the period, the highest soil moisture content was observed under mulching treatment in all the months. The mean moisture content value under this treatment ranged from 11.38 -25.6 %. The soil moisture content under the treatments mulching (T_2) and half moon terracing/half basin ring (T_1) were found significantly superior over control during the period January-May and October-December (Table 7). During June-September (monsoon) all the treatments were at par with each other. The highest moisture content in mulching and half moon terracing was due to conservation of maximum rainwater in monsoon period. The half moon terracing provided the much more time to rainwater for its retention while mulching reduced the evaporation loss of conserved rainwater. Perusal of Table 7 and Figure 13 shows the lowest soil moisture content (7.7- 24.89 %) control.

Table 7. Soil moisture content at 0-60 cm under various conservation treatments.

Month	Soil moisture content (%)					
	T_1	T_2	T_3	T_4	T_5	CD (P = 0.05)
Jan. 08	10.73	11.68	10.05	9.80	8.98	1.09
Feb. 08	10.10	11.38	9.45	8.98	8.55	1.24
Mar. 08	11.00	12.15	9.78	9.05	8.83	2.14
Apr. 08	10.85	11.38	8.73	7.95	7.70	2.44
May 08	12.78	13.65	11.50	10.50	10.03	2.62
June 08	21.98	22.12	21.35	21.31	20.61	NS
July 08	25.35	25.60	25.20	25.15	24.89	NS
Aug. 08	20.48	20.99	19.15	18.94	18.43	NS
Sept. 08	20.18	20.68	19.09	18.75	17.85	NS
Oct .08	18.32	19.27	18.03	14.97	13.05	3.86
Nov. 08	12.80	14.95	11.49	10.57	10.48	3.01
Dec. 08	12.57	13.52	10.45	9.37	8.62	1.96

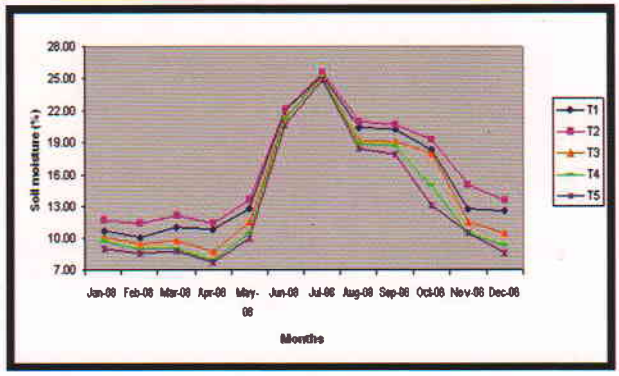


Fig. 13. Soil moisture pattern in 0-60 cm under various conservation treatments in mixed plantation of ber and kusum

Analyzing the moisture content level during the pre monsoon period (Jan-May), monsoon (June-Sep) and post monsoon (Oct-Dec) revealed that the per cent soil moisture content increases in mulching over control and was found maximum (45.7 %) during post monsoon period followed by pre monsoon period (36.6 %). The least difference in moisture content increase in mulching over control was observed during monsoon period (8 %).

Plant growth

All the *ber* plants were pruned uniformly at 1.25 m from the ground level maintaining a single

stem system during mid February. The maximum harvested biomass above the ground was recorded under mulching (22.9 q/ha) and the lowest in control (12.3 q/ha). Thus an increase of 86.1% was recorded in case of mulching over control.

Table 8. Basal girth of *ber*, under different conservation treatments in mixed plantation of *ber* and *kusum*

Month	Plant basal girth (cm)					
	T_1	T_2	T_3	T_4	T_5	CD (P = 0.05)
Jan. 08	17.70	18.31	16.21	16.57	15.83	NS
Feb. 08	17.70	18.31	16.21	16.57	15.86	NS
Mar. 08	17.46	17.92	15.96	16.25	15.57	NS
Apr. 08	17.72	18.71	16.29	16.79	15.91	NS
May 08	17.77	18.74	16.31	16.81	16.04	NS
June 08	18.64	19.83	17.25	17.78	17.00	NS
July 08	19.05	20.21	17.42	17.97	17.29	NS
Aug. 08	19.88	21.20	18.63	18.81	17.49	NS
Sep. 08	20.33	21.58	18.80	19.00	17.78	NS
Oct. 08	21.90	23.90	20.10	20.20	19.20	2.48
Nov. 08	22.00	24.00	20.15	20.25	19.32	2.48
Dec. 08	22.05	24.08	20.25	20.38	19.63	2.72

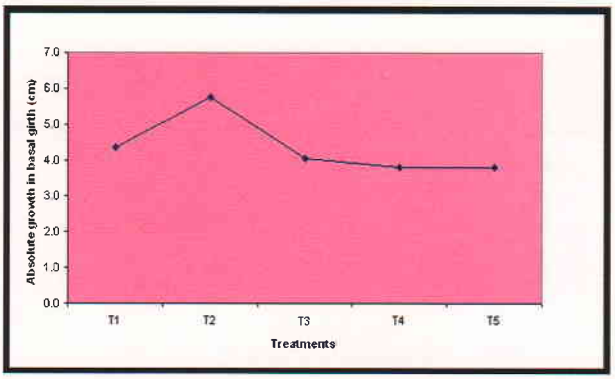


Fig 14. Absolute growth pattern in basal girth of ber plant under different conservation treatments

The maximum mean height of the *ber* plants after seven months of pruning (October, 2008) was recorded under mulching treatment (347.1 cm) whereas the minimum was recorded under control (295.2 cm). Thus an increase of 51.9 cm (17.6 %) was achieved under mulching over control. At the time of pruning (February, 2008) the mean height of the *ber* plants under mulching and control were 296.9 and 246.9 cm, respectively.

An increase of 31.5% in absolute growth of basal girth was found in mulching as against 23.9% in case of control. *Ber* girth growth pattern and absolute growth rate have been presented in Table 8 and Figure 14, respectively.

Number of primary branches

Number of primary branches did not show significant differences among the treatments. The trends in vegetative growth of *ber* plants showed that all the treatments were effective in inducing better vegetative growth than control. This might be due to more moisture conservation under different conservation measures over control. Though, the incremental magnitude in plant height of *kusum* was observed as 44.2, 34, 39.8, 35.8 and 38.9% in treatments T_1, T_2, T_3, T_4 and T_5, respectively (Table 9 and Fig. 15), but no significant difference was observed in various moisture conservation techniques adopted.

Table 9. *Kusum* plant height under different conservation treatments.

Month	Plant height (cm)					
	T_1	T_2	T_3	T_4	T_5	CD (P = 0.05)
Jan. 08	115.50	128.75	155.00	113.25	85.50	NS
Feb. 08	115.50	130.00	155.00	113.25	86.25	NS
Mar. 08	116.50	131.25	155.00	113.25	87.00	NS
Apr. 08	124.25	133.75	162.75	115.75	88.25	NS
May 08	128.00	136.75	167.00	118.25	90.50	NS
June 08	131.25	138.50	169.75	122.00	95.00	NS
July 08	150.25	158.75	195.50	137.50	106.00	NS
Aug. 08	153.75	162.50	201.50	139.25	110.25	NS
Sept. 08	156.25	166.25	204.00	143.50	110.25	NS
Oct. 08	157.50	168.75	210.00	148.75	114.50	NS
Nov. 08	164.25	171.25	214.75	152.50	118.75	NS
Dec. 08	166.50	172.50	216.75	153.75	118.75	NS

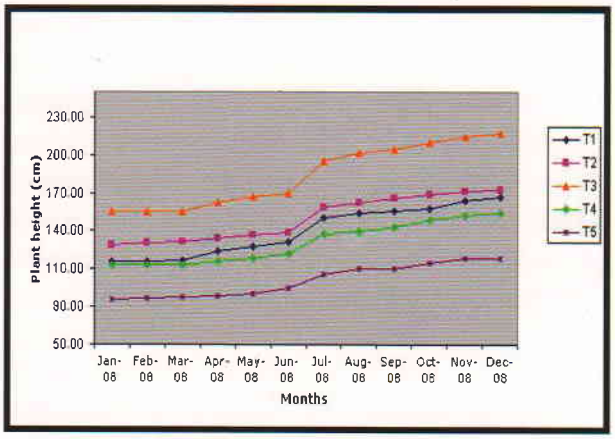


Fig 15. Kusum plant height under different conservation treatments

Yield of inter-cropped urd (black gram)

Black gram was sown as intercrop @ 17.36 kg/ha (0.25 kg per plot) in each replication of the treatment T_4 in the month of August. The crop was harvested in early November and the grain yield was found to be 1.6 q/ha. Biomass (Roots + stalks + leaves) @ 16.4 q/ha was also obtained, which was used over the soil surface to act as surface mulch in the plot. The intercropping with black gram in

the system will help in improving soil condition, reduction in soil loss and employment generation with extra remuneration to the farmers.

Fig 16. a) Ber plant under mulching treatment and b) ber plant under control

1.3.2 Development of *kusmi* lac cultivation technology on *Albizia procera (Siris)*

The experiment was carried out at Putidih village of Jhalda block in Purulia district (West Bengal). Winter crop 2007-08 was harvested from 25 trees of *siris*, where 10 trees each were inoculated 6 and 12 months after pruning and 5 trees 18 months after pruning. The observations indicate wide variation in productivity of lac irrespective of interval of pruining period (6 and 12 months). There was no lac production on one third trees despite inoculation of 1-3 kg broodlac per tree. Whereas in control where five *ber* trees were inoculated, neither much variation exists nor trees without lac production was observed. The productivity from *ber* trees was about 6.5 times to broodlac inoculated. The average weight of per meter broodlac was 77, 65 and 64 gm from 6, 12, 18 months pruned *siris* trees respectively and weight of scraped lac was 46.8, 52.3 and 60.9% respectively (Table 10). Higher proportion of scraped lac from higher age group of trees is due to the fact that lac insect also settled on petioles due to insufficient availability of primary shoots. The petioles are tender and succulent, suitable for lac insect settlement. In control (*ber* trees), the average weight of per meter broodlac was 137 gm and proportion of scraped lac was 78.1% (Table 10).

Table 10. Biological characteristics of harvested lac from *siris* and *ber* trees during winter crop 2007-08

Host	Age group of trees after pruning (months)	Average length of broodlac (cm)	Total weight of broodlac sticks (gm)	Weight of scraped lac (gm)	Proportion of scraped lac (%)
Siris	6	100	77	36	46.8
	12	100	65	34	52.3
	18	100	64	39	60.9
Ber	5	100	137	107	78.1

Kusmi - summer crop (2008) was raised on 20 trees of *siris*, 10 trees each with age group of 6 and 12 months after pruning prior to inoculation. Three trees of *kusum* were kept as control. The initial settlement density variations were 14-34 and 3-45 per square cm on trees pruned six and 12 months prior to inoculation, respectively with an average of 26.1 and 17.5. The initial mortality was observed to be 10.5 and 14.3% with a range of 1.7-20.7 and 0-42.9% on six and 12 months old pruned trees, respectively (Table 11). The lac insects died on all 20 trees of *siris* during 3rd week of April, 2008. However, *siris* trees identified earlier at Udeysur village, produced 8.5 kg of broodlac by inoculating one kg broodlac, indicating survival during summer season also.

Table 11. Biological characteristics of lac insect on *siris* and *kusum* trees during summer crop

Host	Age group of trees after pruning (month)	Range of settlement density per sq. cm	Average settlement density	Average Initial mortality (%)	Range of initial mortality (%)
Siris	6	14-34	26.1	10.5	1.7 – 20.7
	12	3-45	17.5	14.3	0-42.9
Kusum	18	43-91	66.9	6.1	5.3 – 7.2

Kusmi-winter crop 2008-09 was raised on 25 trees of *siris* trees and five *ber* trees as a check. Out of 25 trees of *siris*, 10 each were pruned six and 12 months prior to inoculation and five trees 18 months prior to inoculation. The observations were recorded for different biological characteristics and presented in Table 12. The observations revealed that the settlement density was significantly higher on *ber* shoots than *siris* ($P<0.05$). The initial mortality was significantly higher on *siris* ($p<0.05$) shoots with age group of six and 12 months old as compared to *ber* trees. No difference was found in sex ratio between *siris* and *ber* as well as between different age group of *siris* trees.

Table 12. Biological characteristics of lac insect on *siris* and *ber* trees during winter crop 2008-09

Host	Age group of trees after pruning (month)	Range of settlement density per sq. cm	Average settlement density	Average Initial mortality (%)	Sexual stage mortality of lac insect (%)	Per cent male insect
Siris	6	6-39	23	21	18.5	22
	12	12-33	25	20	20.6	21
	18	10-26	16	13	20.3	19
Ber	5	25-55	40	14	23.5	24

Monitoring of lac crop during first week of October 2008 indicated that lac insect also settles on petioles and development was found better than on shoots. The average length of settlement was 22 cm out of total average length of petiole (25 cm). As the bark of the shoots are thick and hard, the lac crawlers preferred to settle on petioles (Fig.17). Though there was fall of leaflets wherever there was heavy encrustation on trees but petioles remained intact on trees till harvesting of mature lac crop. The observation on growth of tree indicated that two year old trees attained a trunk diameter of 7.5 cm and 5-6 years old 15 cm with around 25 ft height. The latter tree is capable of producing around five kg of broodlac per year (Fig. 18).

Fig.17. Lac encrustation on petiols and secondary

Fig.18. Five year old siris trees attained a hight of 25 ft

1.3.3 Collection, identification and assessment of diseases of commercial lac hosts

Three commercial lac hosts *palas*, *ber* and *kusum* and one potential host *Flemingia semialata* were surveyed for their diseases and find out economically important ones. Institute Research Farm was monitored regularly for disease progress. In addition to IRF, Putidih (Purulia) in West Bengal and Dabgana and Chitramo (Khunti)

in Jharkhand were surveyed during December, 2008. Results are presented in Table 13.

Palas

Leaf spots caused by *Xanthomonas butae* and *Phomopsis butae* were found to be important diseases.

Pycnidial leaf spot: it is caused by *Phomopsis butae*. The disease appeared during July-August and attained severity till November. About 25 % of the trees were infected with the disease. About 10% trees were having more than 50 % of the leaf area covered with the disease. The disease normally appeared on older leaves. New leaves of the tree having severe infection were completely free from the disease. All the trees were not equally susceptible to the disease.

Bacterial leaf spot: disease is caused by *Xanthomonas butae*. The disease appeared during July-August and attained severity till February. At most severe stage *i.e.* during February, about 15% of the trees were having more than 50 % of the leaf area covered with the disease. The occurrence of the disease was found widespread in Jharkhand and West Bengal. It was also observed that smaller bushes were more severely attacted with disease than the grown up trees.

Ber

Powdery mildew caused by *Erysiphe zizyphi* and sooty mould caused by *Cladosporium zizyphi* were found to be the most important diseases in *ber*.

Normally only fruits were found infected with powdery mildew with severity of 5-18 % in December, but at Putidih new leaves were also found infected with less than 1 % severity.

Sooty mould caused by *Cladosporium zizyphi* was found on leaves of 70-100 % trees with severity of 2-5% in December. The disease appears during January-February on the lower surface of the leaves. Severity grows with time and becomes more severe during March causing even leaf fall.

Other diseases like *Cercospora* leaf spot caused by *Cercospora zizyphi,* Stem canker caused by *Botryosphaeria* sp were localized and severity was also very low.

Kusum

Powdery mildew was observed at IRF with very low incidence and severity. It was observed only at IRF. Since perfect stage was not noticed, it is being reported as *Oideum* sp.

Flemingia semialata

Stem canker caused by *Botryosphaeria* sp was found with moderate intensity at IRF and Chitramo (Khunti) in Jharkhand. Disease was recorded during early July affecting the nodes at aerial portion. Disease progresses from there and resulted in wilting of twig above the point of infection. Disease incidence and severity

Table 13. The types of diseases recorded on major lac hosts and *F. semialata*

Disease	Pathogen	Status
Palas		
Bacterial leaf spot Leaf spot	*Xanthomonas butae* *Phomopsis butae*	widespread
Ber		
Sooty Mould	*Cladosporium zizyphi*	Severity-Moderate , widespread
Powdery mildew	*Erysiphe zizyphi*	
Cercospora leaf spot	*Cercospora zizyphi*	Severity-Traces
Stem Canker	*Botryosphaeria* sp	Incidence is about 5 % in August-September. Fresh infection almost stopped in October
Kusum		
Stem blight Powdery mildew	*Rosellinia bunodes* *Oideum sp*	1 tree in IRF
Flemingia semialata		
Leaf spot	*Phyllosticta* sp	Severity-traces
Stem Canker	*Botryosphaeria* sp	Incidence is about 5 % in August-September. Fresh infection is almost stopped in October Fresh infection on soil line was recorded during November to December.

increased till August and then new infections reduced. During December infection at soil level was observed and it was more in fields having irrigation.

1.3.4. Management of sooty mould, causing lac insect death and failure of lac crops

The lac insect cell contains only three openings-two anterior branchial pores (through which respiration occurs) and one posterior anal tubercular pore. The insect profusely produces honey dew during active feeding. This invites species of *Capnodium,* which grow profusely making a dense fungal mat that covers the lac encrustation. This blocks and chokes the branchial pores and result in suffocation of the lac insects leading in their death and complete or partial failure of the lac crop.

Management of sooty mould through fungicide in kusmi lac in summer crop on kusum

An experiment was undertaken in randomized block design to study the effect of fungicides on sooty mould growth and on lac yield of *kusmi* lac on *kusum* during summer crop. Nine treatments (8 fungicide formulations and 1 control) with three replications (one tree per replicate) were taken. Fungicides were applied twice on 15.05.08 and 11.06.08. Sooty mould growth was recorded on 01.07.08. Crop was harvested on 21.07.08 and lac yield was recorded. The results are presented in Table 14.

The eight fungicide formulations did not show significant differences on sooty mould severity and insect mortality at maturity. However, Carbendazim (0.2g/l) (2.59) and Hexaconazole (3.66) increased the yield (brood/yield ratio).

Management of sooty mould through fungicide in kusmi lac in winter crop, 08-09 on ber

Similar experiment was laid out during winter crop of *kusmi* lac on *ber*. Fungicides were applied four times on 13.08.08, 10.09.08, 26.09.08 and 24.10.08. Sooty mould growth was recorded on 04.11.08. Data reveals that all the fungicides reduced the sooty mould growth significantly. Hexaconazole was the most effective in reducing the sooty mould growth (Table 15).

Table 15. Management of sooty mould through fungicides on winter season *kusmi* lac crop raised on *ber*

Sl No.	Fungicide	Concentration	Sooty mould (%)
1	Copper oxychloride	2g/lt	26.6 (30.8)*
2	Captan + Hexaconazole	2g/lt	26.7 (30.8)
3	Mancozeb	2.5g/lt	25.1 (29.9)
4	Metalaxyl+ Mancozeb	3g/lt	24.0 (28.9)
5	Hexaconazole	2.5ml/lt	15.3 (22.6)
6	Carbendazim	1g/lt	25.6 (30.1)
7	Carbendazim	0.2g/lt	31.4 (34.0)
8	Chlorothlonil	2.5g/lt	34.2 (35.7)
9	Control		50.2 (45.1)
CD at 5%			(11.2)
CD at 1%			(15.4)

* Value in parentheses is arcsine transformation

Role of ants in development of sooty mould growth

Experiment was undertaken to know the role of ants in development of sooty mould growth

Table 14. Management of sooty mould through fungicide on summer season *kusmi* lac crop raised on *kusum*

Sl No.	Fungicides	Dose	Sooty mould (%)	Insect mortality (%)	Yield (Brood lac produced/used)
1	Copper oxychloride	2g/lt	20.6 (26.6)*	4.4	1.14
2	Captan + Hexaconazole	2g/lt	8.4 (14.0)	8.4	0.94
3	Mancozeb	2.5g/lt	21.2 (27.2)	5.8	0.99
4	Metalaxyl+ Mancozeb	3g/lt	19.4 (25.2)	7.7	2.01
5	Hexaconazole	2.5ml/lt	26.3 (29.9)	12.4	3.66
6	Carbendazim	1g/lt	11.8 (16.7)	6.0	2.00
7	Carbendazim	0.2g/lt	10.8 (15.3)	3.8	2.59
8	Chlorothlonil	2.5g/lt	3.0 (8.4)	4.4	1.34
9	Control		13.3 (21.3)	9.3	1.30
CD at 5%			NS	5.1	1.24
CD at 1%			NS	NS	1.70

* Value in parentheses is arcsine transformation

on winter crop on *ber*. There were two sets of experiments. In one set, Institute's recommended plant protection measures (1 spray of endosulfan + carbendazim followed by 2 sprays of nuvan + carbendazim) was adopted (P-1) and in another set no protection measures was adopted (P-2). In both the sets of trees, on two branches ants were not allowed (A-1) and on others two branches ants moved freely (A-2). Two observations on sooty mould growth were taken at approximately monthly interval. The data was analyzed through t test in paired plot technique. Results indicates that visit of ants to lac encrustation resulted in significant reduction in sooty mould growth both under P-1 and P-2 conditions. Movement of ants were also recorded under both P-1 and P-2 conditions and it was observed that under P-1 condition 1.39 ants/ min were moving in the sample region on the tree trunk while under P-2 conditions, it was 1.11 ants/ min., showing the protection method adopted did not significantly affect ant activity.

Role of microenvironment on sooty mould growth

In order to know the growth of sooty mould under different microclimatic conditions of *ber*, two sets of experiments were carried out at IRF. In one set (A), planting was dense (2 x2 m) and plants were chosen from the interior and in another set (B) plants was less dense and trees were chosen from the periphery. There were eight replications with one *ber* tree per replication. Observations of sooty mould severity were taken in the month of October and November and results revealed that sooty mould growth was more (31.3%) in less ventilated condition as compared to dense planting (17.6%).

1.3.5 Soil fertility management of ber *(Z. mauritiana)* for shoot growth and lac yield *(aghani)*

The study was aimed to assess the impact of pH management and application of NPK to established *ber*, on pruning response and winter *kusmi* crop yields. Soil pH under each treatment was estimated and lime requirement was calculated and proper liming was done in June. N, P and K fertilizers were applied in July on rings as per schedule. The results are presented in Tables 16-18.

Only CCI was affected significantly due to liming in the month of August. In treated trees 18.1% increase in CCI values was observed as compared to untreated. Significant difference in shoot % infected with shoot borer was observed due to liming and 3.2% shoots were infected with the borer as compared to 1.5% in control. Trees treated with potassium accumulated 2% lesser dry matter during inoculation. Difference was significant. It implies that potassium application make shoots more succulent.

Nitrogen application at 100 g/ tree significantly reduced initial lac insect mortality by 5% compared control, but further increase in doses did not produce any significant impact. Insect mortality reduced with liming and K application and increases with P application, but difference was not significant. Potassium application significantly increased male proportion (2%), which may be related to increased succulence.

Soil samples collected in Dec, 07 from all the treatment sites were analyzed from NHRDF, Nasik for residual N, P_2O_5, K_2O, pH, E.C., $CaCO_3$ and organic matter content of the samples as affected by liming, N, P_2O_5 and K_2O application. Liming could bring a remarkable change in average values of all the parameters excepting that of $CaCO_3$.

Appreciable amount of residual effect was found with K application (7.8 % over control). Residual values of nitrogen were also found high in case of higher rate of application (400 g/ tree). However application of P could not change in residual P level.

Since liming is a very important factor governing availability of many other nutrients, which might have influenced tree growth in many ways, has affected lac growth negatively due to strengthened defense mechanism of the tree, in the last season.

Table 16. Plant growth parameters of *ber* as affected by levels of liming, N, P and K

Factors	Chlorophyll content index (CCI)		Shoot dry matter % (Aug)
	15 DAA	30 DAA	
No lime	16.1	20.7	40.4
Liming	17.2	24.4	40.9
$CD_{(0.05)}$	NS	3.65	NS
N_0	16.4	24.1	40.8
N_{100}	16.4	19.4	41.1
N_{200}	16.1	23.8	40.5
N_{400}	17.6	22.8	40.2
$CD_{(0.05)}$	NS	NS	NS
P_0	16.6	21.4	40.5
P_{150}	16.6	23.7	40.8
$CD_{(0.05)}$	NS	NS	NS
K_0	16.3	23.2	41.7
K_{150}	16.9	21.9	39.6
$CD_{(0.05)}$	NS	NS	NS

* DAA = Days After Application

Table 17. *Kusmi* lac insect parameters during winter season as influenced by levels of lime, N, P and K, on *ber*

Factors	Initial mortality %	Initial settlement/ sq cm	Male %
No lime	28.2	86.6	14.7
Liming	25.2	90.3	14
$CD_{(0.05)}$	NS	NS	NS
N_0	25.9	88.9	14.3
N_{100}	20.9	89.7	14.1
N_{200}	27.3	89.2	14.2
N_{400}	32.8	85.9	14.9
$CD_{(0.05)}$	2.01*	NS	NS
P_0	25.9	88.8	14.7
P_{150}	27.5	88.1	14.0
$CD_{(0.05)}$	NS	NS	NS
K_0	28.1	86.2	15.8
K_{150}	25.3	90.7	12.9
$CD_{(0.05)}$	NS	NS	2.65*

Table 18. Winter *kusmi* lac survival and termite infestation, as affected by levels of liming, N, P and K

Factors	% branches with dead lac on branches of basal diameter		Termite infestation %		Length of coverage by termite per tree (m) in October	Percent shoots infested with borer
	<1.0 cm	>1.0 cm	Sept.	Oct.		
No lime	57.5	4.8	33.3	34.2	3.12	1.5
Liming	58.3	2.5	42.3	37.1	3.86	3.2
$CD_{(0.05)}$	NS	NS	NS	NS	NS	1.62*
N_0	51.2	2.9	36.0	28.3	2.7	2.0
N_{100}	57.2	5.4	39.6	40.3	4.07	2.3
N_{200}	57.1	1.7	27.3	31.3	3.11	2.3
N_{400}	66.1	4.5	48.3	42.6	4.07	2.8
$CD_{(0.05)}$	10.0*	NS	NS	NS	NS	NS
P_0	57.4	3.6	42.3	40.1	3.91	2.2
P_{150}	58.4	3.6	33.3	31.1	3.07	2.5
$CD_{(0.05)}$	NS	NS	NS	NS	NS	NS
K_0	60.2	2.9	40.2	38.8	3.82	2.4
K_{150}	55.6	4.3	35.4	32.4	3.16	2.3
$CD_{(0.05)}$	NS	NS	NS	NS	NS	NS

1.3.6 Production of quality *kusmi* broodlac at Institute Research Farm

Under Revolving Fund Scheme (RFS), a total of 3589.7 kg broodlac was produced during the year 2008-09 and Rs 2,69,627 have been earned as revenue from the sale of 2327.9 kg broodlac and 161 kg sticklac to different projects/farmers/ entrepreneurs. About 500 kg of phunki lac collected from *kusum/ber* trees is in the stock. Closing balance of the scheme during the year was Rs 20,59,045.

Summer season (jethwi) crop

A total of 1838.6 kg broodlac was produced under Revolving Fund Scheme (RFS) on *kusum* during summer season *(jethwi)* crop in July / August 2008. This includes: 423.1 kg of Gumla stock, 343.5 kg of *ber* stock, 130.5 kg of Kulajanga stock, 320.0 kg of mix stock, 517.5 kg of Nawadih and104.0 kg of Bandgaon stock. 880.5 kg of broodlac (worth Rs. 1, 14, 465) has been sold to needy farmers / NGOs and 347.4 kg (worth Rs. 45, 162) provided to the externally funded projects / Institute projects for experimentation. About 610 kg broodlac has been inoculated on *ber/ khair* trees / bushes. Details of the Balance Sheet are provided in the table given below:

Winter season (aghani) crop

A total of 1751.1 kg broodlac was produced under Revolving Fund Scheme (RFS) on *ber* during winter season (*aghani*) crop 2008-09. This includes 240.0 kg of *ber* stock, 427.6 kg of Gumla stock, 148.2 kg of Kulajanga, 394.1 kg of Nawadih, 443.0 kg of Bandgaon and 80.8 kg of mix stock. About 1100 kg broodlac worth of Rs 1,10,000 has been sold to needy farmers/NGOs. About 650 kg broodlac have been inoculated on *kusum* trees during summer season *(jethwi)* crop 2009.

Balance Sheet of Revolving Fund Scheme for 2008-09

Corpus / Capital Fund & Liabilities		Current Year	Previous Year
Capital Fund			
(a) As on 01.04.2008	1727193		
(b) Net Profit/Loss from P& L A/C	235745	1962938.00	1727193.00
Reserve		0.00	0.00
Earmarked/Endowment Funds		0.00	0.00
Current Liabilities & Provision			
(a) O/S Worker's Share	96107	96107.00	59714.00
(b) Others	0		
TOTAL		**2059045.00**	**1786907.00**

Assets			
Fixed Assets		0.00	0.00
Investments		0.00	0.00
Endowment Funds		0.00	0.00
Current Assets, Loan & Advances			
(a) O/S Credit Sales	0		
(b) Loans to RFS : II	100000		
(c) Cash in Bank	1959045	2059045.00	1786907.00
TOTAL		**2059045.00**	**1786907.00**

Profit & Loss Account for the Year ended as on 31.3.2009 (Amount in Rupees)

A. CREDIT		Current Year	Previous Year
Income from Sales/Service		0.00	0.00
(a) Cash sale of (i) Broodlac (ii) Sticklac	251387 37560	288947.00	113465.00
(b) Credit Sales (i) Institute (ii) Broodlac (iii) Sticklac	0 0 0	0.00	74985.00
Income from Royalty, Publications		0.00	0.00
Interest Earned		57910.00	0.00
Other Income		0.00	0.00
Prior Period Income		0.00	0.00
TOTAL		**346857.00**	**188450.00**

B. DEBIT		Current Year	Previous Year
Cost of Sales : (a) Labour Charges (b) Contingency (Seeds & Other) inputs) (c) Travelling Allowance (d) Others	 48479 26240 0 0	74719.00	74533.00
O/S Worker's Share		36393.00	59714.00
Miscellaneous Expenses		0.00	0.00
Depreciation		0.00	0.00
Prior Period Expenses		0.00	0.00
TOTAL		**111112.00**	**134247.00**
Balance being surplus/deficit carried to Corpus/Capital Funds		**235745.00**	**54203.00**

	Receipt	Current Year	Previous Years		Payments	Current Year	Previous Year
1	Opening Balances			1	Expenses		
	a) Cash in Hand	0	0		a) Labour Charges	48479	68205
	b) Cash in Bank				b) Contingency	26240	6326
	in current accounts	1611922	1672990		c) Travelling Allowance	0	0
	in Deposit accounts (STD)	0	0		d) Others	0	0
	in saving accounts	0	0				
2.	Cost of Sales	363932	113465	2	Investment & Deposits		
					a) Investment	0	0
					b) Loans	0	100000
					c) Advances	0	0
3.	Interest on Term Deposit	57910	0	3.	Closing Balances		
					a) Cash in Hand	0	0
					b) Cash in Bank	1959045	1611922
					in current accounts	0	0
					in Deposit accounts	0	0
					in savings accounts	0	0
					c) in transit		
	TOTAL	**2033764**	**1786455**		**TOTAL**	**2033764**	**1786453**

Production of quality *kusmi* broodlac at Institute Research Farm

Expenditure		Income	
Item	**Amount (Rs.)**	**Item**	**Amount (Rs.)**
Labour	48479	Sale of Broodlac	251387
CB (Purchase of pesticides etc.	26240	Sale of Sticklac	37560
TA	0	Interest earned on STD	57910
Other items	0	Any other	0
Total	74719	**Total**	346857
		Profit	
		Workers' share and establishment charges	
		Net Profit	235745

Description of Reserve growth during 2008-09

Items	Withdrawls (Rs.)	Item	Balance (Rs.)
Expenditure during the year	674719	Opening Balance	00
Less workers' share and establishment charges		Income during the year	346857
Transferred to PPD RFS			
Total		**Total**	346857
		Closing Balance	

Comparative performance of different productive kusmi breeds on kusum

Maintenance and multiplication of productive *kusmi* breeds of lac insects was carried out under RFS. Record maintenance of individual *kusum* tree was initiated from this year to assess the comparative performance of different productive *kusmi* breeds on *kusum* during summer season (*jethwi*) crop and identification of good yielding trees. Observations recorded are shown in Table 19.

Table 19. Comparative performance of different productive *kusmi* breeds on *kusum* during summer season (*jethwi*) crop.

Lac insect Stock	No. of trees inoculated	Broodlac inoculated (kg)	Broodlac harvested (kg)	Output / Input ratio	Yield per tree (kg)
Kulajanga	21	54.7	130.5	2.386	6.214
Nawadih	99	247.2	517.5	2.093	5.227
Ber	58	132.7	343.5	2.589	5.922
Bandgaon	28	46.0	104.0	2.261	3.714
Gumla	64	142.9	423.1	2.961	6.611
Mix	78	198.5	320.0	1.612	4.103
Total	**348**	**822.0**	**1838.6**	**2.237**	**5.283**

Effect of irrigation on lac yield during summer season

Summer irrigation (about 500 lt / tree) was provided to five *kusum* trees during April - May at weekly interval. Broodlac output to input ratio showed a marked improvement (Table 20) in comparison to unirrigated trees. However, the sample size was very small, selection of trees was not random and input-output ratio of

broodlac on some of the trees under un-irrigated conditions was also at par with the irrigated trees. Therefore, the experiment needs to be repeated keeping in view the above three observations.

Table 20. Effect of irrigation on lac yield during summer season

Stock	No. of trees inoculated	Broodlac inoculated (kg)	Broodlac harvested (kg)	Output / Input ratio	Yield per tree
Un - irrigated	348	822.0	1838.6	2.237	5.283
Irrigated	5	33.7	186.5	5.534	37.3

1.3.7 Evaluation of potential herbicides for weed management in *semialata* and *ber* plantation

During the period under report five experiments were conducted to evaluate potential herbicides for weed control and their safety to lac insects and host plants.

***New Plantation*:** Expt. I: Effect of pre and post planting application of herbicides (monsoon) on growth of weeds and host *Flemingia semialata*. Expt.II: Effect of pre and post planting application of herbicides on growth of weed and host *Ziziphus mauritiana*.

***Established plantation*:** Expt.III a: Effect of herbicides on shoot growth and lac yield (*aghani*) of *F. semialata;* Expt.III b: Evaluation of herbicides (pre and post inoculation) against *kusmi* lac insects (*aghani*) on *F. semialata*; Expt. IV: Effect of pre and post application of herbicides (monsoon) on shoot growth and lac yield (*katki/ aghani*) of *Z. mauritiana*.

In total there were seven treatments which included five herbicides i.e. paraquat @ 0.4 kg ai/ ha, *Glyphosate* @ 1.0 kg ai/ha, *Glufosinate* @ 1.0 kg ai/ha, *Atrazine* @ 2.0 kg ai/ha and *Quizalofop*-p-ethyl @ 0.2 kg ai/ha, one weed free (manually) and one unweeded as control. In Expt.III b, only six treatments including five herbicides and one unweeded control was undertaken.

Effect of herbicides on weed suppression

Nursery raised seedlings of *F. semialata* and *ber* were transplanted in the field after 20 and 24 days of imposition of pre-planting treatment of herbicides and repeated after 34 and 45 days of planting, respectively. Weeds were removed manually in weed-free treatment.

Glyphosate was found to be superior to all tested herbicides showing 80.51 and 77.54% weed control efficiency (WCE) at pre and post planting of *F. semialata,* respectively which were at par with all non selective herbicides and weed free treatment (manually).The weed control efficiency in *ber* plantation for pre and post application of herbicides was almost similar to that of *F. semialata* plantation.

An experiment was also conducted in RBD replicated thrice in one year old established plantation of *F. semialata*. Herbicides were applied one week prior to *kusmi* lac inoculation thereafter 45 days after inoculation. The weed control efficiency of different herbicides varied from 35.98 to 70.54% at pre-inoculation whereas at post-inoculation stage varied between 44.27-84.30%. The highest being in case of *glyphosate* (70.54 and 84.30%) which was 11.73 and 7.6% lower than that of weed-free treatment (82.7 and 91.90%) at pre and post-inoculations stages respectively.

Application of herbicides on one-year-old *F. semialata* plantation, resulted in some mortality of host plants which varied from 2.56-18.38%. The highest plant mortality was observed with *glyphosate/atrazine* treatment and least in weed free; under unweeded condition mortality was observed to the tune of 3.84 per cent.

Effect of herbicides on soil flora

The study related to quantification of microbial population in lac host plants rhizosphere indicated that all the herbicides had a depressive effect on the soil microbial (fungal) population within 5 days of herbicide application and thereafter there was a build-up of soil fungal population. The highest depression of fungal population at 5 DAS was recorded with *glyphosate* ($0.5x10^{-6}$ /g oven dry soil) treatment while the highest build-up of fungal population at 45 DAS with *paraquat* ($2.92x10^{-6}$ /g oven dry soil) where as *atrazine* @ 2.0 kg ai/ha did not show any appreciable increase in fungal population at 45 DAS.

Effect of herbicides on lac insects

An experiment was laid out in RBD with six treatments, replicated thrice in established plantation of *F. semialata* to evaluate herbicides (pre and post inoculation) against *kusmi* lac insect (*aghani*). It was recorded that herbicides application in established plantation of *F. semialata* at pre-inoculation stage had no adverse effect on the lac larvae and host plants. The lowest mortality recorded with *glufosinate* (9.77%) followed with *glyphosate* (11.14%) while in case of control it was 11.79% which were statistically at par.

All the seven treatments as mentioned above were imposed in the established plantation of *ber* and plants have been inoculated with *kusmi* strain of lac insects for raising winter season lac crop (*aghani*).

Composition and relative frequency of weed flora

Study on weed flora in five lac host plantations were also carried out during rainy season and weeds were identified, categorized and their relative frequency was determined (Table 21).

1.3.8 Development of lac production system using high density *ber* plantation under semiprotected condition

In view of the satisfactory growth of the plants of the high density plantation of *ber* raised in 2006. Out of 536 plants in four strips 165 plants, with basal diameter >2.5 cm were selected for pruning (Fig. 19). One set of 88 plants in two alternate strips were pruned head back in the first week of March and the remaining in April. The former set of plants was used for raising the winter *kusmi* and the latter for summer *rangeeni* lac crops. Mulching was done in mid February with dried paddy straw. Flood irrigation was provided as per requirement. Vermicompost was applied @ 113 kg per strip of the plants, in mid May. Soil samples were collected for analysis to evaluate change in fertility status.

In response to pruning, the mean length of shoots produced per plant was 2.0m (range: 0.8-2.75 m) and the mean number of shoots generated per plant was 2.9 (range: 1-5) in Oct. The high density plantation of *ber* was thus ready for initiation of lac cultivation in about two years

Table 21. Important weed species present in different lac host plantations and their relative frequency during monsoon season

Name of weed species/Host	*Palas*	*Ber*	*Kusum*	*Bhalia*	*Semialata*
Grasses					
Setaria verticillata (L.)	-	-	-	20.0	-
Digitaria sanguinalis (L.)	11.43	3.96	12.0	1.82	16.0
Andropogan gayanus	-	-	2.0	5.45	-
Cynodon dactylon (L.)	-	-	1.0	-	-
Sccharum spontaneum (L.)	-	-	-	-	8.0
Brachiaria remosa	-	1.98	-	-	-
Eleusine indica		6.93	-	-	-
Echinochloa colonum	25.71	-	-	-	-
Echinochloa glabrascence	20.00	-	-	-	-
Broad leaved					
Ageratum conyzoides (L.)	-	29.70	52.00	3.64	53.34
Alternanthera sessilis	22.86	-	1.00	7.27	-
Emelia sonchyfolia	8.57	1.98	10.00	-	8.0
Spilanthes acumella	-	39.60	8.00	-	5.33
Ludwingia octovalvis	-	1.98	-	20.0	-
Commelina benghalensis (L.)	11.43	1.00	7.00	1.82	-
Phyllanthus niruri (L.)	-	-	-	-	4.0
Stellaria media	-	6.93	2.0	-	5.33
Scoparia dulsis	-	5.94	-	-	-
Sedges					
Cyperus iria (L.)	-	-	3.0	25.45	-
Cyperus rotundus (L.)	-	-	2.0	10.91	-
Cyperus difformis (L.)	-	-	-	3.64	-

after establishment and about 57% plants could be brought under lac production. The remaining plants will also be brought under cultivation from subsequent crop season.

The winter *kusmi* (*aghani)* lac crop was raised on 129 plants in two strips, both pruned and unpruned plants with inoculable shoots, using 12 kg brood lac of late *kusmi* breed in March. The larval emergence from the broodlac was good but satisfactory settlement of emerging larvae could not be achieved due incessant rains during the period. But satisfactory survival and growth of the settled larvae was recorded subsequently.

The summer *rangeeni* (*baisakhi*) was raised in the third week of October on 176 plants in two strips of plants using 30 kg. broodlac. The settlement, survival and growth of the lac crop were very good till the end of period under report (Fig. 20).

Fig. 19. View of the high density plantation of ber after pruning of two strips

Fig. 20. Kusmi winter crop on ber in high density plantation

1.3.9 Development of Lac-integrated Farming System at Institute Research Farm

Lac Integrated Farming System (LIFS) aims at interlacing of mutually beneficial farming and other components including lac into the existing regional cropping system to attain food, nutritional and income security and employment to farmers. Based on the above concept a representative Lac Integrated Farming System is being developed in a suitable area of IRF (Fig. 22). About 1.7 ha of land has been earmarked, which contains about 1.0 ha upland (*tanr*) and about 0.7 ha lowland (*doan*) in plot nos. 22, 23, 35, 36, 37 and 39. The principal thrust of this system is to superimpose lac production and other agricultural technologies over the existing basic cropping style/preference of local farmers as well as soil conditions and land topography. The cropping systems have been chosen in the light of existing farmers' practices and interests as well as recommended varieties/ technologies.

The agriculture enterprises to be integrated are:

- Food crops and vegetables: Rice (transplanted and upland); Maize, Ragi and Tuber crop (*kharif*); Niger, Barley and Bengal gram (*rabi*); Vegetables (*zaid*).
- Fruit trees: Aonla, guava and citrus/papaya
- Lac: *Ber*, *Palas*, *Kusum* and *F. semialata*
- Fisheries: short-term, during monsoon

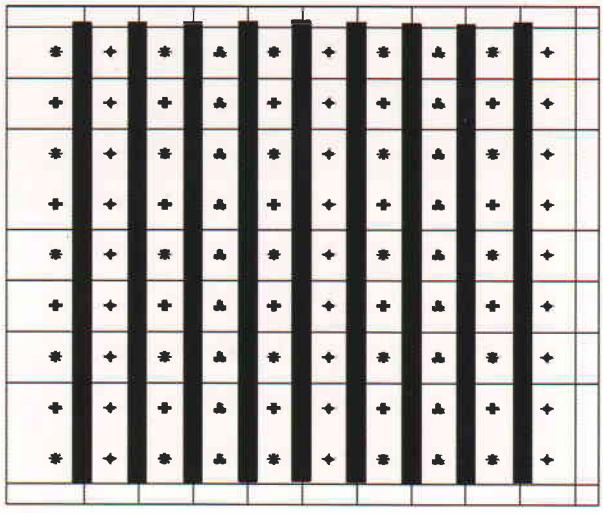


Fig. 21. Lay-out of the field plot of fruit trees and lac hosts at Institute Research Farm (Aonla (✱) ; Guava (✦); Papaya(⁂) ; Ber (✚)

The components of LIFS in farmer's fields will be farmer-specific, depending on the nature and the area of the land, farmers' interests as well as other resources. The model being developed is envisaged as a representative one, demonstrating the benefits of such systems.

The work done during the period under report included development of the total area earmarked for the model with development of i) 4 bunds, ii) water harvesting pond (cap.: about 1600 cu.m.),

iii) drainage channels and iv) two *jalkundas* (3 x 1.5 x 1m).

Ber and *semialata* plants were planted as per layout. Borders of upland (about 20%) was earmarked for the lac host *ber* and bunds for *semialata*. The crops raised were as follows: upland rice (800 sq m), transplanted rice (1800 sq. m), ragi followed by ragi (1600 sq. m) and colocasia (local).

For lac-horticulture integration, lac host plants were introduced in the inter spaces of fruit trees, in a compatible mode. An area of 2500 sq. m. was taken for this purpose and the lay out and planting system of the trees are given below:

Spacing of the trees, variety and number of plants in the plot:

Aonla (Kanchan + NA7) : 10 x 10 m ; 18

Guava (Allahabad Safeda): 5 X 5 m; 27

Papaya (Surya): 2.5 x 5 m; 34

Ber (local cultivar): 10 X 10 m; 20

F. semialata : 0.5 X 1m; 780

Fisheries: Three varieties of fishes (silver carp, *rohu* and *katla*, 300) were introduced in the water harvesting pond in August.

It is envisaged that introduction of lac would improve profitability besides providing employment. In the model about 8.5% of the total land and 15.8 % of the medium land has been used for lac cultivation, which is projected to increase the net profit by about 60%.

Figs. 22. Views of the LIFS model laid out at the IRF.

2. PROCESSING AND PRODUCT DEVELOPMENT

2.1 Synthesis and Product Development

2.1.1 Synthesis of thiosemicarbazide and thiodiazole from aleuritic acid and testing its activity as antifungal/hypoglycemic/ antinemic

Thiadiazole was prepared from natural lac resin following organic synthesis route. The sequential reaction steps followed are mentioned below :

Lac resin → Aleuritic Acid → Methyl aleuritate → Hydrazide of aleuritic acid → Thio-semicarbazide → Thiadiazole

The aleuritic acid prepared from lac resin has m.p. 100-101^{0}C. The solid methyl aleuritate obtained has yield of 80% and m.p. 68-69^{0}C, IR-1742 cm^{-1} indicating the presence of ester group. The yield of hydrazide of aleuritic acid was found to be 85%. The compound has melting point 138-139^{0}C and IR-1672cm^{-1} confirming the presence of C=O of amide group. The thiosemicarbazide obtained has m.p. 122-123^{0}C and yield 90%. The final compound thiadiazole of aleuritic acid was characterized by FT-IR, which has yield of 40% .

Derivative of thiosemicarbazide

The hydrazide of aleuritic acid was converted into 4-ethylphenyl thiosemicarbazide, 4-bromophenyl thiosemicarbazide and 2-methylphenylthiosemicarbazide of aleuritic acid as solid (m.p. 141-42^{0}C, 147-148^{0}C) and liquid, respectively by adopting the above method for preparation of the thiosemicarbazide. The compounds were characterized by their spectral data (FT-IR) where as their purity were confirmed by thin layer chromatography (TLC).

2.1.2 Comparative evaluation of physico-chemical anti-inflammatory and hypolipidemic properties of oleogum resins from *Boswellia serrata, Commiphora mukul* and *Commiphora wightii*

Exudates of oleogum-resin from different climatic zones such as *Boswellia serrata* from Hyderabad (Andhra Pradesh), Jabalpur (Madhya Pradesh) and Vadodara (Gujarat); *Commiphora mukul* from Anjar (Gujarat) and *Commiphora wightii* from Ajmer (Rajasthan) were procured.

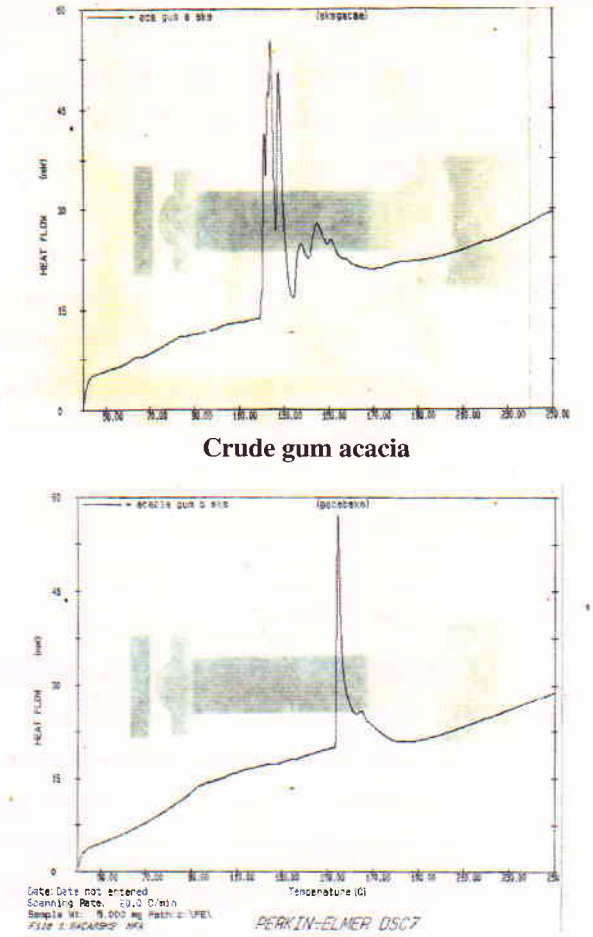
Extraction of exudates of *Boswellia serrata* from Jabalpur (Madhya Pradesh) and *Commiphora mukul* from Anjar (Gujarat) with polar organic solvent (ethyl acetate) were carried out to obtain the desired resin. The yield of the resin was found to be 66%. It was a light brown coloured powder, soluble in alcohol. The product has melting point 108-110^{0}C, moisture percent 0.7, ash present 0.42, acid value 52.82. The DSC analysis of the extracted resin was also carried out.

2.1.3 Synthesis of hydrogel from gum *acacia* and gum *karaya* for their comparative evaluation in drug release.

Samples of different grades of gum *karaya* were collected from Girijan Cooperative Corporation (GCC), Vishakhapatnam (Andhra Pradesh). Gum *karaya* was purified by dissolving it in distilled water at room temperature. It was crystallized by manipulating its pH. The samples were dried in hot air and at room temperature. Yield of the purified gum *karaya* in powder form was 60% (Fig. 23).

Fig 23. Photograph of purified gum karaya

Samples of Gum *acacia* were purchased from the market. Gum *acacia* was purified by dissolving in cold distilled water, crystallizing, and drying in vacuum. Yield of the pure gum *acacia* in powder form was found to be 60 %. Differential Scanning Calorimetry (DSC) analysis of the purified gum *acacia* revealed a sharp single peak for the purified sample in contrast to the multiple peaks exhibited by the crude one (Fig 24).



Crude gum acacia

Purified gum acacia

Fig 24. Thermogram of DSC of crude and purified gum acacia

2.1.4 Screening of bioactive compound synthesized from aleuritic acid.

The following bio-active compounds were synthesized from aleuritic acid to evaluate their respective bio-activities.

- 1, 9-Nonanediol diacetate
- Thiocarbamate of aleuritic acid
- 9-Hexadecenolide
- 10 - Carboxymethyl - 2 - decenoic acid (PGR)
- Trizole of azelaic acid

The compounds 1, 9-Nonanediol diacetate and 9-Hexadecenolide were purified by distillation under reduced pressure, where as 10-Carboxymethyl-2-decenoic acid by Column Chromatography and Trizole and Thiocarbamate of aleuritic acid by crystallization. The synthesis of the compounds were confirmed by their respective IR Spectra. Purity of the compounds were routinely checked by thin layer chromatography.

2.2 Surface coating and Use diversification

2.2.1 Development of surface coating formulations based on shellac synthetic resin/polymer blends

Blending of shellac with rosin was done at seedlac stage to see the effect of adulteration of rosin on shellac and changes in the physico-chemical properties of shellac over a period of time. Button lac of four different compositions of shellac and rosin blends were made by the local manufacturer (Fig. 25). Physico-chemical properties like flow, life under heat, colour index, acid value, saponification value, wax content and impurity of the blended products were determined. It was observed that by increasing the quantity of rosin in the blended products, flow, life under heat and acid value increases while colour index, wax content, saponification value and impurity decreases. Flow (fluidity) and life under heat of blended compositions increased about 65% and 115% respectively to that of pure shellac by replacing

30% shellac with rosin. Decrease in impurity and wax content with increasing rosin ratio may be because of absence of impurity and wax in rosin. Colour index decreases with increasing ratio of rosin, because of pale colour of rosin. Blending of shellac with rosin was studied with the help of Differential Scanning Calorimetry (DSC). It was observed from the spectra that peaks of shellac broadened and flattened by reacting with rosin and fully disappeared as concentration of rosin is increased, indicating cross-linking reaction between shellac and rosin at melt temperature.

Samples of shellac and rosin blends were further studied for their different physico-chemical properties after an interval of four months during storage. Except flow, no appreciable change in the properties of shellac and shellac, rosin blends were observed. It was observed that flow of shellac (100%) decreased by 17% over a period of four months while 26%, 31% and >31% decrease in flow was observed in shellac : rosin blends of 70:30, 50:50 and 40:60 respectively (Table 22).

Table 22. Physicochemical properties of shellac rosin blends

		Shellac (100%)	S : R (70:30)	S : R (50:50)	S : R (40:60)
Impurity (%)	I	1.05	0.76	0.61	0.50
	II	1.05	0.78	0.70	0.60
Wax (%)	I	3.25	2.30	1.98	Could not be detected
	II	3.20	2.38	2.00	Could not be detected
Flow (mm)	I	69	113	>125	>125
	II	57	84	86	86
Life (min.)	I	62	133	>150	>150
	II	56	130	>150	>150
Colour index	I	8.0	5.0	4.0	3.6
	II	8.0	5.5	4.5	4.0
Acid value	I	69.00	102.7	118.96	127.7
	II	69.06	102.2	119.00	127.7
Sap. Value	I	227.5	220.0	209.0	208.0
	II	226.0	220.8	208.2	206.9

I –Initial values, II- Values after interval of four months

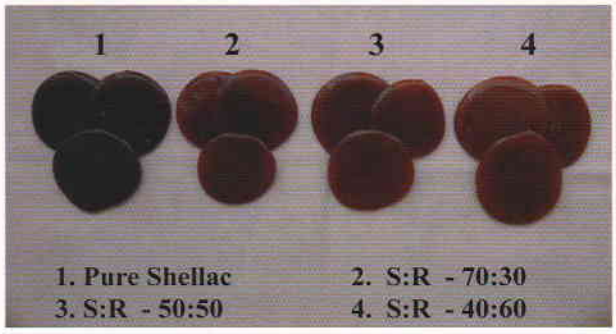


Fig 25. Button lac of different compositions

Blending of Shellac with Novolac

Attempts were made to blend shellac with novolac (a synthetic resin-formed by the condensation of phenol and formaldehyde under acidic conditions) in order to achieve improved properties in resultant products as compared to pure shellac and novolac. Blending of shellac with novolac was done in solution medium at ambient temperature. It was observed that shellac is compatible with novolac. Various combinations of shellac-novolac blends were tried and their surface coating properties like heat and water resistance, gloss, scratch hardness, flexibility and impact resistance were studied as per standard procedure. It was observed that except gloss, all the properties of shellac were deteriorated by blending with novolac. As the ratio of novolac was increased, gloss of blended products increased but resistance to water and heat decreased. Films of blends developed on glass slides blushed early compared to those of pure shellac. Scratch hardness decreased with the increase in concentration of novolac. No marked change in impact resistance and flexibility was observed after blending with novolac.

However, when the films were baked at elevated temperature (at 150±5^{0}C for 15 min), improvement in the properties of blended products was observed. No effect of water was noticed on the films of shellac novolac blends (up to 50:50) till 7 days. Scratch hardness and gloss was also improved as compared to unbaked films of the same compositions.

Development of shellac based dental plate

Dental base plates are used to replace missing teeth just like a false teeth. The plates are used as an intermediate in prosthesis. After checking in the patient's mouth and possible corrections, the base plates are replaced with synthetic resins. The base plates are plastic compositions comprising

of shellac, fillers and colouring matter. The base plates can be easily softened over a flame and moudeled to the desired shape. Upon cooling, the base plate retains its shape to form a strong and dimensionally stable intermediate base for the prosthesis.

A number of different shellac based compositions of dental plate samples were developed and their properties were evaluated (Fig 26). Encouraging results were obtained after testing of the samples. Further, efforts were made to develop the base plates in commercial system of manufacturing to see its commercial feasibility. The plates were developed through a firm in Delhi and twenty three tests like heat stability, colour stability, solubility, resistance to climate changes, strength of the plates, plates softening, mouldability etc. were carried out. The properties of the plates were found to be very good. Storage stability test (shelf life) of the plate samples is being studied. The firm desired for transfer of its technology.

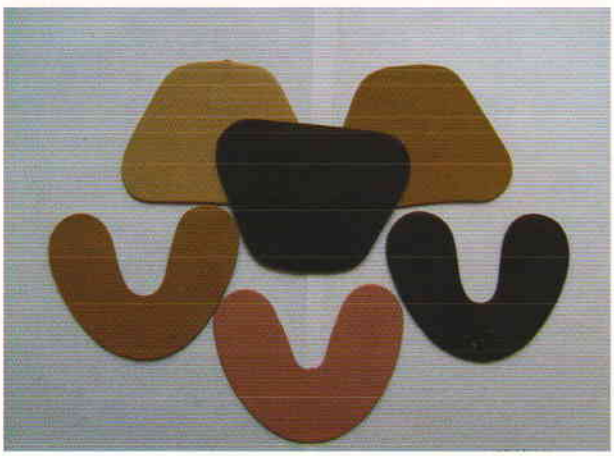


Fig 26. Dental plate

2.2.2 Documentation and characterization of physico-chemical properties of plant based gums of commercial importance

Documentation of information available on physico-chemical properties from literature:

Gum ghatti : Gum *ghatti* also known as Indian gum, is an exudate from *Anogeissus latifolia* tree. It occurs in rounded tears 0.5-1.0 cm in diameter or larger vermiform varying in colour from nearly white to dark brown.

Analysis of gum gave moisture 15.8%; pentosan 26.3%; methyl pentosan 7.6%; galactan 16.4%; N 0.99%; ash 3.0% and riboflavin 68.92 µg/g. It has a molecular weight of approximately 12,000. The gum can be used as a source of L-arabinose. The gum yields 28.2% of furfural (dry basis).

Gum *ghatti* is not completely soluble in water and insoluble in 90% alcohol. In solution the molecules may have an overall rod shape of 1% dispersion of the gum has a pH of 2.63 and no buffering activity. The viscosity of solutions of concentrations 1%, 5% and 10% are 2,288 and 2,444 centi Poise, respectively at 25^{0}C and 30 rpm. The solutions attain their maximum viscosity at pH 8.0 and drops sharply on both sides. It has good emulsifying properties. It does not form a true gel. Films prepared from gum ghatti dispersions are relatively soluble and brittle. The adhesiveness of gum *ghatti* dispersions is similar to that of gum Arabic and better than those of *babul* and *khair* gum.

Karaya gum : *Karaya* gum or Indian tragacanth is obtained from *Sterculia urens* tree. The gum in the natural state is irregularly shaped pieces, sometimes its appearance is like worm. They are white or pinkish-brown in colour and generally striated. It may contain 12-14% moisture and less than 1% insoluble ash.

Karaya gum is a partially acetylated complex polysaccharide. The molecular weight is around 9,500,000. It contains approximately 8% acetyl groups and around 37% uronic acid residues. Its acid number has been found to vary from 13.4 to 22.7. The molecular structure is still incompletely known.

It absorbs water very rapidly and forms viscous dispersions at low concentrations. Normal viscosities of gum *karaya* dispersions range from about 400 centi Poise for a 0.5% concentration to 10,000 centi Poise for a 3% dispersion. In dilute solutions up to 0.5% the viscosity increases linearly with concentration. Thereafter, gum *karaya* dispersions behave as non-Newtonian solutions. The swelling behaviour of gum *Karaya* is caused by the presence of acetyl groups in its structure. Chemical de-acetylation through an alkali treatment results in a water-soluble gum.

The normal pH of 1% gum *karaya* dispersion is about 4.5-4.7. De-acetylation occurs above pH 8, resulting in an increase in viscosity and degree of ropiness. Because of the high uronic acid content, gum *karaya* resists hydrolysis in 10% hydrochloric acid solution at room temperature for at least 8 h.

The viscosity development depends on particle size, the smaller the particle size, the higher the viscosity of gum solution. Gradual increase in temperature from 20 to 85^{0}C of fully hydrated gum *karaya* decreases the viscosity. Boiling reduces the viscosity of the solutions. Solubility of gum increases along with the reduction in viscosity by cooking its suspension under pressure. In this manner, solutions of concentrations as high as 15 to 18%, can be prepared. The viscosity decreases upon the addition of acid or alkali.. The viscosity of the solution remains constant for several days. It loses its viscosity-forming ability, when stored in dry state; the loss is greater for a powdered material than for a crude gum. Cold storage inhibits its degradation. It forms smooth films. The gum exhibits strong wet-adhesive properties at concentrations 20 to 50% in water.

Tamarind gum: Tamarind gum is the pulverized endosperm of the seed of tamarind tree (*Tamarindus indica*). The tamarind fruit contains seeds 33.9% by weight. The seed has about 70% endosperm enclosed by about 30% seed coat or testa. The endosperm powder, also known as tamarind kernel powder (TKP) is creamy white to light tan in colour. It has a fatty taste and odour. It has a tendency to lump. The composition of tamarind kernel, the source of gum, resembles the cereals: 15.4 to 22.7% protein, 3.0 to 7.4% oil, 0.7 to 8.2% crude fibre, 65.1 to 72.2% nonfibre carbohydrates, 2.45 to 3.3% ash, all measured on a dry basis. Tamarind gum polysaccharide, the purified product is a free-flowing, pale, creamy white powder without taste or odour.

Chemically tamarind kernel powder is highly branched carbohydrate polymer. The molecular weight of the polymer is probably between 52,000 and 56,000 though some studies show the weight as high as 1,15,000. Tamarind gum has been hydrolyzed with fungal enzymes as well as with acids. Metal complexes are formed when an aqueous solution of the polysaccharide is treated with a solution of a metal hydroxide or an alkaline salt.

Tamarind gum hydrates quickly in cold water, but reaches maximum viscosity after boiling for 20 to 30 mins. These solutions exhibit a non-Newtonian flow and are pseudoplastic. Tamarind gum polysaccharide is more soluble but still requires some heat. A tamarind gum solution attains its maximum viscosity at pH 7.0 to 7.5. Beyond these limits, whether on the acid or alkaline side, the viscosity falls. A blend of tamarind kernel powder and xanthan gum has been found to have a synergistically high viscosity in aqueous solution. Tamarind seed polysaccharide forms gels over a wide pH range in the presence of high sugar concentrations (765 wt.%), and it can therefore substitute for fruit pectins.

Salai gum: *Boswellia serrata* tree, commonly known as 'Salai' is native to India. The tree on tapping exudes an oleo-gum-resin known as 'Dhup', 'Indian Frankincense', 'Indian olibanum' or Salai guggal'. It is light yellowish to brownish yellow to brown in colour. The gum oleo-resin consists of essential oil, gum and terpenoids. The terpenoid portion contains the boswellic acids. The average composition is moisture 10-11%; volatile oil 8-9%; rosin 55-57%; gum 20-30%, insoluble matter 4-5%. The constituents of gum oleo-resin can be separated either by steam distillation or solvent extraction followed by steam distillation.

The physico-chemical properties of the gums separated by (I) steam distillation and (II) solvent extraction followed by steam distillation are respectively as follows : yield 30.0% and 34.0%; moisture content, 4.0 and 8.5%; Petroleum ether : chloroform (1:1) extract 4.65% and 10.6%; crude fibre 3.42% and 3.95%; Ash content 7.52% and 8.29%; viscosity (15% solution by Red Wood Viscometer), 85 seconds and 150 seconds; adhesiveness good and very good; constituents of sugars glactose, arabinose in both the gums.

Analysis of purified gum gave acid insoluble ash (0.85%), Nitrogen content (0.75%), methoxy value (3.8%), Pentosan content (18.88%), equivalent weight 844, specific rotation +35^0 and uronic acid anhydride (30.9%). Hydrolysis of the pure gum yields mainly pentoses (65% as arabinose) with a high proportion of arabinose . Galactose and xylose are present only in small quantities. The gum, insoluble in alcohol forms a thick mucilage with 3 parts of water. A paste of 25% solution has shown excellent adhesive property to paper slip.

Study on physicochemical properties

The physico-chemical properties of different gum samples were studied. The results of preliminary measurements are given in Table 23 and 24.

Table 23. Physicochemical properties of natural gums

Sl. No	Gums	Bulk density of powdered sample (g/cc)	Moisture content at 65% RH (%)	Loss on drying (110°C) (%)	Acid insoluble matter (%)	Ash content (%)	Nitrogen content (%)	Dielectric strength (Breakdown voltage) (Kv/cm)
1	Babul gum	0.88	6.09	8.50	0.86	1.17	0.00	18.7
2	Khair gum	0.91	6.42	8.86	0.64	2.05	0.00	18.4
3	Karaya gum	0.89	8.80	11.27	2.40	1.50	0.00	17.6
4	Gum ghatti	0.93	6.07	8.02	2.72	2.10	0.55	15.8
5	Salai gum*	0.74	5.82	6.72	20.2	-	-	-
6	Tamarind gum	0.61	4.58	5.60	23.5	3.70	2.74	13.1

Gum component of oleo-gum-resin

Table 24. Adhesive property of natural gums.

Sl. No.	Gum samples MPa	Stress at Auto Break (J)	Energy to Break Point (J)	Strain at Auto Break (%)
1	*Babul* gum (*Acacia nilotica*)	31.886	0.182	0.773
2	*Khair* gum (*Acacia catechu*)	31.498	0.254	1.013
3	*Karaya* gum (*Sterculia urens*)	39.254	0.361	1.173
4	Gum *ghatti* (*Anogeissus latifolia*)	37.066	0.496	1.337
5	Salai gum* (*Boswellia serrata*)	17.309	0.047	0.389
6	Tamarind gum (*Tamarindus indica*)	28.281	0.128	0.645

*Gum component of oleo-gum-resin

Perusal of data from Table 23 indicates that at 65% R.H., the moisture content and loss on drying are comparatively more in *karaya* gum. The gum component of *Boswellia serrata* and tamarind gum show high value of acid insoluble matter. Tamarind gum also shows comparatively high value of nitrogen content. Table 24 shows the adhesive properties of different gums. The results indicate that *karaya* gum and gum *ghatti* have better adhesiveness.

The wide angle x-ray diffractograms of the above gum samples were studied. The diffractograms in general, show halos around 20~40 indicating their amorphous structure (Fig 27).

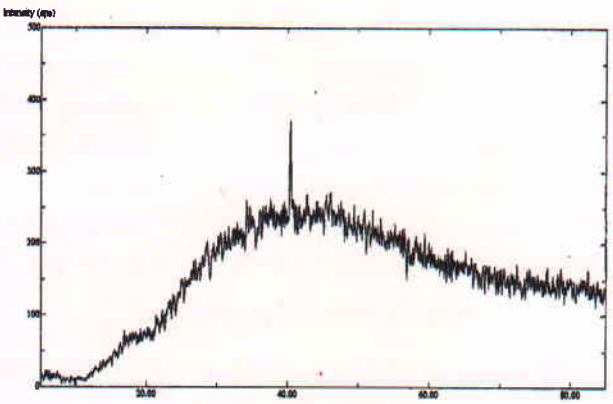


Fig 27. X- ray diffractograms of different gums

2.2.3 Preparation and market evaluation of heat and water proof shellac varnish for wooden surface and air-drying type shellac based glazing varnish.

The above project was undertaken under revolving fund scheme of the Institute, to popularize the products developed by the division and assess the response of the users.. Lac Wood Shine (earlier known as melfolac) 75.2 lit (Rs.7990) and Lac Glaze (earlier known as multi purpose glazing varnish) 12.0 lit. (Rs.2280) was sold from different platforms. Practical demonstrations were carried out with a view to popularize both the lac based varnishes at various places such as at the offices of Director (Works), ICAR, New Delhi, Regional Representative for South Asia, World Agro-forestry Centre, New Delhi; M.D. JHASCOLAMPF, Ranchi; Second-in-Command, Deep Ordnance Unit No.23, Namkum, Ranchi and proprietors of Wooden furniture/metal ware shops at Ranchi. Popularization drive for varnishes amongst the proprietors of Wooden furniture/ metal ware shops in Saharanpur, Moradabad and Bareilly (Uttar Pradesh) was also undertaken. A small model door of 1x1/2 ft. was prepared and varnished with Lac Wood Shine for display purpose.

Comparative evaluation of the properties such as heat resistance, water resistance, gloss, drying time, acid value, scratch hardness and flexibility of marketed products like Wudfin and Touch Wood *vis-à-vis* our Lac Wood Shine and Lac Glaze was carried out. It has been found that properties like water resistance, gloss, acid value and scratch hardness of Touch Wood is better than Lac Wood Shine and are in the following order :- Touch Wood>Lac Wood Shine>Wudfin.

2.2.4 Comparative performance of water soluble lac varnishes and their keeping quality by using different alkalies.

Treatment of water soluble lac based varnishes with urea as well as thio-urea

Water soluble lac varnishes based on ammonia, morpholine, triethanolamine and borax using ordinary shellac in place of dewaxed lac were prepared. Surface coating properties of films were studied after treatment of the varnishes with 3%, 4% and 5% urea as well as thio-urea on the wt. of shellac. Before testing the film properties of above resultant varnish (coated) M.S. panels and glass slides were baked at 100±2°C for one and half an hour in an oven. The average film properties of all the above varnishes using various proportions of urea as well as thio-urea are mentioned in Table 25-28.

It has been observed that there was an improvement in the water resistance property of all the varnishes up to 7 days except borax based varnishes. Films of borax based varnishes leached out from the glass slides as they came into contact with water. Impact resistance failed for all the varnishes. Scratch hardness varied from 1.800 kg to 1.900 kg in case of 3% urea treated varnishes and was above 2.000 kg for 3% thio-urea treated varnishes. In case of 4% and 5% urea as well as thio-urea treated varnishes the scratch hardness varied from 0.800 kg to 2.000 kg. Flexibility property passed for all the resultant varnishes. The gloss was found to be maximum 85% in case of triethanolamine based varnish treated with 4% thio-urea and minimum 16% for borax based varnish treated with 3% urea on the wt. of shellac. Again 3% urea as well thio-urea on the wt. of shellac has been observed to possess better properties in comparison with the other percentages of urea and thio-urea. Cost calculated to be the lowest (Rs.39/lt) for ammonia based 3% urea treated varnish while the highest cost (Rs.57/lt) in case of triethanolamine based water soluble lac varnish treated with 5% thio-urea on the wt. of shellac.

Table 25. Properties of varnish consisting 3% urea on the wt. of shellac.

Formulation	Properties					
	Water resistance	Impact resistance	Scratch hardness	Flexibility	Gloss %	Cost of varnish/ litre (Rs.)
Ammonia	No effect up to 7 days	FAIL	1.800 kg	PASS	51	39
Morpholine	No effect up to 7 days	FAIL	1.850 kg	PASS	75	48
Triethanolamine	No effect up to 7 days	FAIL	1.900 kg	PASS	62	52
Borax	Leached out the film within half an hour	FAIL	1.850 kg	PASS	16	51

Table 26. Properties of varnish consisting 4% urea on the wt. of shellac.

Formulation	Properties					
	Water resistance	Impact resistance	Scratch hardness	Flexibility	Gloss %	Cost of varnish/ litre (Rs.)
Ammonia	No effect up to 7 days	FAIL	1.450 kg	PASS	56	39
Morpholine	No effect up to 7 days	FAIL	1.150 kg	PASS	61	48
Triethanolamine	No effect up to 7 days	FAIL	0.800 kg	PASS	50	52
Borax	Leached out the film within half an hour	FAIL	0.800 kg	PASS	16	51

Table 27. Properties of varnish consisting 5% urea on the wt. of shellac

Formulation	Properties					
	Water resistance	Impact resistance	Scratch hardness	Flexibility	Gloss %	Cost of varnish/ litre (Rs.)
Ammonia	No effect up to 7 days	FAIL	0.850 kg	PASS	38	40
Morpholine	No effect up to 7 days	FAIL	1.300kg	PASS	58	49
Triethanolamine	No effect up to 7 days	FAIL	2.000 kg	PASS	38	53
Borax	Leached out the film within half an hour	FAIL	1.100 kg	PASS	21	52

Table 28. Properties of varnish consisting 3% thio-urea on the wt. of shellac

Formulation	Properties					
	Water resistance	Impact resistance	Scratch hardness	Flexibility	Gloss %	Cost of varnish/ litre (Rs.)
Ammonia	No effect up to 7 days	FAIL	Above 2.000 kg	PASS	65	41
Morpholine	No effect up to 7 days	FAIL	Above 2.000 kg	PASS	76	50
Triethanolamine	No effect up to 7 days	FAIL	Above 2.000 kg	PASS	68	54
Borax	Leached out the film within half an hour	FAIL	Above 2.000 kg	PASS	17	53

2.3 Processing and Storage

2.3.1 Establishment of commercially viable pilot plant for preparing pure/food grade lac dye

Installation of pilot plant of pure lac dye, including insulation of acidification and crystallization tank and chilled water circulation pump has been completed. The testing of crystallization unit was carried out for checking its ability to maintain lower temperature and to maintain the temperature below 10°C inside the unit, when room temperature was higher (37°C).

A trial run was carried out on the pilot plant for the preparation of pure/food grade lac dye. The wash water (3000 liters) from 200 kg *kusmi* sticklac was collected, acidified in acidification tank, allowed to settle and decanted. The decanted water was filtered through sparkler pressure filter and collected in processing tank where calcium salt of lac dye was precipitated and allowed to settle. The supernatant liquid was decanted and the calcium salt was filtered and washed. The calcium salt was transferred to crystallizing tank, where it was acidified and kept for a week at (5±2°C). The dye (technical grade) thus obtained was filtered under vacuum and washed. Technical grade lac dye (yield 430g, 0.21% on the wt. of sticklac) was further dissolved in alkaline water in a dissolution tank and the insolubles were filtered off. The filtrate was acidified to pH 2.0 and filtered again and the filtrate brought to crystallization tank where it was cooled to 5°C and further acidified to pH below 2.0 and kept for crystallization for a week. The pure dye was vaccum filtered, washed and dried. The yield of pure lac dye was 130g, 25% on the wt. of technical grade lac dye. The pure dye is soluble in Dimethyl formamide (DMF). The dye has ash content 0.87%; volatile matter 11.37% at 135°C, solubility in water 0.13g/100g water at 35°C, melting point 238°C with charring. Its absorption maxima are at 291.2 and 489.5 nm in water.

Another sample of commercial lac dye from Tajna Shellac Pvt.Ltd. , Khunti was procured and purified and both the sample were sent to Sriram Institute for Industrial Research for estimation of metals, which are shown in Table 29.

Table 29. Presence of heavy metals/non metals in lac dye

Metals	Pure from pilot plant in ppm	Purified dye (lab) from Tajna Shellac Pvt.Ltd., khunti, in ppm
Nickel	25.5	3.8
Lead	17.3	12.0
Chromium	261.1	18.0
Magnesium	26.4	5.4
Iron	1072.0	44.8
Arsenic	0.03	0.03
Cadmium	0.09	BDL*
Mercury	BDL*	BDL*

* Limit of detection 0.02 ppm

Heat stability of pure grade lac dye

Study on heat stability of lac dye was carried out in buffer solution at pH-3, 5, 7, and 8 and temperatures 60°C, 70°C and 80°C in hot air oven i.e. using indirect heating. The concentration of lac dye in the solution was 0.06 mg/ml and buffered with citric acid and sodium hydrogen phosphate (Na_2HPO_4). It was observed that lac dye solution was stable at pH 3 and 5 up to 80°C (tested for two hours) but at pH 7 and 8 it was not stable. The rate of degradation increased with increasing pH and temperature. Therefore, it is concluded that lac dye degradation is more depended on pH than temperature.

The same study was also carried out by direct heating using water bath up to 72 hr at pH 3, 5, 6, 7 and 8 and at temperatures 60, 70 and 80°C.

Lac dye solution in buffer was found to be stable at pH 3 and 5 before and after heat treatment but not in the case of pH 7 and 8. Degradation trend of lac dye was observed to be similar to the case of indirect heating.

Use of Lac dye as food colour in meat product

The lac dye, a natural colour is reported to be used as food additive in meat products. Keeping this in view, an experiment was conducted to evaluate the effect of lac dye in emulsion based meat product namely, chicken nugget. Total ten formulations were prepared to evaluate the effect of lac dye as food additve. The quantity of lac dye was varied from 4 ppm to 100 ppm with a control (having no additive at all) and a standard (having sodium nitrite as additive). Studies were carried out using Lovibond tintometer and sensory evaluation scores, the result indicated that addition of dye between 10 to 25 ppm in the emulsion is appropriate for chicken nugget. Microbiological study of the samples revealed that lac dye gave better result in comparison to sodium nitrite against bacterial growth in both emulsion and cooked product.

2.3.2 Storage loss assessment for lac and lac based products

Different quality parameters *viz.* moisture content, hot and cold alcohol insolubles, heat polymerization time, flow, rate of filtration, colour index and surface coating properties of sticklac (*ari* and *phunki*), seedlac and shellac samples were measured at an interval of 3 months during storage under different conditions. Sticklac samples were stored under four different methods *viz.* spreading on earthen floor (EF), spreading on cemented floor (CF), inside gunny bags(GB) and in plastic bags (PB). Similarly, seedlac was stored on cemented floor (CF), inside gunny bags (GB), inside plastic bags (PB) and inside metal containers (MC), where as shellac was stored under five different methods *viz.* spreading on cemented floor (CF), inside gunny bags (GB), inside gunny bags with cotton lining (GBc) , in plastic bags (PB) and under cold storage (CS).

The changes in different parameters of sticklac with time for different methods of storage are depicted in Figure 28. It was observed that hot and cold alcohol insolubles increased with time for all the methods of storage. Hot and cold alcohol insolubles were found higher in samples stored in plastic bags and on earthen floor compared to other methods of storage. Very little difference in the value of flow was observed between different methods after one year of storage. Sticklac samples stored on earthen floor exhibited better life and colour of products. More degradation in properties was observed in case of *phunki* sticklac compared to *ari* sticklac

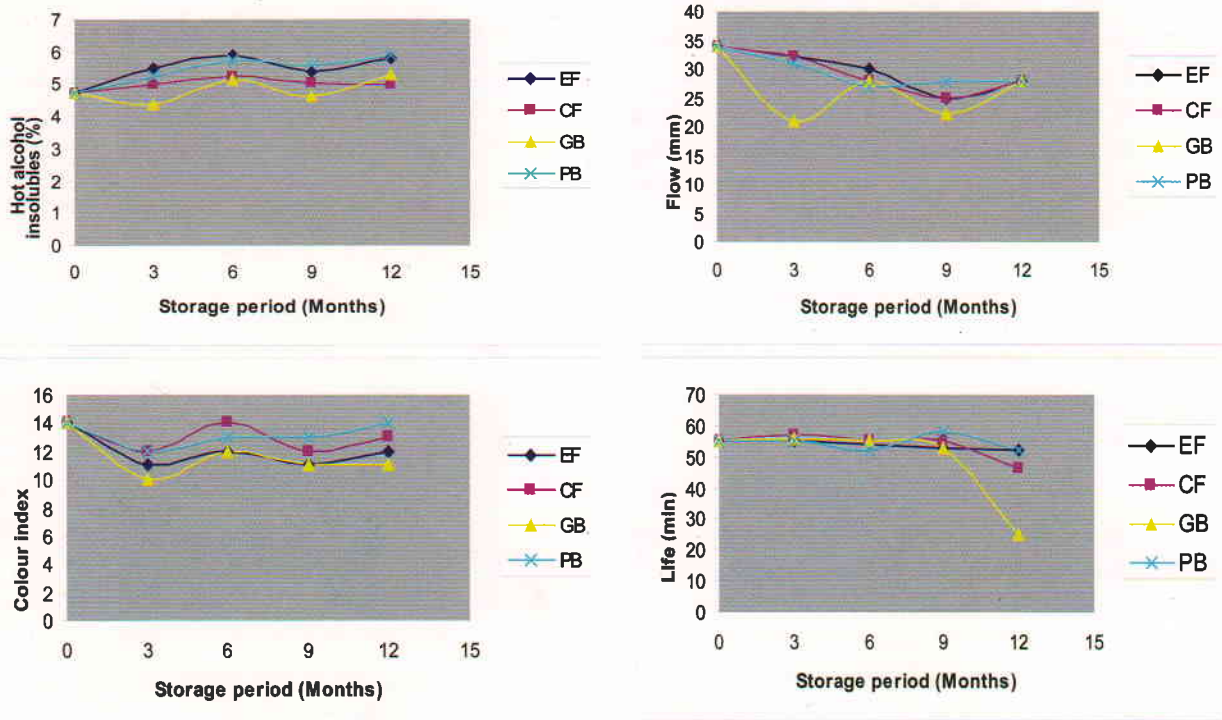


Fig 28. Changes in different properties of sticklac (ari) with time during storage

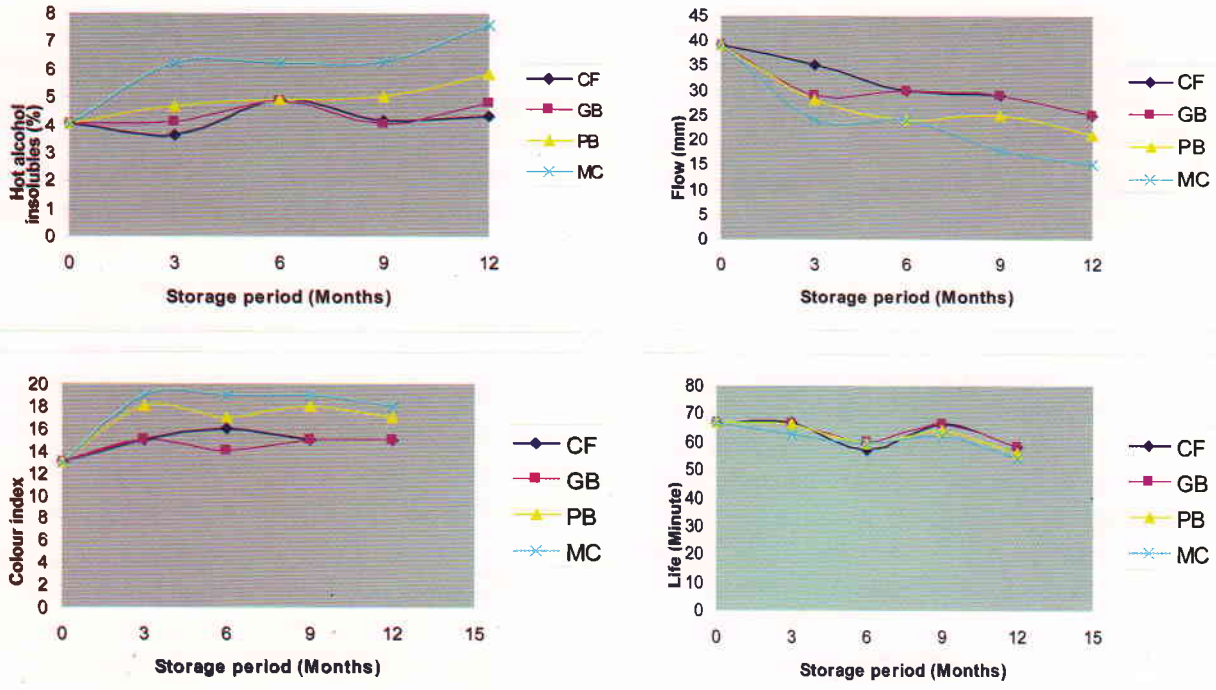
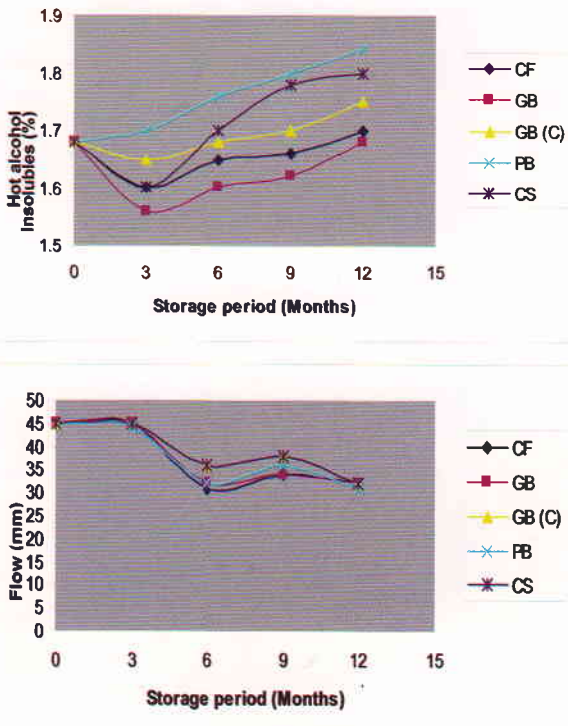


Fig 29. Changes in different properties of seedlac with time during storage

Table 30. Surface coating properties of shellac after 1 year of storage

Parameters	Storage methods				
	CF	GB	GB(C)	PB	CS
Gloss	9.7	10.1	11.8	16.8	6.2
Scratch hardness	600	500	600	400	300
Impact resistance	Fail	Pass	Pass	Pass	Fail
Water resistance	Fail	Fail	Fail	Fail	Fail
Heat resistance	Fail	Fail	Fail	Fail	Fail
Flexibility	Flexible	Flexible	Flexible	Flexible	Flexible

Fig 29 shows the variation in different quality parameters of seedlac during storage. The figure indicates that that the qualities of seedlac samples stored on cemented floor and inside gunny bags were better than those of other samples during storage. Seedlac stored on cemented floor retained maximum properties after 1 year of storage. Storage in metal container resulted in maximum loss in properties. In case of shellac, life (min) and flow (mm) of samples stored under cold storage in refrigerator and inside gunny bags (with cotton lining) were found higher than other samples after 1 year of storage .



Different surface coating properties of shellac samples are given in Table 30. Gloss was found highest in samples stored in plastic bag and lowest in cold stored samples. Scratch hardness was also lowest for cold stored samples. Impact resistance failed for cold stored samples and samples stored on cemented floor, wheras it passed for other three methods

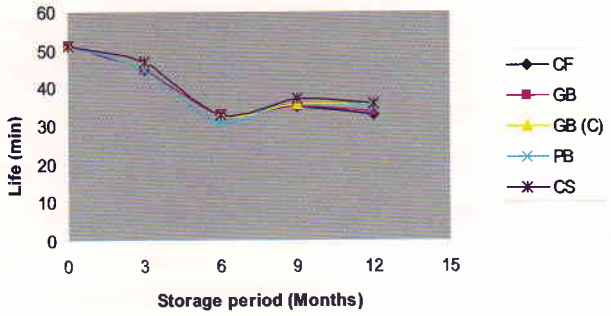


Fig 30. Changes in properties of shellac with time during storage

2.3.3 Establishment of commercially viable pilot plant of aleuritic acid for training, demonstration and process refinement

Performance evaluation of the aleuritic acid pilot plant (capacity: 2 kg/batch) was carried out. The functioning of various equipments in the pilot plant *viz.*, dissolution vessels, filter presses, tray dryer, pulverizer etc. was checked and suitable modifications were made wherever required. The speed (rpm) of the feed pumps in the filter presses was reduced from 135 rpm to around 75 rpm for proper filtration. Trial runs were conducted on the pilot plant to evaluate its performance. Aleuritic acid (technical grade) was successfully produced in the plant with a yield of approximately 16.5% of the weight of seedlac. Melting point of the product was determined and found to be around 92-93°C.

In subsequent trial experiments, aleuritic acid (technical grade) was manufactured in the pilot plant using cotton filter cloths. The saponification time was 10 days and no agitation was provided during the period. The yield of aleuritic acid (technical grade) was approx. 19% of the weight of seedlac. The melting point and acid value of aleuritic acid was found to be 92-93°C and 178.6, respectively and it's purity was around 96.5% (based on acid value).

Fig 31. Training on Aleuritic acid production in the pilot plant

Training was imparted to an entrepreneur from Purulia (West Bengal) on production of aleuritic acid in the pilot plant (Fig 31).

2.3.4 Design and development of seedlac dryer

Design and development of Centrifugal Seedlac Drier - A centrifugal drier (Fig 32) of capacity 10 kg/batch has been designed and fabricated and tested for its suitability to fit in the package of machines of Small Scale Lac Processing Unit (100 kg/day). The drier was able to brought moisture content from 35% to 10% in 2 minutes at 570 rpm.

Fig 32. Centrifugal drier

Performance Evaluation of centrifugal seedlac drier: The developed centrifugal seedlac drier was tested at different drum speeds (475, 576, 712.5 and 855 rpm) for drying washed lac. For conducting the trail 10 kg seedlac sample was taken and its moisture content was determined. The sample was immersed in water in a tub for one hour. The wet seedlac was transferred in a cloth bag and water was allowed to drain. When the self draining of water stopped, sample in bag was transferred to the drier for drying. The drier was operated and sample mass was determined after operating drier for at every minute for 10 minutes. The moisture content of the samples were then determined for each observation which is presented in the Table 31 and Fig. 33.

As the drum speed is increased the moisture removal rate also increases, but the difference is not much i.e. after 1 minute as drum speed increases from 475 to 855, the moisture removal per cent increased from 14.5 to 19.2 %. However, at higher drum speed there is increase in vibration and machine needs to be designed and fabricated more precisely. Hence, the drum speed of 576 rpm is recommended without compromising much in moisture removal rate but reducing vibration level in machine and simpler design and fabrication.

It can be observed from Table 31 and Fig. 33 that even after 1 minute of operation the moisture content of the seedlac is brought down from initial 27-29 % to 9.3-12.6 %. Thus such drier will be very helpful in reducing the drying time requirement of seedlac.

Table 31. Effect of centrifugal drier drum speed on moisture removal of washed lac

Time, min	Moisture content of washed lac, % (d. b.) at different drum speed			
	475 rpm	576 rpm	712.5 rpm	855 rpm
0	27.1	28.9	28.8	28.5
1	12.6	11.8	9.6	9.3
2	12.1	11.2	9.2	8.6
3	11.8	10.9	8.9	8.3
4	11.5	10.6	8.7	8
5	11.4	10.4	8.5	7.8
6	11.3	10.2	8.4	7.8
7	11.2	10.1	8.2	7.7
8	11	10	8.2	7.7
9	10.9	9.9	8.1	7.6
10	10.9	9.8	8	7.6

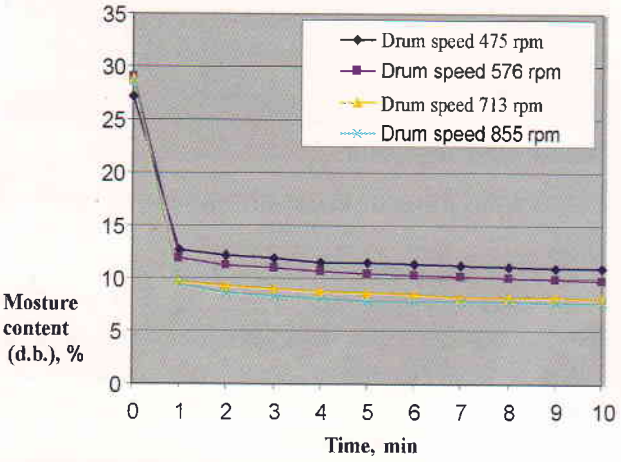


Fig 33. Performance of centrifugal drier

2.3.5 Establishment of pilot plant for dewaxed bleached lac (40 kg cap) for training, demonstration and process refinement.

A pilot plant of bleached lac (Fig 34) of capacity 40 kg/batch has been installed. It consists of dissolution tank, bleached tank, brass wire mesh screen, washing barrel and circulatory pump and a sparkler filter. A trial run on the pilot plant was carried out with 10 kg of seedlac. Problem of choking of valves and difficulty in de-waxing of bleached lac solution was encountered. The wax content of prepared bleached lac was 0.8% (BIS standard – 0.5% max.). Use of sparkler pressure filter during trial was found to bring down the wax content to 0.26%. However, whole lot could not be filtered due to slow rate of filtration and frequent chocking of filters.

Fig 34. Pilot plant of bleached lac

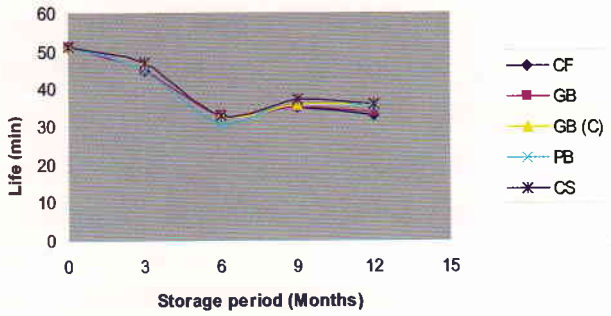


Fig 30. Changes in properties of shellac with time during storage

2.3.3 Establishment of commercially viable pilot plant of aleuritic acid for training, demonstration and process refinement

Performance evaluation of the aleuritic acid pilot plant (capacity: 2 kg/batch) was carried out. The functioning of various equipments in the pilot plant *viz.*, dissolution vessels, filter presses, tray dryer, pulverizer etc. was checked and suitable modifications were made wherever required. The speed (rpm) of the feed pumps in the filter presses was reduced from 135 rpm to around 75 rpm for proper filtration. Trial runs were conducted on the pilot plant to evaluate its performance. Aleuritic acid (technical grade) was successfully produced in the plant with a yield of approximately 16.5% of the weight of seedlac. Melting point of the product was determined and found to be around 92-93°C.

In subsequent trial experiments, aleuritic acid (technical grade) was manufactured in the pilot plant using cotton filter cloths. The saponification time was 10 days and no agitation was provided during the period. The yield of aleuritic acid (technical grade) was approx. 19% of the weight of seedlac. The melting point and acid value of aleuritic acid was found to be 92-93°C and 178.6, respectively and it's purity was around 96.5% (based on acid value).

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Performance Evaluation of centrifugal seedlac drier: The developed centrifugal seedlac drier was tested at different drum speeds (475, 576, 712.5 and 855 rpm) for drying washed lac. For conducting the trail 10 kg seedlac sample was taken and its moisture content was determined. The sample was immersed in water in a tub for one hour. The wet seedlac was transferred in a cloth bag and water was allowed to drain. When the self draining of water stopped, sample in bag was transferred to the drier for drying. The drier was operated and sample mass was determined after operating drier for at every minute for 10 minutes. The moisture content of the samples were then determined for each observation which is presented in the Table 31 and Fig. 33.

As the drum speed is increased the moisture removal rate also increases, but the difference is not much i.e. after 1 minute as drum speed increases from 475 to 855, the moisture removal per cent increased from 14.5 to 19.2 %. However, at higher drum speed there is increase in vibration and machine needs to be designed and fabricated more precisely. Hence, the drum speed of 576 rpm is recommended without compromising much in moisture removal rate but reducing vibration level in machine and simpler design and fabrication.

3. TRANSFER OF TECHNOLOGY

3.1 Human Resource Development

3.1.1 Training, demonstration, extension education and information service on lac culture, processing and product development.

The Institute conducted different types of training programme as per need of the stake holders pertaining to scientific lac cultivation, processing and utilization. The Institute continuously assessed the need of stake holders and modified the programmes accordingly. Besides in-campus programme, many field out reach activities in terms of training, technical guidance, lac crop monitoring were also undertaken.

Farmers' and Housewives' training programme

This one-week programme mainly covered lac cultivation, processing at farm level and uses of lac. A total of 876 farmers from 14 districts of four states namely Jharkhand, Orissa, Chhattisgarh and West Bengal participated in this programme. A summary of different programme is given in Table 32. It is evident that maximum participation was from Jharkhand followed by Chhattisgarh, Orissa and West Bengal.

Expert imparting training to the farmers and housewives in IRF

Table 32. **Farmer's training programme on scientific lac cultivation, processing and utilization**

Month	Course No.	Sponsoring Organization	State	Period	No. of participants
January	1	TRIFED, Orissa.	Orissa	14-19 January, 2008	50
	2	TRIFED -Kalamandir, East Singhbhum	Jharkhand	21-25 January, 2008	24
		TRIFED, Purulia	West Bengal	do	7
	3	TRIFED, Sundargarh	Orissa	28 Jan - 2 February, 2008	50
February	4	KGVK, East-Singhbhum	Jharkhand	11-16 February, 2008	18
	5	Chhattisgarh Tribal Development Programme, Pathalgaon, Jaspur	Chhattisgarh	18-23 February, 2008	51
	6	Janamitram Kalyan Samiti, Raigarh	Chhattisgarh	25 Feb-1 March, 2008	38
March	7	DHAN Foundation, Latehar	Jharkhand	10-15 March, 2008	13
		Society for Integrated Development, Ranchi	Jharkhand	do	21
	8	District Co-operative, Department, Ranchi	Jharkhand	17-20 March, 2008	39
April	9	Jan Jagran Kendra, Ranchi	Jharkhand	31 March- 5 April, 2008	23
	10	Jan Jagran Kendra, Ranchi	Jharkhand	15-19 April, 2008	29
		Mahila Jagriti Samiti, Samlong, Ranchi.	Jharkhand	do	40
May	11	District Co-operative Department, Ranchi	Jharkhand	5-9 May, 2008	21
	12	District Co-operative Department, Ranchi	Jharkhand	13-17 May, 2008	15

	13	Chhattisgarh Tribal Development Project, Ambikapur	Chhattisgarh	12-17 May, 2008	17
		Private	Jharkhand	do	2
	14	Jan Jagran Kendra, Ranchi	Jharkhand	26-31 May, 2008	14
June	15	Jan Mitram Kalyan Samiti, Raigarh	Chhattisgarh	9-13 June, 2008	44
		Private	Jharkhand	do	1
	16	VICAS, West Singhbhum	Jharkhand	16-21 June, 2008	36
		Society for Integrated Development, Ranchi	Jharkhand	do	19
	17	Society for Integrated Development, Ranchi	Jharkhand	23-28 June, 2008	8
		TRIFED, Orissa	Orissa	do	39
July	18	TRIFED, Orissa	Orissa	30 June-5 July, 2008	51
	19	VICAS,West Singhbhum	Jharkhand	14-19 July, 2008	35
		Zila Panchayat, Kanker	Chhattisgarh	do	1
		Private	Chhattisgarh	do	2
September	20	ATMA, Jamtara	Jharkhand	1-6 September, 2008	10
	21	Forest Department, Korba	Chhattisgarh	22-27 Sept, 2008	32
		VICAS, West Singhbhum	Jharkhand	do	10
		Private	Jharkhand	do	3
October	22	District Co-operative Department,Ranchi	Jharkhand	20-25 October, 2008	15
November	23	Private	Jharkhand	3-7 November, 2008	2
	24	VICAS, East Singhbhum	Jharkhand	10-15 November, 2008	8
	25	District Co-operative Department, Ranchi	Jharkhand	17-19 November, 2008	32
	26	MECON, Ranchi	Jharkhand	24-29 November, 2008	7
December	27	District Co-operative Dept. Khunti	Jharkhand	15-20 December, 2008	8
	28	Dstrict Co-operative Dept. Khunti	Jharkhand	22-27 December, 2008	18
		Adivasi Chhatra Sangh	Jharkhand	do	13
		Dstrict Co-operative Dept. Ranchi.(MESO.Project)	Jharkhand	do	3
	29	Society for Human Development and Educational Research, Raipur	Chhattisgarh	29 December- 2 January, 2009	7
		Total			**876**

Educational programme on Lac production, processing and uses (One week):

The agriculture graduate students from Allahabad Agricultural Institute (Deemed University), Uttar Pradesh, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh and Mandsaur Institute of Technology, Mandsaur, Madhya Pradesh have undergone one week training in lac cultivation, processing and its utilization (Table 33). A total of 80 students were educated through four courses under this programme.

Table 33. Educational programme (One-week) on lac production, processing and utilization

Course No.	Sponsoring Organization	State	Period	No. of participants
1.	Institute of Agricultural Sciences, BHU, Varanasi	Uttar Pradesh	19-24 May, 2008	15
2.	Allahabad Agriculture Institute (Deemed University), Allahabad.	Uttar Pradesh	26-31 May, 2008	13
3.	Mandsaur Institute of Technology, Mandsaur	Madhya Pradesh	13-18 October, 2008	21
4.	Allahabad Agriculture Institute (Deemed University), Allahabad.	Uttar Pradesh	29 Dec, 08-3 Jan, 2009	31
		Total		**80**

Expert imparting training to the Students in IRF

Expert imparting training to the students for preparation of lac based products

Experts imparting training to trainers of different organizations

Trainer's training programme on scientific lac production, processing and uses

District Rural Agriculture Extension Officers, Agriculture Development Officers and unemployed educated rural youths designated as Lac facilitator, sponsored by Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur have undergone Trainers' training programme on Scientific method of lac cultivation, production, processing and utilization. A total of 366 trainers have completed this course through 18 courses (Table 34).

Table 34. Trainer's training programme on scientific lac production, processing and utilization for Chhattisgarh state

Course No.	Sponsoring Organization	District (Forest Division) - State	Client	Period	No. of participants
1.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Bilaspur, Rajnandgaon , Raipur, Mahasamund	Rural Agricultural Extension Officer & Ag. Development Officers	31Dec,07 -5 January, 2008.	13
2.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Rajnandgaon, Raipur, Bilaspur, Korba	Rural Agricultural Extension Officer & Ag. Development Officers	7-11 January, 2008	12
3.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Rajnandgaon, Raipur, Kabirdham, Surguja	Rural Agricultural Extension Officer & Ag. Development Officers	14-19 January, 2008	22
4.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Raipur, Bilaspur, Surguja, Janjgir	Rural Agricultural Extension Officer & Ag. Development Officers	21-26 January, 2008	18

5.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Raipur, Bilaspur, Surguja, Janjgir, Koriya.	Rural Agricultural Extension Officer & Ag. Development Officers	28 Jan -2 February, 2008.	25
6.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Raipur, Surguja, Janjgir, Koriya, Jashpur, Raigarh	Rural Agricultural Extension Officer & Ag. Development Officers	4-8 February, 2008	29
7.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Surguja, Janjgir, Jashpur, Raigarh	Rural Agricultural Extension Officer & Ag. Development Officers	11-16 February, 2008	17
8.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Korba, Surguja, Jashpur, Raigarh	Rural Agricultural Extension Officer & Ag. Development Officers	18-23 February, 2008	16
9.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Bilaspur, Surguja, Raigarh, Kanker, Dantewara	Rural Agricultural Extension Officer & Ag. Development Officers	25 Feb – 1 March, 2008	11
10.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Surguja, Raigarh, Kanker, Dantewara.	Rural Agricultural Extension Officer & Ag. Development Officers	3-7 March, 2008	15
11.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Korba, Surguja, Kanker.	Rural Agricultural Extension Officer & Ag. Development Officers	10-15 March, 2008	13
12.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Kanker, Surguja, Raipur.	Rural Agricultural Extension Officer & Ag. Development Officers	16-21 June, 2008	5
13.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Bilaspur, Marwahi, Raigarh, Janjgir-Champa Dharamjaigarh Korba, Kathghora	Rural Lac Facilitator (unemployed rural graduates)	3-9 November, 2008	41
14.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Beejapur, Sukhma, Dantewara, Jagdalpur, Rajnandgaon, Durg	Rural Lac Facilitator (unemployed rural graduates)	10-16 November, 2008	35
15.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Mahasamund, Narayanpur	Rural Lac Facilitator (unemployed rural graduates)	17-22 November, 2008	9

16.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Jashpur, Manendragarh, Koriya, South-Surguja, East-Surguja, Kavardha, Dhamtari	Rural Lac Facilitator (unemployed rural graduates)	24-29 November, 2008	35
17.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Raipur, Khairagarh, South-Kondagaon, North-Surguja	Rural Lac Facilitator (unemployed rural graduates)	1-6 December, 2008	20
18.	Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur	Kanker, North-Kondagaon, Narayanpur, Bhanupratapur, Udanti, Mahasamund	Rural Lac Facilitator (unemployed rural graduates)	8-13 December, 2008	30
			Total		**366**

Field out-reach programme:

On - Farm training on scientific cultivation of lac

A total of 18 camps were conducted in collaboration with other organizations in Chhattisgarh, Orissa and Gujarat covering representation of more than 60 villages of seven districts. A total of 2,167 farmers benefitted from this programme. Maximum participation was from Raipur district of Chhattisgarh, followed by Narmada district, Panchmahal district of Gujarat, Balasore district of Orissa, Godhra district of Gujarat, Korba district of Chhattisgarh and Surat district of Gujarat. The details of training programme conducted have been presented in Table 35.

Table 35. On-farm training programme on scientific lac cultivation

Camp No.	District -State	Sponsoring/ Nominating Agency	Venue (Village, Block)	Dated	No. of Participants
1	Godhra- Gujarat	Gujarat Forest Department	Range Forest Office, Godhra	25.01.08	250
2	Panchmahal-Gujarat	Gujarat Forest Department	Range Forest Office, Panchmahal	26.01.08	350
3	Narmada-Gujarat	Gujarat Forest Department	Sagbara, Narmada	27.02.08	210
4	Narmada-Gujarat	Gujarat Forest Department	Sagbara, Narmada	28.02.08	170
5	Surat-Gujarat	Gujarat Forest Department	Visdhaliya, Mandvi, North Forest Range Surat	29.02.08	60
6	Chhattisgarh	MFP, Raipur	Panchayat Bhawan,Cidhkalo, Dharamjaigarh	08.03.08	48
7	Chhattisgarh	MFP, Raipur	Primary, School, Champra, Dharamjaigarh	09.03.08	81
8	Chhattisgarh	MFP, Raipur	Panchayat Bhawan, Tuman	10.03.08	51
9	Chhattisgarh	MFP, Raipur	do	11.03.08	86
10	Chhattisgarh	MFP, Raipur	Community Hall, Durgkondal, East Bhanupratapur	13.03.08	72
11	Chhattisgarh	MFP, Raipur	D.F.O.,Conference Hall,East Bhanupratapur	14.03.08	74

12	Orissa	Mankadpada lac Samabaya Samiti Ltd, M.B.J.	K.C.Pada, Sarat	27.03.08	120
13	Orissa	K.C.Pur Lac Ind.Co-operative Society, Nilgiri, Balasore	Chandan,Chaturi, Jadunathpur, M.B.J.	28.03.08	175
14	Orissa	K.C.Pur Lac Ind.Co-operative Society, Nilgiri, Balasore	Dorkhuli, Nilgiri, Balasore	16.04.08	100
15	Assam	Forest Department	Hojai, Guwahati	07.08.08	50
16		Forest Department	Kukurmara	08.08.08	50
17	Chhattisgarh	Forest Department	Beda, Korba	23.08.08	130
18	Chhattisgarh	Forest Department	Basin, Korba	24.08.08	90
				Total	**2167**

Field educational, motivational and supplementary training programme on lac cultivation

A total of 32 camps were organized in collaboration with NGOs and GOs of different states. A total of 3077 persons mainly farmers representing around 120 villages of 13 districts, benefitted from this programme. The details of training programme conducted have been given in Table 36.

Table 36. On-farm motivational/ supplementary training programme on lac cultivation

Camp No.	District -State	Sponsoring/ Nominating Agency	Venue (Village/Block	Dated	No. of Participants
1.	Dhanbad, Jharkhand.	Forest Dept. Dhanbad	Amghata, Gobindpur	11.03.08	65
2.	Ranchi, Jharkhand.	Akhil Bharat Adivasi Parishad	Saimandir, Lapung	31.03.08	75
3.	Raipur, Chhattisgarh	SIRD, Raipur	Rajnandgaon Zila Panchayat	04.05.08	97
4.	Do	do	do	05.05.08	80
5.	Do	do	Acholi, Dongargarh	06.05.08	100
6.	do	do	Range Office, Khairagarh	07.05.08	75
7.	Kabirdham. Chhattisgarh	SHARD, Raipur	Govt. Primary School, Baijalpur, Bodela Kavardha,	08.05.08	63
8.	Kabirdham Chhattisgarh	do	Sanskritik Bhawan, Kalin, Kukdur, Pandaries	09.05.08	73
9.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Gram Sabha, Bastipali, Gharghora	10.05.08	69
10.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Meeting Place, Bhalmundi, Gharghora	10.05.08	96
11.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Meeting Place Injhar, Semijhar, Tamnar	11.05.08	80
12.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Badpali	01.06.08	10
13.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Bastipali (Gharghora)	02.06.08	200
14.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Balpeda (Dharampur)	03.06.08	20
15.	Dhanbad, Jharkhand	Forest Dept.,	DRDA, Training Hall, Combined building	16.06.08	70
16.	Giridih, Jharkhand	Forest Department	Asthayi Nursery, Bandetad, Rajdhanwur, Giridih	24.06.08	85
17.	Seoni , Madhya Pradesh	Pragya Research Seoni	Kopijhola, Keolari	04.06.08	55

18.	Seoni , Madhya Pradesh	Pragya Research Seoni	Ugadiwada, Keolari Seoni	05.06.08	150
19.	Seoni , Madhya Pradesh	Pragyan Research Seoni	Bichuwa	06.06.08	90
20.	Seoni, Madhya Pradesh	Pragyan Research Seoni	Sitakoh	07.6.08	250
21.	Seoni, Madhya Pradesh	Pragyan Research Seoni	Pawania	08.06.08	35
22.	West Singhbhum, Jharkhand	VICAS, Goelkera	Panchayat Mandal, Goelkera	16.07.08	148
23.	Korba, Chhattisgarh	Forest department	Bela, Korba	23.08.08	130
24.	Korba, Chhattisgarh	Forest department	Basin, Korba	24.08.08	90
25.	Raigarh, Chhattisgarh	Jan Mitram Kalyan Samiti	Jobi, Tanmar, Pussore, Gharghoda,	25.08.08	150
26.	Ranchi, Jharkhand	District Co-operative Office (DCO office)	Barwatoli	14.10.08	100
27.	Ranchi, Jharkhand	DCO, Ranchi	Hardag LAMPS	15.10.08	50
28.	Latehar, Jharkhand	Jharkhand Swabhimani	Nareshgarh	16.11.08	70
29.	West Singhbhum, Jharkhand	ATMA, Chaibasa	ATMA Bhawan, Chaibasa,	19.12.08	51
30.	Mahasamund Chhattisgarh	Forest Department Mahasamund	Forest Training Institute	18.12.08	75
31.	Dhamtari, Chhattisgarh	Forest Department	Dhamtari Training Hall	19.12.08	25
32.	Jagdalpur, Chhattisgarh	Forest Department, Jagdalpur	Van Vidyalaya, Jagdalpur	21.12.08	350
			Total		**3077**

Other Transfer of Technology activities:

Monitoring of *kusmi* lac crop, technical guidance, remedial measures for pest attack, demonstration of inoculation, spraying etc at different locations were carried out in the states of Jharkhand and Chhattisgarh Table 37.

Table 37. Demonstration and other transfer of technology activities related to lac production

Sl No.	District -State	Venue (Village/ Block)	Collaborating Agency	Dated	Purpose
1.	Raigarh, Chhattisgarh	Bhengri Charmar Bastipali Bhalmundi Gharghori	Janmitram Kalyan Samiti	10.05.08	*Kusmi* lac crop monitoring
2.	Raigarh, Chhattisgarh	Darama (Tamnar) Tenda (Gharghora) Sardhap (Gharghora)	Janmitram Kalyan Samiti	02.06.08	*Kusmi* lac crop monitoring on *kusum* tree
3.	Raigarh, Chhattisgarh	Kudumkela (Daramjaigarh)	Janmitram Kalyan Samiti	03.06.08	*Semialata* plantation
4.	Raigarh, Chhattisgarh	Balpeda (Dharamjaigarh)	Forest Department	03.06.08	*Kusmi* lac crop monitoring
5.	Korba, Chhattisgarh	Bela, Korba	Forest Department	23.08.08	*kusmi* lac crop monitoring
6.	Korba, Chhattisgarh	Rita Farm House Non-Birra (Kartala)	Entrepreneur	24.08.08	Monitoring of lac crop on *Flemingia semialata* on commercial scale
7.	Dhanbad, Jharkhand	Ambadih -Dhanbad	Forest Department	31.11.08	Lac crop monitoring on *palas* tree

Training on Product demonstration:

A total of six trainings on different aspects of product demonstration were organized as detailed in Table 38.

Table 38. Transfer of technology for lac based products

Sl No.	Subject	Sponsoring Agency	Duration	Persons
1	Aleuritic Acid	Self	3-11 January, 2008	Shri Manoj Tiwari Bhilai, Chhattisgarh.
2	Bleached lac	Self	3-11 January, 2008	Shri Bharat Kumar Jha, Bhilai, Chhattisgarh.
3	Bleached lac	Self	11-21 February, 2008	Shri Devashish Dutta. Sundar Nagar,H.No.379, Raipur,Chhattisgarh.
4	Aleuritic Acid	Self	10-20 March, 2008	Mr Bishnu Charan Mahato Vill.Bandhdih P.O.Kalimati, Dist.Purulia (W.B.)
5	Isoambrettolide	Self	31 March -11 April, 2008	Mr Bishnu Charan Mahato, Vill.Bandhdih,P.O.Kalimati, Dist.Purulia (W.B.)
6	Testing and analysis of the lac	M/S D.Manoharlal (Shellac) Pvt. Ltd. Sakti	25-30 August, 2008	Sumeet Agarwal S/o Suresh Agarwal.

3.1.2 Enhancing livelihood options for poor tribal families of the Jharkhand state through capacity building in cultivation of lac and its value addition (JLDS)

A. Training

- One-Week training has been conducted in one batch for 9 extension cadres sponsored by different NGOs (Table 39).
- 22 On-farm trainings have been organised for 1995 beneficiaries of the project (Table 40).

Table 39. One-week training for beneficiaries sponsored by different NGOs

Sl. No.	Name of the NGO	Duration	No. of Participants
1.	PRADAN, Gumla	31.12.07-5.1.08	5
2.	SEEDS, West Singhbhum	- Do -	2
3.	AID, Khunti	- Do -	1
4.	AGRAGATI, Hazaribagh	- Do -	1
	Total		**9**

Table 40. On farm training at various villages for beneficiaries sponsored by different NGOs.

Sl. No.	Venue / Place	Name of the NGO	Date	No. of families participated
1.	Sonse School, Chandwa, Latehar	SARDA	21.1.08	70
2.	Middle School, Kita, Latehar	SARDA	21.1.08	75
3.	Banhaldi, Club-Hall, Latehar	SARDA	22.1.08	75
4.	Ranchi Middle School, Latehar	SARDA	22.1.08	65
5.	Kudadih, Bandgaon, W. Singhbhum	SEEDS	1.3.08	100
6.	Kudadih, Bandgaon, W. Singhbhum	SEEDS	1.3.08	100
7.	Tokad, Bandgaon, W. Singhbhum	SEEDS	3.3.08	75
8.	Tokad, Bandgaon, W. Singhbhum	SEEDS	3.3.08	75
9.	RC Mission Compound (E), Khanjaloya, Simdega	Gram Jan Jagriti Manch	14.3.08	100
10.	RC Mission Compound (W), Khanjaloya, Simdega	Gram Jan Jagriti Manch	14.3.08	100
11.	Upper Primary School, Pakar tand, Simdega	Gram Jan Jagriti Manch	15.3.08	50
12.	Training Hall, Pakar tand, Simdega	Gram Jan Jagriti Manch	15.3.08	50
13.	Samudayik Bhawan, Rampur, Gumla	Gram Jan Jagriti Manch	19.3.08	100
14.	Samudayik Bhawan, Chainpur, Gumla	Gram Jan Jagriti Manch	19.3.08	100
15.	GEL Church, Lumbai, Simdega	Sunita Kala Niketan	26.5.08	100
16.	Jampani, Simdega	Sunita Kala Niketan	26.5.08	100

17.	Utkramik Prathmik Vidyalaya, Dhankara, Latehar	GVT India	16.6.08	150
18.	Utkramik Prathmik Vidyalaya, Sisi, Latehar	GVT India	16.6.08	100
19.	Utkal kranti Madhya Vidhyala, Chhotaki, Dundil, Kaporfutawa, mandu, Ramgargh	AGRAGATI	24.6.08	100
20.	Utkramit High School, Tubil (Arki), Khunti	AID	26.6.08	100
21.	Training cum production centre, Arki, Khunti	AID	26.6.08	60
22.	Kolhan Mahila Sangthan Office and training Centre, Goelkera, E. Singhbhum	Kolhan Mahila Sangthan	1.11.08	150
	Total			**1,995**

B. Action Research

1. Intensive lac cultivation on bushy host-plants

Kusmi broodlac (40.0 kg) was inoculated in July 2008 on about 1200 *semialata* plants in Kharsidag village in the field for demonstration of *kusmi* lac cultivation under JLDS in collaboration with SEEDS, an NGO. The crop is progressing well (Fig. 35). One farmer at Chitramu, Khunti trained under the project has inoculated lac on *semialata* on his own this year after successful demonstration of technology under JLDS last year. About 10,000 sapling of *semialata* were raised and sold by him to farmers / NGOs after learning the nursery raising techniques.

Fig. 35. Lac crop on Flemingia semialata at Kharsidag village

2. Raising plantation of alternate / high yielding host plants for evaluation at Ranchi conditions

Plantations of *Albizia procera, Prosopis juliflora* and *Zizyphus mauritiana* raised at IRF under Jharkhand Lac Development Scheme have shown a very healthy and promising growth. One year old saplings of these host-plants raised in the nursery in poly bags were transplanted in the field during July 2007. Average height of the sampled plants in July 2008 was observed to be 3.87 m in *A. procera* and 1.64 m in *P. juliflora.* Growth of *Z. mauritiana* was also very good.

Fig. 36. Lac crop on two year old Prosopis juliflora at IRF

Kusmi broodlac was inoculated on two year old unpruned plants of *A. procera* and *P. juliflora* in July 2008. The crop is satisfactory in upland plot on *P. juliflora* (Fig. 36) but twigs of the plants in the low land dried under water logged condition affecting lac culture. While in case of *A. procera,* lac insect showed the preferential tendency of settling on petioles (Fig. 37) than on twigs. Moreover, heavy mortality was observed on twigs but lac insects survived well on petioles of the plants. The petioles were shed before crop could attain maturity.

Fig. 37. Lac crop on petioles of two year old Albizia procera at IRF

3. Field demonstration of productive breeds of lac insects

Forty kg broodlac of productive breeds of *kusmi* strain (20 kg each of Kulajanga and *Ber* stock) has been inoculated on *ber* at Mangobandh village of Ranchi district through SEEDS, an NGO and 60 kg broodlac (20 kg each of Kulajanga, *Ber* and Nawadih stock) has been inoculated during July-August, 2008 on *ber* at Gutwa village of Khunti district through PRADAN, an NGO for evaluation of improved breeds under field conditions. The crop is progressing well. Field visits under taken under the project are shown in the Table 41.

Table 41. Field visits under taken under Jharkhand Lac Development Scheme (JLDS)

Sl. No.	Date	Village	Purpose
1	27.05.08	Fulwatangar and Binjhia Bandh, Simdega	Broodlac Farm Site selection proposed by the NGO Chakriya Vikas Sangthan under JLDS. On-farm training was also organised for 35 lac growers at Fulwatangar.
2	28.05.08	Pojenga, Sawnapatra and Umra, Gumla	Assessment of the bushy lac host *semialata* planted in combination with other hosts in a large area.
3	28.05.08	Dumar Tand, Gumla	Site selection for *semialata* plantation proposed by Sunita Kala Niketan
4	30.05.08	Bansgarha, Vijaydih, Korembe and Serenghatu, Ramgarh	Broodlac Farm Site selection proposed by the NGO Agragati under JLDS
5	17.06.08	Jiddupandra, Chandra, Sildari, Hesatu and Khantanga, Ranchi	Broodlac Farm Site selection proposed by the NGO Chakriya Vikas Sangthan under JLDS.
6	06.09.08	Kharsidag and Mangobandh, Ranchi	Lac Crop monitoring on *semialata* and *ber*
7	22.09.08	Mangobandh and Kharsidag, Ranchi	Lac Crop monitoring on *semialata* and *ber* and to show around lac field to a team of the senior officers of Forest Department
8	28.11.08	Sonpur (Arki), Bichna and Chitramu, Khunti and Kharsidag, Ranchi	*Semialata* plantation and lac crop monitoring
9	08.12.08	Kharsidag, Ranchi	Lac Crop monitoring on *semialata*
10	26.12.08	Nichitpur, Later, Kherkai,Guphu and Sondari	Assessment of *semialata* plantation for summer lac crop under Action Research

C. Infrastructure Development carried out under JLDS

Proposal for building like Training Hall for on-farm training at IRF has been vetted by ICAR and work is likely to be initiated soon.

3.1.3 Skill development and capacity building in lac culture through training and demonstration in Gujarat.

The project was undertaken during July 2004 and completed in December 2008 with the following accomplishments.

Host resource development

A layout of different lac host plants required to be raised at the Centre was suggested for demonstration of sustained production of *kusmi* lac crop during summer and winter seasons. Plantation of lac host, *ber* (*Zizyphus mauritiana*) was established in about 0.5 (0.3+0.2) ha for raising winter crop of *kusmi* (*aghani*). For ensuring sustained lac production cycle, plantation of quick-growing bushy host, *Flemingia semialata* was raised in 1.5 ha, for summer season crop (*jethwi*) under irrigation. This has ensured availability of broodlac for raising winter crop on *ber*.

Kusum plantation is available at Kevdi, which was brought under cultivation especially for production of summer broodlac. Plantations of *F. semialata* were raised at various Forest Research Farms in Godhra, Shivrajpur, Piplez, Rajpipla, Rajkot, etc. Plantation of *ber* is available in these farms, which can be alternated for winter crop. Based on the trials conducted in the region so far as well as the climatic conditions and host plant availability in Gujarat, *kusmi* lac production is recommended for promotion in the State. Besides, *kusmi* crop yields the best quality lac combined with high productivity and returns.

Identification new potential host

Identification of *Prosopis juliflora* as a very good *kusmi* lac host, under the potentiality trials conducted in different areas, is a very significant finding. Natural plantations of this host are available in large numbers in the state, which can be exploited for lac production during winter season. Trials for determining appropriate pruning time and brood rate for winter crop inoculation was conducted at Thalsar and Victoria garden at Bhavnagar. A very good crop with a yield ratios of 25 (output/ input) was harvested and lac production technology on this host was formulated on that basis. The production technologies for *kusmi* lac in winter season was tested and demonstrated at Bhavnagar, Junagarh, Rajkot, Bhachau (Kuchchh) and Basan. *Ber* has also provided a yield ratio of 17 (output/ input) at Basan and different field stations.

Lac production technologies for Gujarat

Technologies namely i) High returns from *kusmi* lac cultivation on *Ziziphus mauritiana* (*ber, bordi*) in Gujarat and ii) *Kusmi* lac cultivation on *Prosopis juliflora* (*ganda bawel*), a drieded weed in Gujarat have been prepared.

A successful trial of summer *kusmi* broodlac production on *F. semialata* was conducted at Piplez under which 90 kg broodlac was produced using 9 kg broodlac during *jethwi* 2007. This could supplement summer broodlac to many alternate hosts. Two small scale processing units (100 kg/day) were installed at Basan and Piplez for conversion of sticklac to seedlac.

Human Resource Development

Seventy-three forest officers have been trained by the Institute so far, at the IINRG head quarter and at Basan and Kevdi. Thirteen training camps have been organized under the project, benefiting 565 farmers and forest officials. Four forest officers have been imparted training in scientific methods of lac cultivation at IINRG headquarters. Demonstration of scientific method of lac cultivation on *Z. mauritiana* and *P. juliflora* was given to almost all Forest Research Farms/ Field stations. At Basan research farm *kusmi* lac production on *Z. mauritiana, Acacia catechu* and *P. juliflora* was demonstrated to forest officials and some progressive farmers. Most of the broodlac produced (300kg) was sold @130/kg. At Rajkot and Junagarh lac cultivation on *Z. mauritiana* during winter season was demonstrated successfully for two years and at Bhachau in Kuchch for one year. Some summer broodlac was also produced on *Z. mauritiana* during summer season. Winter season *kusmi* lac crop was demonstrated successfully at Thalsar and Victoria garden on *P. juliflora*. A yield ratio (output :input) of 1:20 was harvested at Thalsar. Summer broodlac production technology was demonstrated successfully at Piplez on *F. semialata* and at Kevdi on *kusum*. Summer lac crop has been raised on *kusum* at Shivrajpur and different places in Dang districts.

Recommendations for future development of lac cultivation in Gujarat

Cultivation of *Kusmi* lac on *P. juliflora* (ganda bawel) and *Z. mauritiana* (bordi) during winter crop season and on *S. oleosa* during summer season is recommended.

In absence of *kusum*, summer broodlac may be produced on *Flemingia semialata* (24,000 plants/ ha) under irrigated condition up to 30% insect stress.

Two nucleus broodlac farms with 2,000 *kusum* trees in each farm may be started for supplementing summer broodlac to be started preferably one at Kevdi and the other at Dang.

Each research farm should be equipped with at least 1 ha *F. semialata* plantation for production of summer broodlac to cater local needs.

The technologies for *kusmi* lac production on above hosts may be transferred to at least 10 FDAs each year through training and on-farm demonstration to lac growers.

At least one Kisan Mela on MFP should be organized by the forest department to acquaint the stakeholders about the products and their utilization.

Marketing facilities need to be developed for consumption of the products.

In order to take the above achievements to the farmers' field a project entitled 'Production of summer *kusmi* broodlac on *kusum* for promotion of lac cultivation in Gujarat with farmers' participation' is under process in the Gujarat Forest Dept which would be implemented with the scientific support by the Institute.

Table 42. Details of on-farm training organized on scientific lac cultivation

Sl No.	Consortium partner	Venue of training	Date of training	Number of participants
1	Agrocret Society, Kanker	Primary School , Village- Kanhanpuri, Kanker	20.12.08	85
2	PARDS, Jagdalpur	Village- Kotamsar, Block- Daibha, Jagdalpur	22.12.08	70
3	S G College of Agriculture, Jagdalpur	Village – Tahakapal Jagdalpur	23.12.08	65
4	R K Mission Ashram, Jagdalpur	Training Hall of Brehberra Village – Palki, Narayanpur	24.12.08	30 75
			Total	**325**

3.1.4 Improving rural livelihood security through sustainable integrated farming system model and allied enterprises in Bastar region of Chhattisgarh (NAIP)

The project started in October 2008 under Component-3 of NAIP. The institute is a consortium partner and S G College of Agriculture, Jagdalpur of Indira Gandhi Krishi Viswavidyalaya, Raipur is the lead centre. The other partners are Agrocret Society, Kanker (NGO), Participatory Action for Rural Development Society (PARDS) Jagdalpur, CSWCRTI, ICAR and Sanjeevni (Forest Dept) Raipur. Promotion of lac cultivation is proposed to be carried out in four clusters namely Bastanar, Pandawada, Pusagaon of Jagdalpur district and Kanhanpuri in Kanker district. On-farm training programme has been conducted with consortium partners as given in the Table 42.

The forest department has intervened for lac promotion for a limited period in Kanhanpuri. Hence farmers were aware of this venture. While interacting, a few problems of the lac growers were identified, namely a) attack on lac insect by ants b) nibbling of lac encrustation by squirrel c) lac insect death after two months of inoculation on *kusum* trees d) theft of mature lac crop especially in November- December and mortality of lac insect on *kusum* trees having white bark. Most of the farmers are already carrying out lac cultivation but by conventional technique. In Daibha block, four villages namely Kotamsar, Pedewara, Majheepal, Dhurmaras have been adopted under the project. As per initial estimates around 350 *kusum* and 70 *ber* trees are available in this cluster. People are not aware of lac in this area. Two *kusum* trees have been pruned by the farmers under our supervision as a demonstration. Climbing on big size tree is not a problem as both trees were pruned within one and half hours only by three farmers. Demonstration of inoculation process was also done besides delivering lecture. In Tahakapal village and adjoining three villages, more than 1000 *ber* trees are available in this cluster but nobody know about lac cultivation. Two *ber* trees were pruned by the farmers under our supervision as a demonstration. In Narayanpur area, as per information collected more than 500 *kusum* trees are available in cluster of two villages. Only one farmer knew about lac cultivation out of 75 attending the training course. Demonstration of pruning of *kusum* tree was given where two farmers pruned two small and one big size *kusum* trees.

Demonstration of kusum tree pruning at Palki village, Narayanpur

Training on Scientific lac cultivation to formers at Palki, Narayanpur

3.1.5 Developing sustainable farming system models for prioritized micro watersheds in rainfed areas of Jharkhand (NAIP)

Project was sanctioned in July 2008 under component-3 of NAIP. The institute is a consortium partner and Birsa Agriculture University, Ranchi is the lead centre. The other partners are Horticulture and Agroforestry Research Programme, Ranchi, Central Upland Rice Research Station, Hazaribag. The launch workshop was held during 7th to 9th Feb 2008. Intervention in respect of lac production is to be done in four clusters of Jamtara and Dumka districts. The Institute actively participated in District level Kisan Mela at Jamtara on 25 and 26th February 2008 to interact with farmers of selected and adjoining villages. They have been briefed about NAIP and its activities to be carried out in Jamtara and Narayanpur blocks. The farmers took keen interest in the programme. An exhibition on lac was also put as awareness drive on lac cultivation aspects.

Table 43. Pruning of lac host trees in Jamtara and Dumka district

Block	Village	No. of *palas* trees pruned	No. of *ber* trees pruned
Jamtara	Sinjotola	50	15
	Saurumundu	20	10
	Dulaidih	20	15
	Bajragoda	50	25
	Rupaidih	30	15
Narayanpur	Madnadih	25	15
	Bara Majhladih	50	25
	Tetuliatand	20	15
	Total	**265**	**135**

Pruning demonstration of *palas* and *ber* trees has been carried out at Sinjotola, Saurumundu and Rupaidih villages of Jamtara block and Baramajhladih of Narayanpur block during February and April 2008 (Table 43).

Raising of lac crop: All adopted villages have plenty of *palas* trees but farmers are not aware of lac cultivation. In order to educate the farmers about lac crop growth and production, rainy season crop was raised on 576 trees of *palas* involving 59 families of nine villages (six village of Jamtara district and three villages of Dumka district) during July 2008 (Table 44). Recommended pesticides endosufan and carbendazim were applied as a demonstration by the farmers. At crop maturity stage it was found that crop survived on 439 trees of *palas* with expected yield of around 230 kg. In view of sparse settlement and availability of more area for settlement, most of the trees were self inoculated. These trees will be harvested completely in April for *ari* crop so as to earn money for farmers and they learn the value of lac through marketing. A few farmers have sold *phunki* scrap in the market to know the value of lac in the market and how to market the same. It gave them much required confidence to adopt lac production further as all are beginners.

Table 44 . Inoculation of rainy season *rangeeni* lac crop on *palas* in Jamtara and Dumka district

District	Block	Village	No. of beneficiaries	Quantity of *rangeeni* broodlac used (kg)	No. of *palas* trees inoculated
Jamtara	Jamtara	Sinjotola	9	116	122
		Dahartola	4	60	60
		Khastola	9	84	93
		Saurimundu	2	12	13
		Haisalgutu	3	12	17
		Charedih	10	48	51
		Sub total	37	332	356
	Narayanpur	Baramajhladih	8	18	38
	Total		45	350	394
Dumka	Dumka	Karmatan	5	60	63
		Guhiajori	6	66	95
		Sub total	11	126	158
	Jama	Bhounra	3	24	24
	Total		14	150	182
	Grand total		**59**	**500**	**576**

Summer season crop was raised on *palas* tree during October 2008. A total of 500 kg of broodlac was inoculated on 811 *palas* trees in Jamtara district and 200 kg in Dumka district as given in Table 45. Light inoculation was carried out in order to avoid summer mortality. A total of 29 farmers from Charedih, Sinjotola, Baramjhladih, Rupaidih-Dahartola, Rupaidih-Khastola and Saurimundu have been trained at IINRG on "Scientific Method of lac cultivation" through three courses. Field level trainings were conducted in seven villages where lac crop was raised on farmers trees on following aspects like, method of broodlac inoculation on *palas* trees, importance of *phunki* removal, identification of insect pests damaging lac crop and control measures for pest and diseases.

Table 45 . Inoculation of summer season *rangeeni* lac crop on *palas* in Jamtara and Dumka district

District	Block	Village	Number of beneficiaries	Quantity of broodlac inoculated (kg)	Number of *palas* tree inoculated
Jamtara	Jamtara	Rupaidih- Sinjotola	6	110	138
		Dahartola	2	40	50
		Rupaidih- Khastola	3	60	85
		Saurimundu	2	30	39
		Charedih	5	60	107
		Block total	18	300	411
	Narayanpur	Baramajhladih			
		Cluster I	6	33	40
		Cluster II	3	25	60
		Cluster III	6	100	200
		Cluster IV	4	42	100
		Village total	18	200	400
		Block total	18	200	400
	Total		36	500	811
Dumka	Dumka	Karmatand	3	45	62
		Guhiajori	4	40	86
		Kodokicha- 6	6	55	103
		Kodokicha- 7	2	10	50
		Block total	15	150	301
Dumka	Jama	Bhounra	6	50	75
		Block total	6	50	75
	Total		21	200	376
	Grand total	**Jamtara + Dumka**	**57**	**700**	**1,187**

Spray of insecticide for pest control on lac

Rainy season crop on palas tree in Jamtara district

Collection and scraping of phunki by tribal women in Dumka district

Rainy season lac crop on palas tree in Dumka district

3. 2 Technology Assessment, Refinement and Dissemination

3.2.1 Evaluation of some newer insecticides and bio-pesticides for eco-friendly management of insect pests associated with lac insect and host plants

Evaluation of chemical insecticides

Field experiment was undertaken at Institute Research Farm and Farmer's field for identification of some newer IPM recommended chemical pesticides on lac culture. For the management of two key lepidopteran predators *viz.*, *Eublemma amabilis* and *Pseudohypatopa pulverea* on the lac crop, some IPM recommended newer chemical insecticides *viz.*, indoxacarb, carbosulfan, spinosad, fipronil, lambdacyhalothrin and alphamethrin, identified on the basis of previous year's preliminary trials were again evaluated for their safety to lac insect and toxicity to predators of lac insect on *rangeeni* and *kusmi* lac crops raised on *palas* (*Butea monosperma*) and on *galwang* (*Albizia lucida*) respectively. Recommended insecticides endosulfan and ethofenprox which are presently in use were also sprayed for comparison of effectiveness with the newer insecticides.

Evaluation of chemical insecticides on rangeeni rainy season (katki) lac crop raised on palas

Six IPM recommended newer chemical insecticides *viz.*, lambdacyhalothrin, alphamethrin, indoxacarb, carbosulfan, spinosad and fipronil were evaluated at different concentrations along with recommended ethofenprox (0.02 %) for their safety to lac insect and toxicity to predators of lac insect on *rangeeni* rainy season (*katki*) lac crop raised on *palas* under Farmer's participatory mode at Jhalda (West Bengal). All the six chemical insecticides except lambdacyhalothrin at higher dose were found to be promising as far as safety to lac insect is concerned and were effective in reducing the incidence of lac insect predators for the second consecutive crop season also in confirmatory trials. The survival of lac insect in different treatments of insecticides varied from 73.83 to 92.01 per cent as compared to 91.65 per cent in control clearly indicating the safety of these insecticides towards lac insect (Table 46). Though no significant difference in survival of lac insect was observed in different treatments of insecticides, the reduction in incidence of lac insect predators in different treatments was observed to be to the tune of 36 to 96 per cent in case of *Eublemma ammabilis* and 14.3 to 95.2 per cent in *Pseudohypatopa pulverea*.

Table 46. Bioefficacy of insecticides for their safety to lac insect and toxicity to lac insect predators

Insecticidex	Conc. (%)	Survival of lac insect (%)	Reduction in incidence of lac insect predators over control (%)	
			Eublemma amabilis	*Pseudohypatopa pulverea*
Carbosulfan	0.01	84.84	68.0	14.3
	0.025	80.11	84.0	19.0
	0.05	78.97	96.0	61.9
Indoxacarb	0.005	92.01	36.0	57.1
	0.01	89.39	60.0	57.1
	0.02	83.19	80.0	95.2
Spinosad	0.005	87.74	52.0	80.9
	0.01	87.42	72.0	66.7
	0.02	82.98	88.0	80.9
Fipronil	0.005	84.69	60.0	61.9
	0.01	84.39	84.0	80.9

Lambdac-yhalothrin	0.005	80.30	80.0	90.5
	0.008	73.83	100.0	100.0
Alphamethrin	0.005	83.64	80.0	61.9
	0.01	82.12	88.0	85.7
Ethofenprox	0.02	82.99	76.0	66.7
Control	-	91.65	-	-
S.Em.±		4.92		
CD (5%)		9.79		

Evaluation of chemical insecticides on summer season (jethwi) kusmi lac crop raised on galwang

Summer season (*jethwi*) *kusmi* lac crop was raised on *galwang* for evaluation of chemical insecticides. Crop was inoculated in the month of February, 2008. Six newer chemical insecticides at two different concentrations *viz.*, carbosulfan (0.02 and 0.05%), indoxacarb (0.01 and 0.02%), spinosad (0.01 and 0.02%), fipronil (0.005 and 0.01%), lambdacyhalothrin (0.005 and 0.008%) and alphamethrin (0.005 and 0.01%) were evaluated. Recommended insecticides, ethofenprox (0.02%) and endosulfan (0.05%) were also sprayed for comparison. The survival of lac insect in different treatments varied from 45.91 to 73.43 per cent as compared to 49.44 per cent in control, clearly indicating the safety of these newer insecticides to lac insect.

Evaluation of chemical insecticides on rainy season (aghani) kusmi lac crop raised on galwang

Rainy season (*aghani*) *kusmi* lac crop was raised in Institute Research Farm on *galwang* for evaluation of chemical insecticides. Crop was inoculated in the month of July, 2008. Six IPM recommended newer chemical insecticides *viz.*, lambdacyhalothrin (0.005 and 0.008%), indoxacarb (0.01 and 0.02%), carbosulfan (0.03 and 0.05%), spinosad (0.01 and 0.02%) and fipronil (0.005 and 0.01%) identified on the basis of preliminary trials, along with recommended ethofenprox (0.02%) and endosulfan (0.05%) were evaluated for their safety to lac insect and toxicity to predators of lac insect on *kusmi* rainy season lac crop. All the six chemical insecticides except lambdacyhalothrin at higher dose were found to be promising as far as safety to lac insect is concerned. Survival of lac insect amongst different treatments ranged from 61.39 to 87.02 per cent as compared to 83.80 per cent in control, clearly indicating the safety of these newer insecticides to lac insect.

Bio-efficacy of insecticides against neuropteran predator, Chrysopa lacciperda

To study the bioefficacy of insecticides against *Chrysopa lacciperda*, a laboratory bioassay of seven insecticides was carried out by topical application and by exposing the insect on residual film of insecticides during April, 2008. Topical application of lambdacyhalothrin (0.005 and 0.008%), alphamethrin (0.005 and 0.01%), indoxacarb (0.02%), carbosulfan (0.03%), spinosad (0.01 and 0.02%), fipronil (0.005 and 0.01%) and ethofenprox (0.02%) exerted cent per cent insect mortality within 24 hrs of treatment. Exposure of 2nd and 3rd instar insects on residual films of carbosulfan and spinosad were equally effective as topical application. Residual effect of indoxacarb was not as much pronounced as that to other insecticides against *Chrysopa* (Table 47). In general the residual effect of insecticides was observed to be less as compared to topical application.

Table 47. Per cent larval mortality of lac insect predator, *Chrysopa lacciperda* in different treatments of insecticides.

Insecticide	Conc. (%)	Topical application of insecticides on insects			Exposure of insects on Residual film of insecticides		
		Per cent mortality after			Per cent mortality after		
		2 hr	24 hr	48 hr	2 hr	24 hr	48 hr
Lambdacyhalothrin	0.005	63.33 (53.01)	100.00 (90.00)	-	33.33 (35.55)	56.67 (49.14)	90.00 (72.05)
	0.008	76.67 (61.48)	100.00 (90.00)	-	46.67 (43.39)	70.00 (57.10)	100.00 (90.00)
Carbosulfan	0.02	56.67 (49.14)	100.00 (90.00)	-	36.67 (37.58)	66.67 (55.06)	83.33 (66.27)
	0.03	70.00 (57.10)	100.00 (90.00)	-	43.33 (41.44)	73.33 (59.21)	100.00 (90.00)

Spinosad	0.01	23.33 (29.20)	73.33 (59.21)	100.00 (90.00)	0.00 (4.05)	0.00 (4.05)	36.67 (37.58)
	0.02	30.00 (33.52)	100.00 (90.00)	-	0.00 (4.05)	33.33 (35.55)	90.00 (72.05)
Indoxacarb	0.01	13.33 (21.81)	90.00 (72.05)	100.00 (90.00)	13.33 (21.81)	76.67 (61.48)	100.00 (90.00)
	0.02	56.67 (49.14)	100.00 (90.00)	-	53.33 (47.18)	100.00 (90.00)	-
Fipronil	0.005	43.33 (41.44)	100.00 (90.00)	-	23.33 (29.20)	100.00 (90.00)	-
	0.01	76.67 (61.48)	100.00 (90.00)	-	73.33 (59.21)	100.00 (90.00)	-
Alphamethrin	0.005	76.67 (61.48)	100.00 (90.00)	-	36.67 (37.58)	63.33 (53.01)	80.00 (63.79)
	0.01	90.00 (72.05)	100.00 (90.00)	-	56.67 (49.14)	83.33 (66.19)	86.67 (69.04)
Ethofenprox	0.02	50.00 (45.29)	100.00 (90.00)	-	0.00 (4.05)	56.67 (49.14)	80.00 (63.79)
Control	-	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)
S. Em. ±		3.69	1.13	-	3.60	2.32	3.25
CD (0.05)		11.28	3.46	-	10.99	7.09	10.26
CD (0.01)		15.71	4.83	-	15.32	9.87	14.58

Figures in parentheses are arcsine transformed values

Management of pentatomid bug, Tessaratoma javanica – a pest of kusum trees

For the management of pentatomid bug *Tessaratoma javanica* – a pest of *kusum* tree, laboratory bioassay was carried out to evaluate eight insecticides by topical application of insecticides (Table 48). Application of carbosulfan (0.02 and 0.03%), indoxacarb (0.01 and 0.02%), spinosad (0.02%), lambdacyhalothrin (0.005 and 0.008%), alphamethrin (0.005 and 0.01%) and endosulfan (0.05%) were found to be very effective and resulted into cent per cent insect mortality within 24 hrs of treatment. Spinosad (0.01%) caused 66.67 and 77.78 per cent mortality after 24 hr and 48 hr of treatment, respectively. Application of fipronil (0.005 and 0.01%) exerted 87.50 and 95.83 per cent mortality of *T. javanica*, respectively within 24 hr of treatment and the mortality did not increase with time. Ethofenprox (0.02%) caused 89.77 per cent mortality within 24 hr of treatment.

Table 48. Per cent mortality of *Tessaratoma javanica* in different treatments of insecticides.

Insecticide	Conc. (%)	Per cent mortality of insect after	
		24 hr	48hr
Carbosulfan 25 % EC	0.02	100.00 (90.00)	
	0.03	100.00 (90.00)	
Indoxacarb 14.5% SC	0.01	100.00 (90.00)	
	0.02	100.00 (90.00)	
Spinosad 2.5% SC	0.01	66.67 (55.06)	77.78 (62.24)
	0.02	100.00 (90.00)	
Lambdacyhalothrin 5% EC	0.005	100.00 (90.00)	
	0.008	100.00 (90.00)	
Alphamethrin 10% EC	0.005	100.00 (90.00)	
	0.01	100.00 (90.00)	
Fipronil 5% SC	0.005	87.50 (69.73)	87.50 (69.73)
	0.01	95.83 (78.91)	95.83 (78.91)
Ethofenprox 10% EC	0.02	89.77 (71.85)	89.77 (71.85)
Endosulfan 35% EC	0.05	100.00 (90.00)	
Control	-	0.00 (4.05)	0.00 (4.05)
S. Em. ±		3.64	
CD (0.05)		7.45	
CD (0.01)		10.05	

Evaluation of Bacillus thuringiensis formulation

Two newer commercially available *Bacillus thuringiensis* var. *kurstaki* formulations (Halt and Knock WP) of indigenous origin were evaluated on winter season (*aghani*) *kusmi* lac crop raised on *Zizyphus mauritiana* (*ber*) at four different concentrations for their safety to lac insect and toxicity to lepidopteran lac insect predators. First application of biopesticides was made after 40-45 days of inoculation. The survival of lac insect after application of biopesticides ranged from 84.67 to 90.82 per cent amongst Knock WP treatments and 88.11 to 89.12 per cent with the treatment of Halt which were at par with the control in which survival of lac insect was observed to be 90.71 per cent indicating the safety of biopesticides towards lac insect at all the four concentrations evaluated. *Bt* formulation (Delfin) of exotic origin was also sprayed for comparison in which the survival of lac insect was 88.58 per cent.

3.3 Liaison, Information and Advisory Service

3.3.1 Informatics on lac production, marketing and processing

Efforts have been made at national level for collection of lac related information and data. Frequent survey was made in various lac growing areas of the country for collection of data through out the year during 2008-09. The requisite data have been collected from the respondents at various lac markets and lac processing centers. For updating the information and data, regular contacts were made through phone with the respondents. Survey has been conducted in 28 lac growing districts of 9 states comprising of 44 lac traders, 31 lac manufacturer and 9 other key informants during 2008-09. Name of the states and districts in which survey was carried out have been presented in Table 49 and sample size surveyed during the year have been presented in Table 50.

Monthly export and import data of lac and its value added products have been collected from Directorate General of Commercial Intelligence and Statistics (DGCI&S), Kolkata.

Table 49. States and districts surveyed

States	Districts
Andhra Pradesh	Visakhapatnam
Assam	Karbi-Anglong
Chhattisgarh	Bilaspur, Dhamtari, Janjgir-Champa, Kanker, Korba, Mahasamund, Surguja, Raipur and Rajnandgaon
Gujarat	Vadodara
Jharkhand	Garhwa, Gumla, Latehar, Palamau, Ranchi, Simdega and West Singhbhum
Madhya Pradesh	Balaghat, Honsangabad, Mandla and Seoni
Maharashtra	Gondia
Orissa	Baleshwar and Mayurbhanj
West Bengal	Bankura and Purulia

Table 50. Sample size during the survey

States	Districts	Total number of samples		
		Number of traders	Number of manuf-acturers	Govt. Officials/ NGOs/ Other key informants
Andhra Pradesh	1	-	-	1
Assam	1	2	-	1
Chhattisgarh	9	7	9	1
Gujarat	1	5	-	1
Jharkhand	7	14	10	1
Madhya Pradesh	4	7	2	1
Maharashtra	1	3	2	-
Orissa	2	4	-	1
West Bengal	2	2	8	2
Total	**28**	**44**	**31**	**9**

Lac production in India

On the basis of survey in the markets of different lac producing districts and states, the estimated national production of sticklac during 2008-09 was approximately 17,175 tons. Chhattisgarh state ranks 1st followed by Jharkhand, Madhya Pradesh, Maharashtra and West Bengal. The above five states are contributing around 93 per cent of the national lac production. Contribution of Chhattisgarh in national lac production was 41.91 per cent followed by Jharkhand (23.29 %), Madhya Pradesh (17.29 %), Maharashtra (6.11 %) and West Bengal (4.83 %). Regarding share of different crops, *baisakhi* ranks 1st (30.04 %) followed by *katki* (29.60 %), *aghani* (22.83 %)

and *jethwi* (17.53 %) in national lac production. In the year 2008-09 the production of *baisakhi*, *katki* and *jethwi* crop has decreased by around 35 per cent, 11 per cent and 8 per cent respectively while production of *aghani* crop has increased by 5 per cent. At national level the production of lac was around 17 per cent less than the last year arrival. Lac production scenario in India during 2008-09, share of different crops at national level and lac production in India during last three years are presented in Table 51 and Fig. 38 & 39 respectively.

Table 51. Lac production in India during 2008-09 (in tons)

Name of state	Name of lac crop				Total production
	Baisakhi	*Jethwi*	*Katki*	*Aghani*	
Andhra Pradesh	20	1	20	1	42
Assam	30	0	60	0	90
Bihar	2	0	2	0	4
Chhattisgarh	2207	1410	1666	1915	7198
Gujarat	10	15	10	20	55
Jharkhand	400	1190	810	1600	4000
Madhya Pradesh	1480	250	1040	200	2970
Maharashtra	200	0	850	0	1050
Meghalaya	5	0	6	0	11
Orissa	80	125	90	130	425
Uttar Pradesh	300	0	200	0	500
West Bengal	425	20	330	55	830
TOTAL	**5159**	**3011**	**5084**	**3921**	**17175**

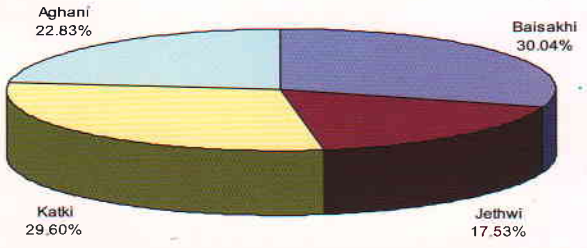

Fig 38. Share of different crops in lac production at national level

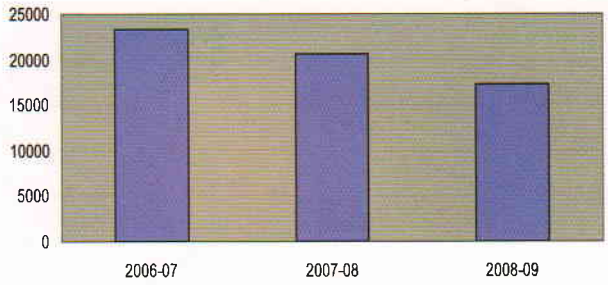

Fig 39. Lac production in India during last 3 years

Lac Processing in India

On the basis of survey of different lac processing centers in the country the total amount of sticklac processed during 2007-08 was 27,110 tons which also included the amount of imported lac in India amounting to 5,797 tons. 25 Lac processing units in Chhattisgarh, 16 units in Jharkhand, 6 units in Maharashtra, 2 units in Madhya Pradesh and 129 units in West Bengal were in running condition during the year 2007-08. In processing of lac West Bengal ranked 1st (40.13 %) followed by Chhattisgarh (32.65 %), Jharkhand (21.01 %), Maharashtra (5.11 %) and Madhya Pradesh (1.09 %). The information on lac processing centers in India, amount of sticklac processed at different lac processing centers in the country and share of different states in lac processing during 2007-08 has been presented in Table 52, 53 and Fig. 40 respectively. There were 10 primary and 9 secondary markets existing at national level in which annual arrival of sticklac was more than 500 tons. Name of the primary and secondary markets with annual arrival of more than 500 tons have been presented in Table 54. Amount of lac processed in India during last three years has been presented in Fig. 41.

Table 52. Lac processing centers in India (2007-08)

State	District (center)	No. of processing units	Product made
Chhattisgarh	Bilaspur (Pendra)	2	Seedlac, Button lac
	Dhamtari	11	Seedlac, Button lac, Bleached lac
	Jajgir-Champa (Sakti)	3	Seedlac, Shellac, Bleached lac, Dewaxed Shellac, Lac dye
	Kanker	2	Seedlac
	Korba (Kathgora)	6	Seedlac, Shellac, Bleached lac
	Rajnandgaon	1	Seedlac, Shellac

Jharkhand	Daltonganj	3	Seedlac, Button lac
	Ranchi	9	Seedlac, Button lac, Shellac, Lac dye, Bleached lac, Aleuritic acid
	Simdega	2	Seedlac
	Chandil	1	Bleached lac
	West Singhbhum	1	Seedlac, Shellac
Madhya Pradesh	Indore	1	Seedlac, Bleached lac
	Bankhedi	1	Seedlac
Maharashtra	Gondia	6	Seedlac, Shellac, Gasket Shellac Compound, Bleached lac
West Bengal	Purulia (Balarampur)	90	Seedlac, Shellac, Button lac, Bleached lac, Aleuritic acid, lac wax, Dewaxed Decolourised lac
	Purulia (Jhalda)	4	Seedlac, Shellac, Button lac
	Purulia (Tulin)	35	Seedlac, Button lac

Table 53. Amount of sticklac processed in India during 2007-08

State	Districts/ Centers	Quantity processed (tons)
Chhattisgarh	Bilaspur (Pendra)	100
	Dhamtari	3600
	Janjgir-Champa (Sakti)	1100
	Kanker	500
	Korba (Kathgora)	3400
	Rajnandgaon	250
	Sub total	**8950**
Jharkhand	Daltonganj	600
	Ranchi	4800
	Chandil	60
	Simdega	250
	West Singhbhum	50
	Sub total	**5760**
Madhya Pradesh	Indore	100
	Bankhedi	200
	Sub total	**300**
Maharashtra	**Gondia**	**1400**
West Bengal	Purulia (Balarampur)	10500
	Purulia (Jhalda)	200
	Purulia (Tulin)	300
	Sub total	**11000**
	Total	**27110**

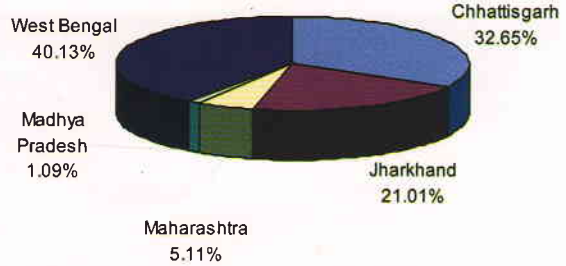

Fig 40. Share of different states in lac processing at national level

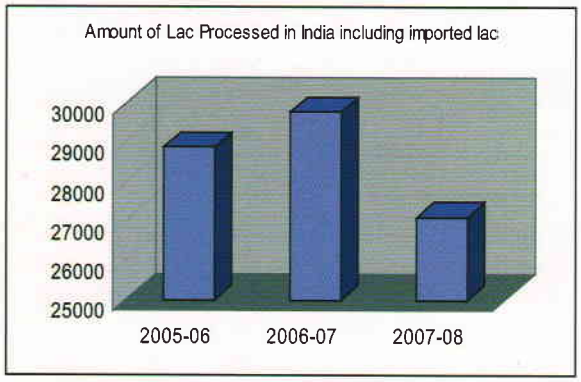

Fig 41. Lac processing in India during last 3 years

Table 54. Markets with annual arrival of more than 500 tons during 2008-09

States	Primary Markets	Secondary Markets
Chhattisgarh	Bhaisama Bazar, Bhanupratappur, Mohala Chowki, Pali, Sambalpur	Dhamtari, Kanker, Kathgora, Sakti
Jharkhand	Jaldega, Palkot	Bundu, Khunti, Daltongunj
Madhya Pradesh	Barghat, Katangi	-
Maharashtra	-	Gondia
West Bengal	-	Balarampur

Export of lac during 2007-08

Data on export of lac and its value added products from India were collected from Directorate General of Commercial Intelligence and Statistics (DGCIS), Kolkata. The total export of lac and its value added products during the year 2007-08 was 7906.33 tons valued Rs.124.27 crores. The top fifteen importing countries of Indian lac are Egypt, Germany, Pakistan, Bangladesh, Indonesia, USA,

Italy, UAE, Spain, Nepal, Jordan, UK, Japan, Haiti and Austria and accounted for around 87 per cent of the total exports by quantity and 75 per cent by value. Details of export in quantity and value during 2007-08 and list of top 15 countries importing Indian lac has been presented in the Table 55 and 56 while the trend in export of lac in quantity and value during last five years and share of different items of lac export from India are shown in Fig. 42 and 43.

Table 55. Export of lac and its value added products from India during 2007-08

Sl. No.	Name of product	Export in 2007-08	
		Quantity (tons)	Value (Rs. lakh)
1.	Shellac	4771.91	6782.49
2.	Seedlac	1507.14	1942.84
3.	Sticklac	2.77	3.51
4.	Dewaxed & Decolorized lac	82.25	215.48
5.	Bleached lac	191.40	350.81
6.	Gasket lac	0.31	1.50
7.	Button lac	628.62	785.63
8.	Shellac wax	17.16	27.52
9.	Aleuritic acid	141.67	1718.65
10.	Lac dye	1.09	1.10
11.	Other lac	562.01	597.34
	Total	**7906.33**	**12426.87**

Table 56. Top 15 importing countries of Indian lac during 2007-08

Sl. No.	Country	Quantity (tons)	Value (Rs. lakh)
1.	Egypt	1108.00	1435.70
2.	Germany	997.71	1561.12
3.	Pakistan	943.58	1226.30
4.	Bangladesh	918.46	1124.86
5.	Indonesia	731.30	862.14
6.	USA	601.11	880.96
7.	Italy	356.23	446.47
8.	UAE	303.30	391.46
9.	Spain	192.33	470.95
10.	Nepal	156.30	63.17
11.	Jordan	122.00	162.62
12.	UK	119.82	203.99
13.	Japan	108.91	163.57
14.	Haiti	102.10	130.62
15.	Austria	94.04	167.32
16.	Other countries	1051.14	3135.62
	TOTAL	**7906.33**	**12426.87**

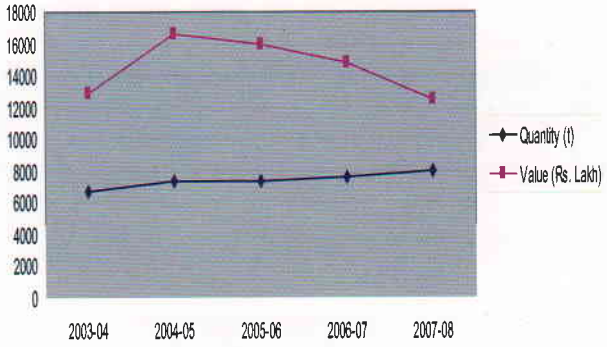

Fig 42. Trend in export of lac from India during last five years

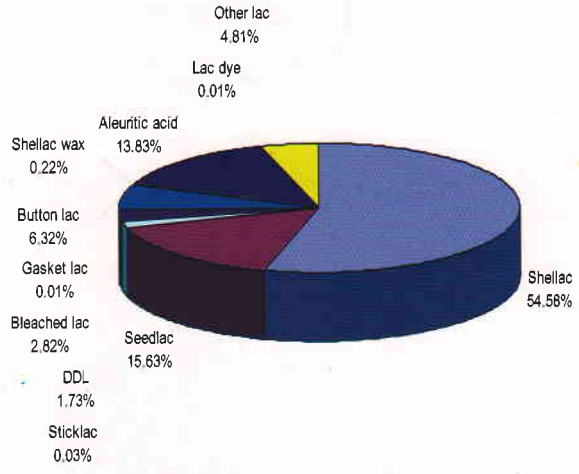

Fig. 43. Share of different items of lac export from India (in value)

Import of lac in India during 2007-08

Data on import of lac in India were collected from Directorate General of Commercial Intelligence and Statistics, Kolkata. The total import of different kinds of lac during the year 2007-08 was 5797.22 tons valued Rs. 34.62 crores. Majority of lac were imported from Indonesia and Thailand. Sticklac is imported from Indonesia and Thailand while seedlac is imported only from Thailand. Details of import of lac in quantity and value during 2007-08 have been presented in the Table 57 and 58 while the trend in import of lac in quantity and value during last five years and share of different items of lac import in India are shown in Fig. 44 and 45.

Table 57. Import of different kinds of lac in India during 2007-08

Sl. No.	Name of product	Import in 2007-08	
		Quantity (tons)	Value (Rs. lakh)
1.	Sticklac	4511.09	2291.81
2.	Seedlac	1284.84	1154.43
3.	Other lac	1.29	15.35
	Total	**5797.22**	**3461.59**

Table 58. Import of lac in India from different countries during 2007-08

Sl. No.	Name of country	Quantity (tons)	Value (Rs. lakh)
1.	Indonesia	3890.07	1989.25
2.	Thailand	1855.86	1412.00
3.	Other countries	51.29	60.34
	Total	**5797.22**	**3461.59**

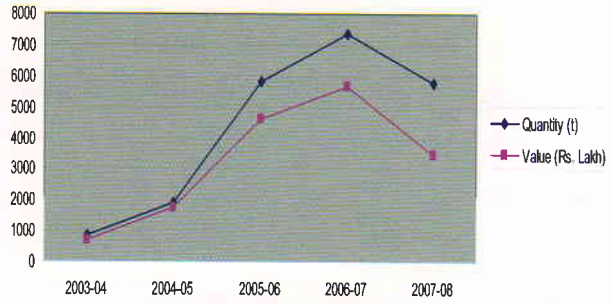

Fig 44. Trend in import of lac in India during last five years

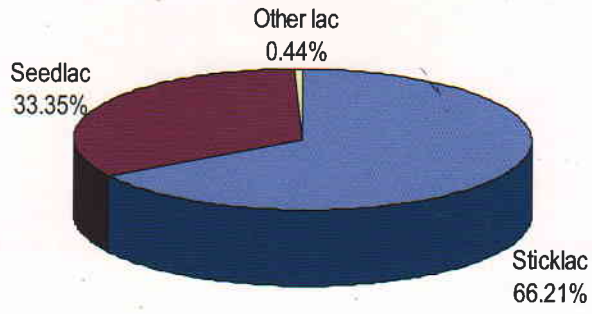

Fig. 45. Share of different items of lac import in India (in value)

3.3.2 Strengthening, liaison, information and advisory services on natural resins and gums

- A Mumbai based varnish manufacturing unit (M/s PNP Corporation) sought some suggestions for improving the quality of his varnish. Necessary suggestions were given to the firm.
- The problem faced by M/s Tajna shellac Pvt. Ltd., Khunti in preparation of quality lac dye was studied and proper remedial measures were suggested.
- Scientist regularly attended the meetings at All India Radio and proposals were given for inclusion of topics for recording and telecast related to crop production and protection.
- Information has been collected from primary and secondary sources for preparation of Directory related to natural resins and gum. Information on around 350 numbers of Exporters, Importers, Traders, manufacturers, GOs and NGOs related to natural resins and gums has been collected and compiled. The draft of the same has been prepared.
- A write up in hindi was prepared and sent to AIR and DD Ranchi for telecast for creating awareness on *Parthenium* on the occasion of 'Parthenium awareness week' 6-12 Sept.2008.
- Participation of the Institute in different exhibition/ Kisan Mela / Kisan Gosthi etc for creating awareness and publicity on lac, natural resins and gums – 17 Nos.
- Established linkages with two NGOs in Purulia District for promotion of lac cultivation and conducted two motivational training also.
- Scientists attended the quarterly review meeting of AIR regularly and finalized the lac related topics for recording and telecast.
- Scientists attended the Inter Media Publicity Coordination Committee. Meeting regularly at various Govt. Departments in Ranchi.
- Scientific Advisory Committee meetings of Ramakrishna Mission Ashram, Divyayan Krishi Vigyan Kendra, Morabadi were attended.
- Visited Jagdishpur village of District Kodarma (Jharkhand) on May 30, 2008 for training cum awareness programme organized by KVK (CRURRS-CRRI), Jainagar, Koderma. Kisan Gosthi was attended by 80 farmers.
- Questionnaires for lac processing units who had taken training in the preparation of lac dye (6 nos.) Aleuritic acid (19 Nos.), bleached lac (14 nos.) during last 10 years have been prepared and sent for feed back.
- Correspondences with farmers, entrepreneurs and other respondents for information and guidance on various aspects of lac, training related matters through letters and telephone >200 Nos.
- Survey has been conducted in Andhra Pradesh and Gujarat for collection of information and data on gums produced in the state.

- Show case consisting of lac based materials and photographs have been displayed in the War memorial museum at Dipa Toli Cantt, Ranchi.

Front line Demonstration

- Established linkages with 5 KVKs in Jharkhand located at Koderma, Palamau, Gumla, Lohardaga and Garhwa for lac promotion activities.
- The Institute has facilitated 105 Kg *rangeeni* broodlac for initiating *rangeeni* lac cultivation on *palas* trees to KVKs located at Palamau, Gumla, Lohardaga, Garhwa and Koderma. Necessary advice has been given for taking plant protection measures. The crop is progressing well.
- The Institute also facilitated 100 *kusmi* broodlac for initiating *kusmi* lac cultivation on *kusum* and *ber* to KVK Lohardaga and KVK Palamau. Necessary advice has been given for taking plant protection measures.
- A plantation of *Flemingia semialata* (4,000 plants) has been raised on 0.5 ha land at Dalpur Ashram, Bankura. *Kusmi* lac (*aghani* crop) has been raised on about 1,000 *semialata* plants from the broodlac provided by the Institute. Necessary plant protection measures have been taken on advice of IINRG.

Crop monitoring

- Three Blocks namely Gurundia, Lahunipara and Kutra of Sundargarh district, Orissa were visited for monitoring of the kusmi lac crop on ber and kusum and necessary advice were provided. The lac cultivation has been initiated first time in the area. Lac cultivation is being promoted in the district by Regional Office, TRIFED, Bhubaneshwar.
- Crop monitoring was also carried out at Putidih (West Bengal) and Khunti area for monitoring of *rangeeni* lac crop.
- Necessary advice has been given for taking plant protection measures during raising of *kusmi* and *rangeeni* lac crops by the NGOs and KVKs.
- Monitoring of lac crops in Putidih, Jamtara, Dhanbad and Khunti areas.
- Officials visited Chandwa, Herhanj, Kundri, Daltongunj, Garhwa, Saraidih, Ramkanda, Chianki, Garu etc. areas for assessing the reasons for insect mortality and poor lac crop in the areas.

4. APPROVED ON-GOING RESEARCH PROJECTS

4.1 Insect Improvement

Sl	Project	Principal Investigator
1.	Collection, conservation, characterization and documentation of lac insect bio-diversity.	Dr. K. K. Sharma
2.	Field evaluation of promising lac insect races, lines and breeds for higher productivity and superior performance.	Dr. Md. Monobrullah

4.2 Host Improvement

3.	Collection, conservation, characterization and documentation of lac host bio-diversity.	Sri S.C. Srivaastava
4.	Host plant evaluation and improvement for lac productivity and summer sustainability.	Dr. R. Ramani
5.	Clonal propagation of *Schleichera oleosa* (*kusum*), a major lac host plant through tissue culture.	Dr. D. Saha

4.3 Crop Production

6.	Studies on *in-situ* moisture conservation techniques for raising mixed plantation of *ber* and *kusum.*	Sri R.K. Singh
7.	Development of *kusmi* lac cultivation technology on *Albizia procera (Siris).*	Dr. A.K. Jaiswal
8.	Collection, identification and assessment of the diseases of commercial lac hosts.	Dr. A.K. Singh
9.	Management of sooty mould, causing lac insect death and failure of lac crop.	Dr. A.K. Singh
10.	Soil fertility management of *ber* (*Z. mauritiana*) for shoot growth and lac yield (*aghani*).	Dr. S. Ghosal
11.	Production of quality broodlac on *kusum* and *palas* at different agro-climatic region.	Dr. K.K.Sharma
12.	Evaluation of potential herbicides for weed management in *semialata* and *ber* plantation.	Dr. B.P. Singh
13.	Development of lac production system using high density *ber* plantation under semi protected conditions. (NABARD sponsored)	Dr. R. Ramani

4.4 Synthesis and Product Development

14.	Synthesis of thiosemicarbazide and thiodiazole from aleuritic acid and testing its activity as antifungal / hypoglycemic / antinemic.	Dr. Divya
15.	Comparative evaluation of physico-chemical anti-inflammatory and hypolipidemic properties of oleo gum resins from *Boswellia serrata, Commiphora mukul* and *Commiphora wightii.*	Dr. M.Z. Siddiqui
16.	Synthesis of hydrogel from gum acacia and gum karaya for their comparative evaluation in drug release.	Sri S.K.S.Yadav
17.	Screening of bioactive compound synthesized from aleuritic acid.	Dr. R.N. Majee

4.5 Surface Coating and Use Diversification

18.	Development of surface coating formulation based on shellac synthetic resin/polymer blends.	Sri M.F. Ansari
19.	Documentation and characterization of physico-chemical properties of plant based gums of commercial importance.	Dr. K.P. Sao
20.	Preparation and market evaluation of heat and water proof shellac varnishes for wooden surfaces and air drying type shellac based glazing varnishes.	Dr. M.Z. Siddiqui
21.	Comparative performance of water soluble lac varnishes and their keeping quality by using different alkalies.	Sri P.M. Patil

4.6 Processing and Storage

22.	Establishment of commercially viable pilot plant for preparing pure/food grade lac dye.	Dr. K.M. Prasad
23.	Storage loss assessment for lac and lac based products.	Dr. S.K. Giri
24.	Establishment of commercially viable plant of aleuritic acid for training, demonstration and process refinement.	Dr. S.K. Giri
25.	Design and development of seedlac dryer.	Dr. N. Prasad
26.	Establishment of pilot plant for dewaxed bleached lac (40 kg capacity) for training demonstration and process refinement.	Er. M. Prasad

4.7 Human Resource Development (HRD)

27.	Training, demonstration, extension education and information service on lac culture, processing and product development.	Dr. A.K. Jaiswal
28.	Enhancing livelihood options for poor tribal families of the Jharkhand state through capacity building in cultivation of lac and its value addition (JLDS).	Dr. K.K. Sharma
29.	Skill development and capacity building in lac culture through training and demonstration in Gujrat. (Gujarat Govt. Project)	Sri. Y.D. Mishra
30.	Developing sustainable farming system models for prioritized micro water shed in rainfed area in Jharkhand under component 3: sustainable rural livelihood security (SRLS) of National Agricultural Innovation Project (NAIP component-3).	Dr. A.K. Jaiswal
31.	Improving rural livelihood security through sustainable Integrated Farming System Model and Allied Enterprises in Bastar Region of Chhattisgarh (NAIP component-3)	Dr A.K. Jaiswal

4.8 Technology Assessment, Refinement and Dissemination

32.	Evaluation of some newer insecticides and bio-pesticides for eco-friendly management of insect pests associated with lac insect and host plants.	Dr. J. P. Singh

4.9 Liaison, Information and Advisory Service

33.	Informatics on lac production, marketing and processing.	Dr. Govind Pal
34.	Strengthening, liaison, information and advisory services on natural resins and gums.	Dr. A. Bhattacharya

5. PUBLICATIONS AND PUBLICITY

5.1 PUBLICATIONS

5.1.1 Research Papers

- Bhattacharya A, Kumar S and Jaiswal AK. 2007. Evaluation of *Trichogramma* species for the suppression of lepidopteran insect predator *Eublemma amabilis* Moore in lac culture on *Flemingia macrophylla*. *Journal of Biological Control*, **21** (2): 267-270.
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- Sharma KK, Kumar P and Ramani R. 2008. Pest sprectrum of lac insects collected from lac growing and non-lac growing regions of India and their emergence profile. *Journal of Insect science*, **21** (3): 290-294.
- Singh D, Sarkar PC and Srivastava S. 2008. Effect of lac based formulation on incidence of *P. italicum* on kinnow fruits. *Indian Phytopathology*, **61** (1), 79-82.
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- Baboo B, Prasad N and Pandey SK. 2008. Lac industry by-product utilization. Paper presented in 42nd ISAE Annual Convention and Symposium held at CIAE, Bhopal during February 1-3, 2008.
- Baboo B. 2008. Prospects of lac in Jharkhand *In* Construction of rural godowns and promotion of lac based industries in Jharkhand at Hotel Landmark, Ranchi on May 23, 2008.
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5.1.3 Books / Book Chapters/ Bulletins / Training Manuals

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- Monobrullah Md, Singh JP and Giri SK. 2008. Compilation of 10th Plan achievements, 20 pp.
- Pal G, Jaiswal AK and Bhattacharya A.2008. Lac statistics at a glance - 2008 IINRG-Technical Bulletin 16 pp
- Pandey SK, Prasad N and Giri SK. 2008. Project Profile on Aleuritic acid. pp: 1-12
- Pandey SK, Prasad N and Prasad M. 2008. Project Profile on Bleached lac (Cap. 50 kg/ day), pp 1-20.
- Pandey SK, Baboo B and Prasad N. 2008. Project profile on Small scale lac processing unit for seedlac (cap. 100 kg sticklac/day). pp.
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- Singh AK and Baiswar Pankaj. 2008. Influence of weather parameters on plant diseases. *In* Climate Change and Food Security (eds: M Datta, NP.Singh and Er. D Daschaudhuri),. New India Publishing Agency, New Delhi, pp.163-170
- Srivastava S, Baboo B and Giri SK. 2008. Quality Evaluation Laboratory – IINRG - A booklet. pp 16.

- Srivastava S and Singh R. 2008. Directory of lac related organization in India and abroad - A IINRG Publication. pp.

5.1.4 Popular Articles

- Ansari MF, Baboo B and Pandey SK. 2008. Capping cement used in electrical lamp industry, *ICAR News,* **14** (2): 22 pp
- Goswami DN, Singh DD and Baboo B. 2008. Multipurpose glazing varnish based on shellac and synthetic resin. *Paint India,* 67 pp
- Mishra YD and Singh BP. 2008. Demonstation of integrated *kusmi* lac production of *Flemingia semialata* with vegetable crops. Natural Resins and Gums *IINRG, News letter,* **12** (1) : 6.
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- Pal Govind, Singh RK and Srivastava S. 2008. *Lakh Ki Kheti- Adhik Aay Avam Rozagar Ka Shro, Rashtriya Krishi*, **3** (1):73-74
- Pal Govind, Singh RK and Bhattacharya A. 2008. Lac cultivation in Jharkhand : Status and Prospects, *Rashtriya Krishi*, **3** (1): 35-36.
- Prasad N, Baboo B, Pandey SK and Jaiswal AK. 2008. Empowering rural women-through small-scale lac-processing unit. *Indian Farming*, **58** (1): 9,13.
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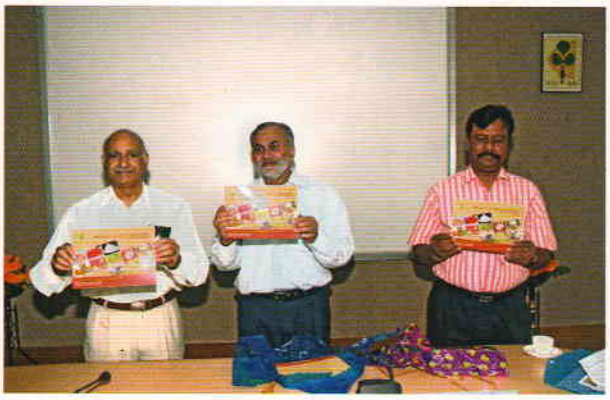
- Singh BP. 2008. Relative frequency of weeds in lac host plantations. Natural Resins and Gums *IINRG, News letter,* **12** (1) : 5-6.
- Singh RK, Pal G. and Giri SK 2008. Lac- a profitable enterprise for rural and unemployed youth. *Rashtriya Krishi*, **3** (2): 106-107.

5.1.5 Institute Publications

- An ISO 9001-2000 certified Quality Evaluation Laboratory Booklet, 16 pp
- IINRG–*Natural Resins and Gums Newsletter*,, **12**(1) : 20 pp
- *Natural Resins and Gums of Commercial Importance – At a Glance,* 2008 : 38 pp.
- IINRG Annual Report, 2007-08, 89 pp
- IINRG–*Natural Resins and Gums Newsletter*, **12** (2): 16 pp
- *Lac Statistics at a Glance* – 2008 : 14 pp
- Descriptors for lac insects with special reference to *Kerria* spp: 40 pp
- 10th Plan Achievements: 20 pp
- Status paper on Food applications of lac dye: 10 pp
- IINRG–*Natural Resins and Gums Newsletter*, **12** (3): 16 pp
- IINRG–*Natural Resins and Gums Newsletter*, **12** (4): 16 pp

Release of 10th Plan Achievements by Dr OP Dubey, Ex ADG (Plant Protection)



Release of directory by Dr S Ayyappan DDG (Fisheries)

5.2 PUBLICITY

5.2.1 Participation in Kisan Melas and Exhibitions

- Dr. JP Singh, Sr. Scientist participated in the Kisan Gosthi at Khelgaon Lagam, in the 5th Pratibha Darshan Mahotsabh (Krishi Mela) organized by All Jharkhand Farmer's Association, Silli, Ranchi on February 2, 2008.
- Dr. JP Singh, Sr. Scientist and Shri K Sharan, Museum Attendant participated in the 30th Annual Central Kisan Mela organized by Rama Krishna Mission at Getalsud Farm, Ranchi during February 7-8, 2008 and put up a stall on lac.
- Dr. G Pal, Scientist (SS) and Shri RN Vaidya, TO participated in the National Vegetable Farmers' Fair at IIVR, Varanasi, Uttar Pradesh during February 9-10, 2008 and put up a stall on lac.
- Sri RK Singh, Sr. Scientist and Shri RP Srivastava, TO participated in the Krishi Mela at Shankarpur, organized by ATMA, Hazaribagh on February 8, 2008 and put up a stall on lac.
- Dr AK Jaiswal, Sr. Scientist and Sri DK Singh, TO participated in the District Level Exhibition cum Kisan Mela, organized by ATMA, Jamtara, at Gandhi Maidan, Jamtara during February 25-26, 2008 and put up a stall on lac.
- Shri RN Vaidya, Sri RP Srivastava and Smt. Ratna Sen participated in the AGROTECH 2008, Kisan Mela organized by Birsa Agricultural University, Kanke, Ranchi during March 3-5, 2008 and put up a stall on lac.
- Shri RN Vaidya and Sri RP Srivastava participated in the Annual Silk Kisan Mela 2008, organized by Regional Sericulture Research Station (Central Silk Board), Ranchi on March 14, 2008 and put up a stall on lac.
- Dr. MZ Siddique and Shri RN Vaidya participated in the Tasar Mela cum Exhibition, organized by Central Tasar Research & Training Institute, Nagri, Ranchi on March 19, 2008 and put up a stall on lac.
- Dr. G Pal, Scientist (SS) participated in the Global Agro-Industries Forum : Increasing competitiveness and development Impact Exhibition organized at NASC Complex, New Delhi, during April 8-10, 2008 and put up a stall on lac, natural resins and gums
- Dr. S Srivastava, Dr M Z Siddique and Sri R N Vaidya put up a stall on lac, resins and gums in the Exhibition held during the Annual Workshop of AICRP, organized at BAU, Ranchi on April 26, 2008.
- Dr. G Pal, Scientist (SS) and Shri K Sharan participated in the exhibition organized by NABARD, Ranchi at Ashoka Hotel, Ranchi on May 12, 2008.
- Exhibition on lac based products was organized at Hotel Landmark, Ranchi on the occasion of the Seminar entitled "Construction of rural godowns and promotion of lac based industries in Jharkhand"
- Dr. JP Singh, Sr. Scientist and Shri K Sharan, Museum Attendant participated in the All India Litchi Show at NRC for Litchi, Mushahari, Muzaffarpur, Bihar during June 8-10, 2008 and put up a stall on lac. The stall was visited by Hon'ble Agriculture Minister and other ICAR dignitaries during the exhibition.
- Dr SK Giri, Scientist (SS) and Shri K Sharan, Museum Attendant participated in the Second Green Revolution Summit & Agro Protech Expo 2008 exhibition organized by ICC and Ministry of Agriculture at Science City, Kolkata during September 24-26, 2008 and put up a stall on lac.

- Shri A K Sinha, TO and Shri Kameshwar Sharan, Museum Attendant. participated in the 28th India International Trade Fair held at Pragati Maidan, New Delhi during November 14-27, 2008. The Institute had put up its stall in the Jharkhand and ICAR Pavilions during the Fair.
- Institute participated in the Udyog Mela organized by the Industries Dept., Govt. of Jharkhand at Military Grounds, Morabadi, Ranchi during November 15-25, 2008.
- Dr. BP Singh, Pr Scientist and Sri RN Vaidya, TO participated in the exhibition organized by ATMA, Hazaribagh during December 22-24, 2008.

Field surveys / Crop monitoring

- Dr. G Pal and Shri Madan Mohan visited Bilaspur, Korba, Janjgir-Champa, Surguja and Koria for assessment lac production and other information related to lac during January 3-8, 2008.
- Dr. G Pal and Shri Madan Mohan visited Jabalpur, Narshinghpur Piparia, Hoshangabad, Katni etc places in Madhya Pradesh during February, 27- March 4, 2008 for assessment of lac production and other information related to lac, natural resins and gums.
- Dr. G Pal, Scientist (SS) and Shri Madan Mohan, T2 visited Vishakapatnam, Vizianagaram, Srikakulam and Rajamundry districts in Andhra Pradesh for survey of lac and gum producing areas for collection of information and production assessment of lac and gums during May 25-31, 2008.
- Dr. A Bhatttacharya, Pr. Scientist and Sri RN Vaidya, TO visited Chandwa, Herhanj, Kundri, Daltongunj, Bhandaria, Garhwa, Chianki and Garu areas for assessing the reasons for insect mortality and poor lac crop in the areas during June 5-6, 2008. The meteorological data of Chadwa and Chianki were also collected .
- Dr. SK Giri, Scientist (SS) visited Chhotaudepur, Vadodara, Ahmedabad and Himmatnagar districts in Gujarat for collection of information regarding processing and storage of natural resins and gums during July 13-21, 2008.
- Dr. G Pal, Scientist (SS) visited Chhotaudepur, Sankheda, Vadodara, Ahmedabad, Himmatnagar in Gujarat for collection of data and information on lac and natural gums in the state during July 13-21, 2008.
- Dr. G Pal, Scientist (SS) and Shri Madan Mohan visited Bhubaneshwar, Balasore, Mayurbhanj etc. districts in Orissa for survey of lac and gum producing areas and for collection of information and production assessment of lac and gum during August 28- September 2, 2008.
- Dr. A Bhatttacharya, Principal Scientist and Dr G Pal, Scientist (SS) visited the lac industries located at Khunti, Murhu and Bundu for collection of information and data related to lac production and processing and validation of the information gathered earlier on august 26, 2008. They also visited the lac growing areas in Khunti district and interacted with the farmers for assessing the reasons for insect mortality and poor lac crop.
- Dr. G Pal, Scientist (SS) and Shri Madan Mohan visited Raipur, Dhamtari, Kanker, Bilaspur, Sakti, Korba etc. districts in Chhattisgarh during December 17-24, 2008 for survey of lac traders, lac manufacturer and discussion with Forest officials, NGOs etc. for collection of information and data related to lac production and processing.
- Dr. R Ramani, Dr. AK Singh, Dr. AK Jaiswal and Dr. JP Singh visited Putidih, West Bengal for crop monitoring of *kusmi* and *rangeeni* lac crops on December 12, 2008
- Dr. AK Singh, Dr. A Bhattacharya and Sh. YD Mishra visited two villages in Khunti area for monitoring of *rangeeni* lac crop raised on *ber* and *kusmi* lac crop on *F. semialata* on December 18, 2008.
- Dr A Bhattacharya and Sri P Pattamajhi visited three Blocks (Gurundia, Lahunipara and Kutra) in Sundargarh district during December 27-30, 2008 for monitoring of the *kusmi* lac crop on *ber* and *kusum* and provided necessary advice. Lac cultivation is being promoted in the district by Regional Office, TRIFED, Bhubaneshwar.

Awareness/Exposure Programme

- About 500 farmers hailing from Gumla and Latehar districts visited the Institute on February 1, 2008 for an exposure.
- Fourteen students and two teachers from BCKVV, Mohanpur, Kalyani, West Bengal visited the Institute on February 5, 2008 for an exposure.
- Thirty farmers from Chaibasa visited the Institute on February 6, 2008 for an exposure.
- Students (6) and Teachers (4) from Ranchi Women's College visited the Institute on February 18, 2008 for an exposure.
- About 40 students from St Margaret School, Ranchi paid a visit to the Institute on February 18, 2008 for awareness.
- About 165 Farmers and SHG members from Tribal Research and Training Centre, Karra Society for Rural Action and Gramin Vikas Trust from different Blocks of West Singhbhum, Jharkhand visited the Institute on March 7, 2008 for an exposure on lac.
- Dr A Bhattacharya and Shri S K Tripathy visited Bankura (Dalpur and Bohra villages) and Purulia (Laulara, Dangordih and Goalapara villages) in West Bengal for an Awareness cum Training and Demonstration programme.
- Dr A Bhattacharya and Dr. JP Singh visited Jagdishpur village of Koderma, Jharkhand on May 30, 2008 for an Awareness cum Training and Demonstration programme organized by KVK (CRURRS-CRRI), Jainagar, Koderma. The *Kisan Gosthi* was attended by over 70 farmers.
- Exposure visit of 40 members of SHG from Tribal Research and Training Centre, Chaibasa, West Singhbhum visited the Institute on June13, 2008.
- Hundred farmers sponsored by BASIX, Khunti visited the Institute Museum and Farm during January7-9, 2008 in three batches for an exposure.

Educational Tour for School/College students

- 32 UG students from BAU, Kanke visited the Institute on May 3, 2008 for an educational tour. They visited the Museum, Research Farm and were shown the film on lac.
- 22 students from Mandsaur, Institute of Science and Technology, Mandsaur, Madhya Pradesh visited the institute on November 11, 2008.
- 53 students from Metas Seventh Day Adventists College, Ranchi on November 14, 2008.
- 27 students from Ramgarh College, Ramgarh on November 27, 2008.
- 75 students from Institute of Science and Management, Pundag, Ranchi on December 18, 2008.
- Other 19 students from different colleges visited the Institute for an educational tour. They visited the Museum, Research Farm and were shown the film on lac.

Lac Promotion Activities

Raigarh (Chhattisgarh): Dr Bangali Baboo, Director alongwith Dr AK Jaiswal, Pr Scientist and Mr DK Singh, TO visited lac growing villages of Raigarh district in Chhattisgarh from 1-3 June 2008. The team visited Badpali village of Raigarh block where around 8,500 plants of *Flemingia semialata* were planted in July 2007 on 4 acre of land. There were 40 trees of *kusum*, which can be alternated with *semialata* for maintaining crop cycle. The team also visited Darama, Tenda, Bastipali and Sardhap villages of Gharghora block (around 40 kms. from Raigarh) where a lac development project under SGSY, sponsored by Zila Panchayat and implemented by a NGO "Janmitram Kalyan Samiti" is being run. The team noted excellent performance of *kusmi* lac crop on *kusum* trees. The team interacted with more than 200 members of SHGs in Darama, Bastipali and Sardhap villages. A plenty of *kusum* trees were available in a cluster of 15 villages which have suitable climate for lac cultivation. Bastipali and Sardhap village have around 1500 and 5000 *kusum* trees, respectively. Several *kusum* trees were able to produce more than 100 kg of broodlac, which costs around Rs. 13,000. Earlier

farmers were fetching Rs. 250-500 per annum from each *kusum* tree by sale of tree seeds. Visit was also undertaken in Kudumkela village of Dharamjaigarh sub-division of the district where around 8,000 plants of *Flemingia semialata* was raised by SHGs during July 2007 and ready for crop inoculation in July 2008. Around 600 quintals of *kusmi* broodlac is expected to be harvested during July from the working area.

Besides, a lac artisan centre in Dharamjaigarh was also visited where the local rural youth started producing lac based commercially viable products like lac bangles; lac based painted glass plate, paper weight, hair clip and other items. Dr Bangali Baboo, Director, IINRG, Ranchi complimented the NGO "Jan Mitram Kalyan Samiti" and ex-trainees for their devotion and excellent work carried out in Raigarh district for development of lac. Director also visited Balpeda village of Dharamjaigarh sub Division for lac crop on *kusum* tree. Very large sizes of *kusum* trees are available in the areas as in Gharghora block. An isolated *kusum* tree with lac crop of around 90-100 ft. height was noted. A group of 20 farmers involved in lac cultivation interacted with Dr Bangali Baboo and Dr AK Jaiswal and answered technical questions raised by the farmers.

Dr. Bangali Baboo, Director, IINRG, Ranchi addressing women self help group in Ranchi district, Jharkhand

Dr. Bangali Baboo, Director, IINRG, Ranchi being shown exhibits prepared by Lac entrepreneurs

Ranchi: Dr. Bangali Baboo, Director, IINRG, Ranchi visited Mangobandh village of Namkum block on 24 May 2008. He assessed the geography and topography of the village and evaluated lac development programme of the village. Sri Prakash Sanga, a progressive lac farmers and ex-trainee of the Institute linked 35 farmers of the village and formed SHG for lac. The village has plenty of commercial host trees like *kusum*, *ber* and *palas*. While addressing around 60 farmers mainly women, he reminded villagers that three years back he addressed the farmers at the same venue and there is a lot of changes since then in terms of people participation and awareness for lac. He appreciated the efforts of Mr Prakash Sanga for implementation of scientific lac production in the village and educating other farmers for the same. Besides, he also suggested the farmers to plant new host on wasteland of village. This village has plenty of *ber* trees and farmers have adopted the Institute's technology of *kusmi* lac cultivation on *ber* trees on large scale. The farmers explained the technical problems faced by them like occasional mortality of lac insect resulting shortage of broodlac, losses caused by *Chrysopa sp*. attack and dearth of money.

Dr Bangali Baboo, Director, IINRG interacting with women self help group

- The Institute facilitated 50 kg *kusmi* broodlac each to KVK Lohardaga and Gumla as a promotional activity for raising *aghani* 2008-09 crop. Crop inoculation, *phunki* removal and insecticidal spraying were carried out as per schedule and the crop condition is good.
- Seventy plants of *Flemingia* species (*F. semialata* - 40 and *F. macrophylla* - 30) were transplanted for gap filling in the Technology Park of BAU, Kanke, Ranchi and 15 plants of *F. semialata* were inoculated with *kusmi*

strain of lac insect for raising *aghani* lac crop in the Technology Park.

- The Institute arranged 80 kg *kusmi* broodlac for crop inoculation on *ber* trees for the NGO, KGVK, Jamshedpur at Rajnagar Block.
- The Institute facilitated 105 kg *rangeeni* broodlac to KVKs at Lohardaga, Palamau, Garhwa, Gumla and Koderma as a promotional activity for raising *baisakhi* lac crop. Crop inoculation, *phunki* removal and insecticidal spraying were carried out as per schedule and the crop position is good.
- Dr. KK Sharma, PS, LP Division organised One –day orientation training programme on February 6, 2008 for 35 representatives of the NGOs selected for implementation of the JLDS project. Mr. RK Ranjan, Deputy Director, Welfare Department, Jharkhand Govt. was also present on the occasion. The participants were apprised of the objectives of the project, role of each stake holder and activities to be carried out for effective implementation of the project.
- Dr. KK Sharma, PS, LP Division organised a five-day training programme for a scientist and a technical officer of NRC Agroforestry, Jhansi on different aspects of lac cultivation, post-harvest and marketing of lac during March15-19, 2008.
- MF Ansari, Scientist (SS) visited Vadodara and Ahmedabad districts of Gujarat during July 13-17, 2008 for collecting information about practice of mixing of salt with stick lac and to have exposure on lacquering of furniture with lac in Sankheda.
- MF Ansari, Scientist (SS) visited Delhi during July 18-21, 2008 to discuss and explore possibility of making shellac based dental plates in commercial system of manufacturing the plates, Shriram Institute for Industrial Research for having exposure about surface coating facility, protocols and procedure for testing of materials etc. He also visited Krishi Anusandhan Bhawan, Pusa Campus and meet with Dr VP Kothiyal, Director (Works) regarding popularization and promotion of Melfolac and Glazing Varnish.
- Dr. KK Sharma, PS, LP Division visited Assam during August 5–10, 2008 for training and demonstration of lac cultivation. He had a meeting with Dr. RM Dubey, CCF to explore the possibility of intercropping bushy lac host plants with forest trees in about one hectare area for livelihood generation. 250 g seeds each of four host-plants namely; *Albizia lucida*, *Acacia catechu*, *Flemingia macrophylla* and *F. semialata* were provided to him for intercropping among the tree plantations to be raised under the sponsored project Natural Resource Management and Integrated Livelihood (NaRMIL). He visited the plantation site at Rani (about 40 km from Guwahati) and advised on technical aspects of nursery raising of bushy plants and layout plan for plantation raising.
- One-day training programmes were organised at Hojai (Nagaon) on August 07, 2008 and Kukurmara (Kamrup) on August 8, 2008. About 50 members of Joint Forest Management Committee (JFMC), Forest Rangers and other forest officials attended the programme at each place. He delivered lectures on Role of lac cultivation in income and employment generation, Scientific methods of lac cultivation and potential of lac cultivation in North Eastern states. Pruning of lac-host plant and broodlac inoculation operations were also demonstrated to the participants. 10.0 kg broodlac was distributed among the trainees who had lac-host plants. Film on lac was also screened before the participants.
- Dr. Md Monobrullah, Sr. Scientist, LP Division organized a farmer's camp on October 30, 2008 in collaboration with SKUAST-J at Raya Research Sub-Station of SKUAST-Jammu for lac cultivation on *ber* and *palas* trees in the region. Farmers were also shown the video film produced by IINRG

and were exposed to a field demonstration for harvesting, bundling and tying/placement of broodlac. Literatures pertaining to lac cultivation were also distributed among the farmers to enhance their knowledge in lac cultivation. Twenty kg broodlac was given to Shri Ranjeet Singh and Md. Rafique (10 kg to each) of village Raya for its inoculation on 20 *palas* trees. Shri Ashok Singh Jamwal of village Suchani volunteered 20 *palas* trees for lac cultivation under our supervision.

5.2.2 Radio / TV talks by Subject Matter Specialists

- Lac cultivation on *Flemingia semialata* was telecast on January 02, 2008.
- Dr. KK Sharma, Principal Scientist, Lac Production Division, delivered a Radio talk on *Lah ki katai avum vipanan vyavastha* which was broadcast by DDK Ranchi on March 22, 2008.
- Recording and telecast of a radio talk on *Lakh ki bazar Vyavastha* by AIR, Ranchi on August 10, 2008.
- Dr. KK Sharma, Principal Scientist, Lac Production Division, delivered a TV talk on *Jharidar podhon par bagan laga kar kusmi lah ki vaigyanik kheti* which was telecast by DDK, Ranchi on July 25, 2008.
- Dr. JP Singh, Sr Scientist, delivered a TV talk on *Care and management of kusmi lac crop* telecast on July 29, 2008 by Etv (Bihar/ Jharkhand).
- Dr. JP Singh, Sr. Scientist, delivered a TV talk on *Management of lac host plants and insect during winter season* telecast on December 12, 2008 by Etv (Bihar/Jharkhand).

6. PARTICIPATION OF SCIENTISTS IN CONFERENCES/MEETINGS/ SEMINARS/ SYMPOSIA/ WORKSHOPS/TRAININGS

6.1 Participation in Conferences / Meetings / Seminars etc.

6.1.1 By Dircetor

- 42nd Annual convention of IASE and symposium on crop residues, animal waste and by-product utilization, CIAE, Bhopal during February 1-3, 2008.
- Management development programme on "Leadership for innovation in agriculture" Indian Institute of Management, Lucknow during February 4-8, 2008.
- RAC meeting of Central Tasar Research and Training Insitute, Ranchi during February 28-29, 2008.
- Science based agriculture transformation towards alleviation of hunger and poverty in SAARC countries. IFFCO and ICAR, New Delhi during March 5-7, 2008.
- Zonal workshop of KVKs (Zone II), ICAR, BAU, Ranchi during March 14-16, 2008.
- XII meeting of Chemical Division Sub-committee CHD-23 (Lac, Lac Products & Polishes) at BIS, Manak Bhavan, New Delhi on April 8, 2008.
- ICAR-ICRAF Agro-forestry Workshop, NASC, New Delhi during April 18-21, 2008.
- Meeting with DDG (Engg.) and chairman, QRT for finalizing QRT and the prorgamme for review at ICAR, New Delhi on April 23, 2008.
- Ministry of Commerce, New Delhi and on regular sharing of data on import and export of natural resins and gums as also possible funding for overseas market research during May 4-5, 2008.
- ISAE Executive Committee meeting at New Delhi on May 14, 2008.
- Interaction with lac farmers groups in Raigarh district and meeting with DFO, Dharamajaigarh for lac development work in the area on June 2, 2008.
- Institute SFC meeting at ICAR, Krishi Bhavan, New Delhi on June 24, 2008.
- National Symposium on "Enhancing Productivity, Nutritional Security and Export Potential through Arid Legumes", CAZRI, Jodhpur during June 28-29, 2008.
- Project Screening Committee meeting of Agril. Engg. Division of ICAR.on July 5-6, 2008, at IINRG, Ranchi.
- Interaction meeting on approach for improving economic sustainability of farmers through cluster and demand driven farming. August 1, 2008, MFPI, Govt. of India, Project Bhavan, Ranchi.
- ASRB foundation day programme and technical session on issues related to recruitment. NASC complex, New Delhi on November 4, 2008.
- Visited SKUAST Srinagar and delivered a lecture on Natural Resins and Gums - A potential source of livelihood in forest, arid regions and mountains. SKUAST Kashmir on November 5, 2008.
- Technical advisory group meeting of NAIP (component – 2). LBS Building, IARI, New Delhi on November 7, 2008.
- Inaugural session of winter school on "Recent advances in rainfed horticultur based farming system in plateau and hilly region". HARP, Ranchi on November 11, 2008.

- Research project committee of NAIP (component – 3). KAB-II Pusa, New Delhi on November 17, 2008.
- National conference on Eco-friendly approaches in sustainable agriculture and horticulture production. Amity University, Lucknow during November 28-29, 2008.
- 68th meeting of Board of Management, BAU, Ranchi on December 16, 2008.
- Meeting of Directors and Project Coordinators of Ag Engg. Division, ICAR, KAB-II, Pusa, New Delhi on December 12, 2008.
- Meeting of DDGs and ADGs on technical programme of network project on Natural Resins and Gums, ICAR, KAB-II, Pusa, New Delhi on December 23, 2008.

6.1.2 By Others

- Dr A Bhattacharya, Pr. Scientist and Head TOT Division attended the IMPCC Meeting held at Dooradarshan Kendra, Ranchi on January 21, 2008.
- Dr A Bhattacharya, Pr. Scientist and Head TOT Division attended the State level Credit Seminar organized by NABARD on January 29, 2008 at Hotel Ashok, Ranchi.
- Dr A Bhattacharya, Pr. Scientist, Dr A K Jaiswal, Sr Scientist and Dr N Prasad, Sr. Scientist attended the Launch Workshop of NAIP on February 7, 2008 at BAU, Kanke, Ranchi.
- Dr A Bhattacharya, Pr. Scientist and Head TOT Division attended the Departmental Seminar (Chemistry) on Fragrance (Essential oils) at Ranchi Women's College, Ranchi on February 16, 2008 and delivered lectures on the Applications of Lac and Management of lac insect predators utilizing essential oils of grasses.
- Dr. N Prasad, Sr. Scientist attended Stake Holder Consultation Workshop on India-Japan Free Trade Agreement/Economic Partnership Agreement held on March 05, 2008 at Hotel Capitol Hill, Ranchi. Organized by FICCI and FJCCI under the Govt. of India –UNCTAD-DFID Project on Strategies and Preparedness for Trade and Globalization in India.
- Dr. Md. Monobrullah, Sr. Scientist, LP Division attended Scientific Advisory Committee Meeting at KVK (CRURRS/ CRRI) Jainagar of district Koderma on March 10, 2008.
- Dr. JP Singh, Sr. Scientist attended the meeting of the IMPCC, Jharkhand at Doordarshan Kendra, Ranchi on March 13, 2008.
- Dr. G Pal, Scientist (SS) attended the quarterly meeting of AIR, Ranchi for finalization of topics for telecast on March 27, 2008.
- Dr AK Jaiswal, Pr. Scientist and Dr JP Singh, Sr. Scientist attended and presented research paper in National Conference on Pest Management Strategies for Food Security at Indira Gandhi Krishi Vishwavidyalaya, Raipur during May 2-3, 2008.
- Dr Bangali Baboo, Director, Dr A Bhattacharya, Pr. Scientist, Dr N Prasad, Sr. Scientist, Dr G Pal, Scientist (SS), Shri SK Pandey, Scientist (SS), Dr SK Giri, Scientist (SS) and Shri FA Ansari, Scientist attended the seminar entitled "Construction of rural godowns and promotion of lac based industries in Jharkhand" at Hotel Landmark, Ranchi, organized by Agri-Horticulture and Agro-Rural Industries Committee on May 23, 2008.
- Dr JP Singh, Sr. Scientist attended the Scientific Advisory Committee Meeting of RK Mission, Ranchi on May 28, 2008.
- Dr AK Jaiswal, Pr. Scientist attended the IMPCC Meeting held at the Railway Headquarters, Hatia, Ranchi on May 28, 2008.
- Dr. N Prasad, Sr.Scientist attended All India Seminar on Recent Advances in Nanotechnology –State of the Art on June 14-15, 2008 at BIT, Mesra. Organized by Institution of Engineers (India) Jharkhand State Centre, Ranchi and BIT, Mesra.

- Dr G Pal, Scientist (SS) attended the quarterly meeting of AIR, Ranchi on June 10, 2008 for deciding the topics for the quarter (July-September, 2008).
- Dr A Bhattacharya, Pr. Scientist attended 28th Foundation Day Celebration function of Birsa Agricultural University, Kanke on June 26, 2008.
- Dr. N Prasad, Sr. Scientist attended 3rd National Symposium on Enhancing Productivity, Nutritional Security and Export Potential through Arid legumes Organized by Indian Arid Legumes Society, CAZRI, Jodhpur during June28-30, 2008.
- Dr JP Singh, Sr. Scientist attended the meeting organized by Jharkhand Tribal Development Society (JTDS) at Hotel Green Acres, Ranchi on June 30, 2008.
- Dr. KK Sharma, PS, LP Division attended a meeting at Deputy Development Commissioner Office on July 29, 2008 organised by GVT for discussion on Rural Business Hub.
- Dr. JP Singh, Sr. Scientist attended the Seminar on "Geo-spatial technology", at Hotel Capitol Hill, Ranchi, organized by Leica Geospatial Ltd. on August 29, 2008.
- Dr. A Bhattacharya, Pr. Scientist and MF Ansari, Scientist (SS) attended and presented the technologies available for commercialization in the seminar on 'One day awareness programme on shellac cluster', under the aegis of Ministry of M.S.M.E, Govt of India, jointly organized by DIC, Purulia and Balrampur KLKSB Samiti, on September 4, 2008 at Balrampur, Puarulia, West Bengal.
- Dr. JP Singh, Sr. Scientist attended the quarterly meeting of AIR, Ranchi for deciding the topics for the quarter October-December, 2008 on September 18, 2008.
- Dr. SK Giri, Scientist (SS) attended a 3-day Conference and exhibition titled "Second Green Revolution Summit and Agro Protech Expo 2008" during September 24-26, 2008 at Science City, Kolkata
- Dr. SK Giri, Scientist (SS) attended a Conference and exhibition on"Second Green Revolution Summit and Agro Protech Expo 2008" during September 24-26, 2008 at Science City, Kolkata.
- Dr. JP Singh, Sr. Scientist attended the IMPCC Meeting held at Jharkhand State Aid Control Society Office in Sadar hospital, Ranchi on September 25, 2008.
- Dr. AK Jaiswal, Pr. Scientist attended the Ex Trainees Sammelan organized by R K Mission, Ranchi on September 26-27, 2008.
- Dr. BP Singh, Pr. Scientist visited KVK Gumla located at Bishunpur, Gumla, Jharkhand for attending the Scientific Advisory Committee meeting on September 29, 2008.
- Dr. KK Sharma, PS, LP Division visited National Bureau of Animal Genetic Resources, Karnal and Central Sericulture Germplasm Resource Centre, Hosur (TN) during October 15-23, 2008 for discussion and collection of information on various aspects of germplasm conservation especially molecular characterization, evaluation, documentation and registration of developed varieties.
- Dr JP Singh, Sr. Scientist attended the meeting of IMPCC at Sadar Hospital, Ranchi on October 27, 2008.
- Dr A Bhattacharya, Dr JP Singh and Dr Anjesh Kumar attended the IMPCC meeting for the month of November which was held at IINRG on November 27, 2008.
- Dr R Ramani, Head, Lac Production Division attended XIX Regional Committee No. 4 Meeting of ICAR on November 21-22, 2009 at IIVR, Varanasi.
- Dr JP Singh, Sr. Scientist attended the meeting of IMPCC at DD Kendra, Ranchi on December 23, 2008.

6.2 Human Resource Development

- Shri RK Singh, Scientist (Sr. Sc.) attended a four day training programme on 'Project Management' at Indian Institute of Forest Management, Bhopal during February 26-29, 2008.

- Sri K.M.Sinha, TO, attended one week training programme on Technical and Administrative support for Consortia-based Research in Agriculture at National Academy of Agricultural Research Management, Rajendranagar, Hyderabad, Andhra Pradesh during May 21-27, 2008.
- Dr AK Singh, Pr. Scientist attended five days training programme on PME of Agricultural Research & Development Projects at NAARM, Hyderabad during June 16-20, 2008.
- Dr AK Jaiswal, Pr Scientist & Co-PI and Shri P. Singh, AAO attended two days training programme on Procurement procedures of the world bank under NAIP at BCKV, West Bengal during June 26-27, 2008.
- Dr N Prasad, Sr. Scientist, attended five days training programme on Leadership for Innovation in Agriculture at MANAGE, Hyderabad during August 25-29, 2008.
- Sh. SKS Yadav attended a training programme on "IT-based Decision Support Systems for Multimedia Development" at National Academy of Agricultural Research Management, Rajendranagar, Hyderabad, Andhra Pradesh during September 15-24, 2008.
- Sh. A.K. Sahay, TO, attended two days training programme on Management Developing Programme on performance assessment of Agriculture organization at NAARM, Hyderabad during September 19-20, 2008.
- Shri RK Singh, Scientist (Sr. Sc.) attended a 21-day training programme (winter school) on 'Recent advances in rain fed horticulture based farming systems in plateau and hill regions', HARP, Ranchi. during Nov 11-Dec 1, 2008.
- Sh. M. Prasad, Pr. Scientist attended Training cum Workshop on IP and technology management at NBFGR Lucknow during December 18-20, 2008.
- Sh. C.L. Meena, JAO and Sh. Arun Gope, UDC attended two days training programme on Financial Management System Under NAIP at BAU, Ranchi during December 22-23, 2008.

6.3 Honours and Awards

- Dr R. Ramani, Head, Lac Production Division received Prof. J.N.Chatterjea Memorial award 2008.
- Dr KK Sharma, Principal Scientist, Lac Production Division received Senior Scientist Award 2008 under Prof. PN Mehrotra Memorial Chair and by Madhavi Shyam Educational Trust (MSET), Ranchi.
- Dr. Md. Monobrullah, Senior Scientist, Lac Production Division was declared Life Fellow of Entomological Society of India, for his contribution in the field of Entomology and Agricultural Zoology by the Entomological Society of India, New Delhi.

7. EVENTS

7.1 Annual Lac Kisan Mela

The Annual Lac Kisan Mela was organized at the Institute on 15 February, 2008. The *Lac Mela* was inaugurated by Shri AK Sarkar, Principal Secretary, Agriculture and Cane Development Department, Jharkhand Government. Dr NN Singh, Vice Chancellor, Birsa Agriculture University, Ranchi presided over the function. Inauguration of mela began with the welcome address by Dr Bangali Baboo, Director who briefly explained the research accomplishment and various programmes being carried out by the Institute for the welfare of farmers and entrepreneurs. He said that the Institute is always ready to help the farmers as per their need and the Institute is regularly organizing incampus and off campus training programmes on scientific methods of lac cultivation. He also highlighted the Institute's expanded mandate, which is now covering on all types of natural resins and gums including lac for research and development. The main objective of the mela was to expose the farmers, industrialists, entrepreneurs and government functionaries about lac based technologies developed by the Institute.

The Chief Guest, while addressing the gathering of farmers, scientists, entreprenures, representative of GOs and NGOs, emphasized that with the increasing demand of natural products, the demand and consumption of lac has increased worldwide. He suggested the farmers to utilize wasteland for lac host plantation and to undertake lac production in a big way in the state as this is most suitable crop in rainfed condition and undulating land of Jharkhand poses limitation for better agriculture crops. He laid emphasis on planting of more lac host trees under social forestry programme. While lauding the role of the Institute under the able guidance of the Director in developing efficient and farmers friendly technologies, Chief Guest opined that progress made by the Institute was excellent and the farmers should use the techniques developed by the Institute to augment

Shri AK Sarkar, Principal Secretary, Agriculture and Cane Development, Jharkhand Government. inaugurating the Kisan mela

Dr Bangali Baboo, Director, IINRG addressing the audience

Twenty stalls from different organizations like Horticulture and Agro-Forestry Research Programme (HARP), IFFCO, Jharkhand State Cooperative Lac Marketing and Procurement

lac production. Dr. NN Singh, Vice Chancellor, Birsa Agricultural University deliberated that the climate of the Jharkhand is congenial for lac production. Lac cultivation is the nature's gift for livelihood support to tribal farmers of the Jharkhand and the wasteland in the state should be utilized for growing lac to enhance the income of poor tribal farmers.

Federation (JHASCOLAMPF), Institute of Forest Productivity (IPF), State Bank of India, TRIFED, JTDS, Indian Railways, Balaji Traders, National Enterprises, Golden Seeds, RK Mission, TRIBES, M/S Jaffar Ali Manihar, Pesticide Firms, NGOs and Entrepreneurs were put in the exhibition. More than 400 farmers, entrepreneurs, officials from GOs and NGOs from different parts of the Jharkhand, Chhattisgarh. Orissa, West Bengal, Madhya Pradesh and Gujarat participated in *Kisan mela* who were shown around the Institute Research Farm. They were apprised of the various lac production technologies, new lac host plants introduced for lac cultivation and pest management methods. On this occasion a *Kisan Gosthi* was also organized in the afternoon session for redressal of the technical problems being faced by the farmers. Specialists from IINRG, HARP, IFP and Birsa Agricultural University directly interacted with farmers and tried to redress the technical problems faced by the farmers in lac cultivation and other agricultural aspects. Dr A Bhattacharya, Principal Scientist and Head TOT was the convenor and Dr JP Singh, Senior Scientist was the co-convener of this event.

During this occasion, the Institute honored the farmers, entrepreneurs, industrialists, lac artisan and Government officials from Jharkhand, West Bengal, Chhattisgarh, Madhya Pradesh, Gujarat and Maharashtra for their outstanding contribution in the areas of production, processing and promotion of lac. In farmer's category Sri Bhaweshwar Nareti, Devendra Nath; in the entrepreneur's category S/sri Mukesh Goswami, Shaktidhar Koeri, Brajesh Kumar Mishra; in industrialist category Sri Gajanan Agarwal, Samar Singh Jaiswal and in the lac promotion category Sri P.L. Solanki, S.S.Maiti, B. Anand Babu, K.C. Shashidhar and J. Amin were honoured.

7.2 Project Screening Committee Meeting for Agricultural Engineering Division

The project screening committee meeting for agricultural engineering division was held during July 5-6, 2008 at IINRG under the Chairmanship of Dr. Nawab Ali, DDG (Engg.), ICAR, New Delhi and following members attended the meeting.

Dr. Nawab Ali, DDG (Engg.)	Chairman
Dr. Pitam Chandra, ADG (PE)	Member
Dr. M. M. Pandey, Director, CIAE, Bhopal	Member
Dr. R.T. Patil, Director, CIPHET, Ludhiana	Member
Dr. S. Sreenivasan, Director, CIRCOT, Mumbai	Member
Dr. S. Bhattacharya, Director, NIRJAFT, Kolkata	Member
Dr. Bangali Baboo, Director, IINRG, Ranchi	Member
Dr. Surindera Singh, PC FIM, CIAE	Member
Dr. S.K. Routray, PC (UAE)	Member
Dr. L.P. Gite, PC (ESA)	Member
Dr. S. K. Nanda, PC (PHT)	Member
Dr. P. R. Bhatanagar, PC (APA)	Member
Dr. S. K. Tandon, ADG (Engg.)	Member Secretary

Welcoming the members present, Dr. Nawab Ali, DDG (Engg.) apprised that the objective of the meeting is to review the final reports of the concluded adhoc projects and to identify the output for further necessary action. During the meeting it was decided to bring out a consolidated report on the significant achievements made under adhoc projects. Dr. Pitam Chandra, ADG (PE) further stressed to take good projects and identify the output and outcome of the projects and also showed his concern for non-submission of reports of the adhoc projects.

During discussion with Director's of Engineering Division, DDG (Engg.) and ADG (PE) asserted that there is an urgent need for projecting visibility of the Engineering SMD during 11th plan and publish their significant achievements in ICAR reporter. The following areas like annual report, publication of the Xth plan achievement, new research being done and future areas of research, research load, expertise list, new frontier areas of research, film on engineering SMD, broucher "At a Glance", collaboration with other Institutes and network on horticultural mechanization etc. were identified. Dr. Bangali Baboo, Director, IINRG, Ranchi proposed vote of thanks to the chair and members.

Project Screening Committee Meeting for Agricultural Engineering Division

7.3 Inauguration of pilot plant of aleuritic acid

Dr. Nawab Ali, DDG (Engg.), ICAR inaugurated the Aleuritic acid pilot plant on July 6, 2008 at Processing and Demonstration (PD) Unit of the Institute. Dr. Pitam Chandra, ADG (PE), Dr. S.K.Tandon, ADG (Engg.) and Directors of other Engineering Instituties were present on the occasion. The plant has been designed and installed at the Institute for training and demonstration to potential entrepreneurs and for research purposes, which can produce 2 kg of aleuritic acid per batch from seedlac.

Aleuritic acid, chemically 9, 10, 16-trihydroxypalmitic acid, is a major constituent acid (~35%) of lac resin (shellac). The demand of aleuritic acid is continuously growing in foreign countries as well as in domestic market especially in the field of perfumery and pharmaceuticals. It is an excellent starting material for the synthesis of different bioactive and perfumery compounds like civetone, ambrettolide, isoambrettolide etc., which have the musk like odour. Besides the perfumery industries, aleuritic acid has its application in various fields such as glucose monoaleuritate in medicines, preparation of plastics with good adhesive properties, lacquers, as an antioxidant agent for protecting skin etc.

Dr. Nawab Ali, DDG (Engg.), ICAR inaugurating the pilot plant of Aleuritic acid

7.4 National Hindi seminar organized

Institute organized a National Hindi seminar on "Status of water conservation at national level and its importance in agriculture" during September 19-20, 2008. Sixty-five delegates including 26 experts from different states and officials from ICAR, scientist and technical officers from HARP, NBPGR, and IINRG participated in the seminar. Addressing the inaugural session as chief guest Dr. AK Singh, DDG (NRM), ICAR, New Delhi dwelt on the importance and need for water conservation. He discussed about the problem of arsenic in water and urban waste water as pollutant in agriculture and stressed upon the use of urban waste water in agricultural work after treatment. He laid stress on judicious use of water.

Dr. AK Singh, DDG (NRM), ICAR, New Delhi lighting the lamp

Welcoming the chief guest and delegates Dr. Bangali Baboo, Director, IINRG said that the topic is very important as the water problem is very common despite good rain and it can be reduced by water conservation only. Sixteen papers were presented in the three technical sessions of the seminar by the experts on status of water harvesting, condition of water level in deserts, drinking water problem, irrigation system used in agriculture, use of water for agriculture in Jharkhand, use of agricultural implements in irrigation system, increase of silting problem and pollution in rivers etc. Dr. Ashwani Kumar, Director, WTCER, Bhubneshwar, chaired the first technical session whereas, second and third session were chaired by Dr. Anil Kumar, Professor & Head, Agriculture Engineering Division, BAU, Ranchi and Dr. Shivendra Kumar, Principal Scientist & Head, HARP, Ranchi, respectively. Dr. Pitam Chandra, ADG (PE), ICAR reviewed the recommendations of different technical sessions as chief guest of valedictory session and stressed the need to implement the different practices of water conservation. Presiding over the session Director of the Institute Dr. Bangali Baboo asserted that despite paucity of experts from the field of water conservation we have taken up an important issue which is equally essential for all. He said that meaningful discussions have taken place on the topic and problem attached to it. Dr. Baboo emphasized upon implementation of suggestions emerged out of the seminar in the right earnest.

Dr. KK Sharma, Principal Scientist and Convener of the seminar proposed vote of thanks and expressed hope that this programme will be helping to make the people aware about the water conservation simply through water harvesting. Seminar was conducted by Dr. Anjesh Kumar, Technical Officer (Official Language).

7.5 Celebration of Institute foundation day

To mark the occasion on the completion of 84 years of dedicated service to the Nation and to mark the occasion of 85th foundation day of the Institute on September 20, 2008, a lecture on Remote sensing in Agriculture was organized at the Indian Institute of Natural Resins and Gums. The lecture was delivered by Chief Guest Dr. A T Jayaseelan, Director, Jharkhand Space Application Centre. The meeting was presided by Dr. Bangali Baboo, Director of the Institute and all the staff members of institute attended a meeting. Dr. Jayaseelan elaborated the importance of Remote sensing techniques and its application in agriculture and he also emphasized that with the help of satellite we can explore the possibilities of suitable crop for the land being used. Addressing the meeting as Guest of Honour Dr. Nagendra Sharma, Ex. VC, SKUAST- Jammu appreciated the achievement of the Institute and said that after expansion of mandate the field of research has considerably increased. Earlier Dr. Bangali Baboo welcomed the guests and congratulated all the officials on this precious occasion. He expressed hope that with the active cooperation of all the staff members we will be able to achieve the goal which we have set after expansion of mandate.

Dr. A T Jayaseelan delivering a lecture on Remote sensing in Agriculture

7.6 International Conference on Transdisciplinary Biological Research organized at IINRG

A three day International Conference on Transdisciplinary Biological Research (ICTBR) was organized by International Consortium of Contemporary Biologists (ICCB) under the aegis of Madhwi-Shyam Educational Trust (MSET) in technical collaboration with Indian Institute of Natural Resins and Gums (IINRG) at its campus during November 20-22, 2008.

110 registered delegates from USA, Egypt and Ethiopia and different states of India participated in the Conference. Dr. Bangali Baboo, Director, IINRG presided over the inaugural session of the Conference. Dr. GHR Rao, University of Minnesota, USA was the Chief Guest and Prof. SI Salaby, University of Cairo, the guest of Honour on this occasion. 15 scientists were conferred Senior Scientist Award under different Chairs and 20 scientists were given Young Scientist Award in appreciation of their research contributions for advancement of scientific knowledge in their respective fields of specialization in the session.

Proceedings of the conference were spread over six technical sessions in which six plenary lectures, one in each technical session, were delivered by distinguished experts - Dr. GHR Rao, Lillehei Heart Hospital, University of Minnesota, USA; Prof. SI Salaby, Laboratory of Complementary Medicine, University of Cairo, Egypt; Dr. Bangali Baboo, IINRG, Ranchi, Dr. Neelima Gupta, Ruhelkhand University, Dr. Janardan Jee, ICAR-RCER, Patna and Dr. E Muniraju, Bangalore. 22 presentations on different aspects of various transdisciplinary subjects were made by subject specialists from different parts of the country. Eight posters were also displayed by the young researchers. Awards were given to three best presentations and two poster presentations. A cultural evening involving local artists was also organized for the participants. Dr. KK Sharma, PS and local Organizing Secretary of the ICTBR coordinated the activities of the Conference and proceedings of the conference were facilitated by Dr. Mahendra Prasad, President, MSET & ICCB, Ranchi.

Some of the important recommendations made during the valedictory session were: i) Organize and undertake the interdisciplinary applied biological research workshop and training centre / institute at an appropriate location, ii) Organize quarterly meeting of ICCB, if possible, in collaboration with local research organizations like IINRG, CTR&TI and RU, Ranchi, iii) Publish a brief Directory of scientists of local research organizations in the proceeding of the conference and iv) Organize the next conference in collaboration with Department of State Sericulture at Nagpur, Maharashtra.

8. MEETINGS OF IMPORTANT COMMITEES

8.1 Meeting of the 4th Quiquennial Review Team of the Institute

ICAR undertakes a quinquenial review of each institution to monitor the progress of research, its relevance and excellence critically and to provide guidelines for better achievement of the mission and goals of the Institution by independent body termed as QRT. It is generally carried out during last year of each five year Plan.

The Quinquenial Review Team for the IINRG, Ranchi for the period 2002-07 was constituted by the Director General, ICAR vide office order F.No.3(5)/2007 IA-II (AE) dated 26th June, 2008 which comprises following members.

1. Dr. O.P. Dubey, Ex ADG (Plant Protection), ICAR, New Delhi. — Chairman
2. Dr. A.K. Pandey, Head, Non-Wood Forest Produce Division, Regional Field Research Centre,Jabalpur. — Member
3. Dr. Md. Saleem, Prof & Head, Division of Agroforestry, SKUAST, Chatha, Jammu — Member
4. Dr. P. Kaushal, Dean (Forestry), BAU, Kanke, Ranchi. — Member
5. Sh. V. Krishna Rao, Chief Executive Officer, Kovel Foundation, Sagar Nagar, Vishakhapatnam, AndhraPradesh. — Member
6. Er. Murari Prasad, PS & I/c PPD Division, IINRG, Ranchi. — Member Secretary

The first meeting of QRT of the institute was convened at New Delhi on August 8, 2008 under the chairmanship of Dr. Nawab Ali, DDG (Engg). It was also attended by Dr. Pitam Chandra, ADG (PE) and Dr. Bangali Baboo, Director, IINRG.

The 2nd meeting was conducted during September 9-12, 2008 at IINRG. During the review meeting, besides overall presentation of progress by the Director, all three Heads of Division, Administrative Officer and Finance and Accounts Officer presented their salient achievements during last plan period. All the nine core program leaders presented their future strategies. The committee visited FLD's in and around Ranchi to assess the impact of the institute programme. They also visited M/s Tajna Shellac Factory at Khunti (Ranchi), HARP and BAU. The team conducted their business through four meetings held at New Delhi, Girijan Co-operative Society, Vishakhapatnam, Raipur, Chhattisgarh and at the Institute. The team has finalized their recommendation for submition to the Director General, ICAR, New Delhi.

Meeting of the 4th Quiquennial Review Team of the Institute

8.2 Institute Management Committee Meeting

The 41st Institute Management Committee meeting was held on 30th September 2008 at 11.00 in Kusmi Conference hall under the chairmanship of Dr. Bangali Baboo, Director and following members attended the meeting.

1.	Dr. Bangali Baboo, Director, IINRG	-	Chairman
2.	Dr. KP Tripathi, PS, CSWCR&TI, Dehradun	-	Member
3.	Sh. DN Choubey (Farmers' representative), Gondia	-	Member
4.	Dr. Anup Srivastava, GM (Forest Deptt.), Raipur (Representative of MD, CGMFP, Chhattisgarh)	-	Member
5.	Dr. H A Khan, PS, CAZRI, Jodhpur	-	Member
6.	Sh. Prem Shankar, F&AO, ICAR, RCER, Patna	-	Member
7	Er. Murari Prasad, HoD, PPD, IINRG	-	Member
8.	Dr. AK Jaiswal, PS& Trg. Coord., IINRG	-	Member
9.	Sh. P Singh, Actg. AO, IINRG, Ranchi.	-	Member-Secretary

Welcoming the members present Dr. Bangali Baboo, Director, IINRG presented a brief progress report of the Institute activities and informed that it is first meeting of IMC after expansion of mandate and change of name of the Institute. All the HODs presented their research achievements, Administrative Officer presented the matter related to establishment, purchase etc. and Finance and Accounts Officer presented financial statement. Recommendations and action taken report of 40th IMC meeting was presented in detail and accepted unanimously. Following important recommendations emerged from the meeting.

- Extension of existing TOT Building to include one Conference Hall of 250 seating capacity.
- Renovation of residential quarters (Civil & Electrical).
- Extension of Guest House as the present Guest House is inadequate in its capacity to accommodate guest.
- Nomination of members to the Institute Grievance Committee.
- It was decided to explore the possibility of rainwater harvesting system.
- Lac host tree will be planted at the Institute entrance (Main gate).
- Arrangement for lights in the Campus Parks
- CD of training/ demonstration programmes of TOT for revenue generation and wide publicity.
- Artificial bushes in the Campus.

8.3 Institute Research Committee

The Institute Research Committee (IRC) meeting for the year 2008-2009 was held during April 15-17, 2008 under the Chairmanship of Dr. Bangali Baboo, Director, IINRG in the Institute Conference Hall for scientific scrutiny of all the projects, to suggest corrective measures for successful implementation of research programmes and suitability of the new project proposals in the light of new expanded mandate of the Institute. Dr. SR Bhatt, Principal Scientist, NRC on Biotechnology, IARI, New Delhi and Dr Suresh Prasad, Professor, IIT Kharagpur were special invitees as outside experts in the meeting. Dr. RP Singh "Ratan", Director Extension, Birsa Agriculture University, Ranchi and Dr D Sasmal, Head, Deptt of Pharmaceutical, BIT, Mesra, Ranchi were not able to attend the meeting due to some urgent engagements.

In his opening remarks, Dr. Bangali Baboo, Chairman, IRC and Director of the Institute, welcomed the Experts, Member Secretary and the Scientists present in the meeting. Chairman emphasizes the present scenario of meager database, increasing demand of natural materials, decreasing production base, decreasing manpower in research, increasing challenges, failure of lac crop in some parts of Jharkhand and West Bengal. To address these issues he outlined some strategies as compile available information on gums and resins, develop package of practices for sustained tapping, scientific method of lac cultivation, processing, value addition, new products development with techno-economic analysis, human intervention for increasing production through plantation and efficient technologies, interaction with international organization like ICRAF, IFAD, WHO etc and national organization

like MEF, MFPI etc were also suggested. He invited suggestions to identify possible causes of lac insect mortality and crop failure during brain storming session. In his concluding remarks, Chairman IRC offered following suggestions .

- He reminded of the purpose of IRC as to consider, evaluate, recommend or reject RPF-I, II and III.
- Every Division should document and compile the highlight of the achievements / recommendations emerging out of scientists work specially before their retirement.
- Divisional projects needs to be minimized and mega projects should be preferred.
- He desired that Institute should fix its own target for enhancing productivity of lac and for developing new products or processing techniques for natural gums and resins during XI Plan.
- Documentation and follow-up of the major meetings, kisan mela etc is needed.
- Scientists / PIs / Core programme leader/ HODs should bring to the notice of the RMU/Director or defend the IRC comment immediately after the proceeding is out or during IRC meeting itself.
- Every RPF-III needs to be critically examined for output/recommendations. System followed by NAIP could be useful.

Chairman, IRC desires at least quarterly monitoring of each project by HODs. The proceedings alongwith comments be send to RMU regularly. Director would also review progress half yearly. All HODs should have strong liaison with related stakeholders to have a close touch with stakeholder's problems and need based research and transfer. The scientist to think and conceive of few high-tech science application projects on gums amd resins. During the three days deliberations in the SRC, 33 on-going research projects and 2 new project proposals were discussed.

To review the half yearly progress of the research projects, Half Yearly IRC meeting was held under the Chairmanship of Dr. Bangali Baboo, Director, IINRG during November 24-25, 2008 in the Institute Conference Hall. Chairman suggested that Two IRC be held in a year. The purpose of the mid-term IRC would be to review the half yearly progress of the research projects and ATR on RAC recommendations. PME cell should meet at least quarterly to review progress and advise on specific projects/programmes. During two days deliverations the progress of on-going research projects were reviewed. In his concluding remarks the Chairman desires that:

- The Scientists should contribute his best and maximum in R&D activity in the interest of the Institute.
- Institute is having very good infrastructure for R & D work and we should use these infrastructure in R&D activity more and more.
- Institute should go step forward on the isoambrettolide which as the big market of lac consumption excluding aleuritic acid.
- Participatory and collaborative research should be stressed and encouraged.
- We should try to use some other crops in monsoon season in addition to our present lac crop.
- Reporting system by HODs needs improvement and monitoring by the HODs level should be done critically.
- The PME cell of the Institute should be activated.
- Purchase Advisory Committee should review purchase of pending equipments / apparatus ensuring that research activities should not hamper.

9. DISTINGUISHED VISITORS

Visitors

Date	Visitor (s)
7.1.2008	Mrs Sakuntala Raha, Senior Manager, Usha Martin, New Delh
9.1.2008	Dr. K P Singh, Director Extension Education, GBPUAT, Pantnagar
16.1.2008	Prof. S. N. Sharma, BHU, Varanasi
18.1.2008	Lt. Col. A.D. Sharma, Second-in-Command, 9 Bihar, Namkum
28.3.2008	A. Dutta, Director, Bureau of Indian Standards, Patna
11.04.2008	Mr.J.Ravi, Dy Secretary (Personal),ICAR, New Delhi
25.04.2008	Mr.N.Goyal and Mr.N.Kumar Education Officers, Kendriya Vidyalaya, Bhubaneshwar.
25.04.2008	Dr. S. K. Dhyani, Director, NRC Agroforestry, Jhansi
1.05.2008	Dr. B. C. Viraktamath, Project Director, DRR, Hyderabad
15.05.2008	Mr. B. Stroever and Dr. Marcel Forsto, Germany
15.05.2008	Dr.M.P. Pandey, Director, Central Rice Research Institute, Cuttak, Orissa.
29.05.2008	Dr. Kirti Singh, Ex Chairman, ASRB, New Delhi and Dr.A.K.Singh, Head, Division of Horticulture and Floriculture, IARI, New Delhi.
14.06.2008	Shri Sudhir Mahto. Dy Chief Minister, Government of Jharkhand.
01.08.2008	Dr S Ayyappan, DDG (Fisheries)
14.08.2008	Dr T P Trivedi, Director DIPA
19.09.2008	Dr A K Singh, DDG (NRM), ICAR Dr Avinash Kumar, Director, WTCER, Bhubaneshwar Dr Pitam Chandra, ADG (PE), ICAR
20.09.2008	Dr S Jayseelan, Director, Jharkhand Space Application Centre, Ranchi Dr Nagendra Sharma, Ex VC SKUAT, Jammu
01.10.2008	Mr. K.P. Tripathi, P.S., CSWCRTI, Dehradun
01.10.2008	Mr. H.A. Khan, P.S., CAZRI, Jodhpur
15.10.2008	Dr. M.P. Chacharkar, Principal, Mandsaur Institute of Science and Technology, Mandsaur, M.P.
20.10.2008	Dr. V.P. Singh, ICRAF, NASC Complex, Pusa, New Delhi
21.11.2008	Dr. A.D. Yadav, Directorate of Sericulture, Govt. of Maharashtra, Nagpur
27.11.2008	Dr. R.K. Upadhyay, HOD (Zoology), Ramgarh College, Ramgarh
27.11.2008	Dr. Shailesh Pandit, Director, Door Darshan Kendra, Ranchi
18.12.2008	Dr. S.P. Mishra, Director, ISM, Pundag, Ranchi
27.12.2008	Dr. V. P. Sharma, Programme Director, BAIF, Pune

Dr S Ayyappan, DDG (Fisheries) visited the Institute

Dr. S Ayyappan, DDG (Fisheries) visited the Institute on August 1-2, 2008 and was shown on-going research activities, farms and laboratories. He took keen interest on the initiatives on Lac Integrated Farming System (LIFS) being developed in the Farm. He said that income can also be generated through fish culture and offered his valuable suggestions on nutrition and water management for enhancing fish productivity. Three species of Carp fingerlings were released by him in a 0.1 ha pond under the project and he wished its success. Dr. R Ramani, Head, Lac Production Division explained the concept of LIFS being developed in the Farm involving

agricultural crops, lac, horticulture and fish culture. Dr Ayyappan explained that such approaches are the need of the hour. In an interaction meeting with the scientists and staff members of IINRG and HARP the DDG discussed several issues related to IPR, NAIP, PMEC, PPP, ITMU, HRD etc. He suggested to rganize an International Conference on lac. A lecture on Inland Fisheries was delivered by him for the benefit of all. Two institute publications namely "Descriptors of lac insects with special reference to *Kerria* sp." and "Directory of lac related organizations in India and abroad" were released by him.

Dr. Ayyappan, DDG (Fisheries) releasing fingerlings in Institute pond

Dr. Ayyappan, DDG (Fisheries) visiting the Institute Research Farm

Dr. T.P. Trivedi, Project Director (DIPA) and A.D.G. (ARIS), ICAR visited IINRG

Dr. TP Trivedi, Projector Director (DIPA) & ADG (ARIS), ICAR, New Delhi visited IINRG, Ranchi during August 14-15, 2008 and addressed the meeting of Scientists and Technical Officers on August 14, 2008. Prior to this, he was shown Institute Research Farm, Lac Production Division, Library, Surface Coating Lab., Quality Evaluation Lab. and Lac Processing Unit, ARIS etc. Addressing the meeting on "Internet connectivity & ICT management" Dr. Trivedi explained the role of DIPA as input provider in agricultural information and said that it is an era of revolution in communication and role of information is very important, but it must be documented. Dr. Trivedi told that even during *Vedic* period, when better facilities were not available information were documented on leaves and that was stored in such a way that we are able to know some of the things happening those days. He said that knowledge of power and effective communication is essential for development of any product. He elaborated about launching of website and its importance. Dr. Trivedi informed that 95 ICAR Institutes, 61 coordinated projects, 16 network projects, 502 KVKs, 41 SAUs are directly connected with DIPA. He appreciated the Institute's performance and expansion of its mandate.

Dr. T.P. Trivedi, Project Director, DIPA and ADG, (ARIS) visiting the Institute Research Farm

Shri AK Sarkar, Principal Secretary, Agriculture and Cane Development, Jharkhand Government and Dr NN Singh, VC BAU visited the Insect Gene Bank of the Institute

Address by Hon'ble Chief Minister of Jharkhand Shri Shibu Soren to Farmers and Scientists at IINRG

Honourable Dy CM, Government of Jharkhand Sri Sidhir Mahto transplanting the kusum sapling in IRF

Visit of Lac Insect Gene Bank by Delegates of Project Screening Committee for Agricultural Engineering Division

Members of QRT visiting the Institute Research Farm

Visit of Hon'ble Dy CM, Government of Jharkhand Shri Sudhir Mahto at Institute Rerearch Farm

Dr VP Singh, Regional Representative of ICRAF for South East Asia visited the Research Farm of the Institute

10. SUPPORT SERVICES

10.1 INSTITUTE RESEARCH FARM

Institute Research Farm is field laboratory. Keeping this in mind, the farm was managed and maintained and tried to result in minimum experimental error due to farm condition. The following activities were undertaken during the period under report.

Research Farm Management

Research Farm was managed and maintained in such a way that it gives a scientific look. Roads, path, channels, hedges and edges were maintained in good conditions. All scientific cultural practices were undertaken in experimental as well as in general plot. Trees were pasted with lime mixed with insecticides (chlorpyriphos) to manage termites. The trees in plots with very unhealthy conditions and not in condition to rejuvenate were replaced. Sparsely populated plots were cleaned for new plantations and wherever possible the gaps were filled with suitable species. About 750 seedlings of *khair* were transplanted in gaps and gap filling of *khair* plots were completed. IRF boundary plantation was completed with the planting of 175 stumps of Teak and 125 seedlings of Gamhar. In Gum and Resin Farm, 15 plants of *Boswellia serrata*, 10 plants of *Guggal* and 8 plants of *Anogiessus latifolia* were planted. Vacant plots were utilized for cultivation of crops *viz*., wheat, paddy, soybean and *urd* for resource generation.

Infrastructure Development

- Plot No 61 of IRF was developed and vegetable crops were grown.
- About 8,000 fry carp (*Catla*, *Rohu*, *Mirgal*, *Grass* and *Silver carp*) were released in Kacha pond and 4,000 fry carps (*Catla*, *Rohu*, *Mirgal* and *Kalpose* etc) were released in Pucca pond for pisciculture.
- Extension of HDPE pipe line for irrigation from Plot No. 54 and installation of GI pipe line from Plot No 72 (deep bore well to lac host gene bank, Plot No 70) has been completed.
- Face lifting of 3 roads, 4 bunds and paths were done and plots were leveled.
- Host trees were pasted with mixture of lime and chlorpyri phos for the management of termite and a programme was initiated to eradicate termitoria from the Institute Research Farm.

Resource Generation:

An amount of Rs. 3, 66,151 (Rupees Three lakh sixty six thousand and one hundred fifty one) has been generated as revenue from sale of the farm produce. The broodlac production of summer *kusmi* crop was 69% higher than the previous year and the increase in winter crop production was 276%.

Revenue generated by IRF

Sl. No.	Item	Amount
1	Lac (Brood lac, scrapped lac etc.)	Rs. 1,35,145
2	Wood (Pruned twigs, bamboo etc.)	Rs. 32,860
3	Other Farm produces (Lac host seeds, seedlings, Paddy, wheat, ornamental plants etc.)	Rs. 1,79546
4	Others (Water Tanker, Fuel charges etc.)	Rs. 18,600
Total :		**Rs. 3,66,151**

10.2 QUALITY EVALUATION LABORATORY

The Quality Evaluation Laboratory (QEL) of the Institute has been awarded IS/ISO 9001-2000 quality management systems certification. The

licence has been granted for rendering laboratory services for collection, analysis, testing and reporting of lac and lac based product samples. During the period 145 samples of seedlac/ shellac/ bleached lac/ aleuritic acid/ lac dye/ by products of lac were received from Govternment. organizations/ Private industries/ Various division of the Institute and in all 556 tests were carried out. In addition to this one trainee was trained in the Analysis and Testing of lac and lac based products. Two trainees were trained in the determination of bleach index . A sum of Rs 26,860 has been earned as testing charges.

Inside view of QEL

10.3 RESEARCH MANAGEMENT UNIT

The Unit performed the following activities during the period under report:

- Correspondence and sending important reports to the Council.
- Compilation and preparation of various reports to the Council like monthly report, monthly report for cabinet secretariat, quarterly progress report, six monthly report of the scientists and DARE report to the Council, information related to SMD meetings, etc.
- Management of HRD programmes of scientists and other staff of the Institute. Maintenance of research project files of the Institute.
- Processing of research / routine activities submitted for publication in Journals, etc.
- Providing LAN and Internet connectivity to the Divisions and Sections of the Institute.
- Providing E-mail services to the scientists
- Annual maintenance of computer system and Local Area Networking (LAN) of the Institute.
- Arrangement for presentation during meetings, seminars etc.
- Maintenance of Conference Hall.
- Upgradation of Internet connectivity to 512 kbps from ERNET India is in process.
- Maintenance of RAC, QRT and SRC files.
- Maintenance of database for Personnel Information Management System Network (PERMISNET) and Intelligent Reporting System.
- Right to Information.

The RMU presently maintains three servers namely, Proxy server for providing internet connectivity to various Divisions/ Sections, Mail server for providing e-mail facilities and Apache Web server for hosting web site.

10.4 LIBRARY AND DOCUMENTATION CENTER

The library of the Institute plays an important role in meeting the information needs of its users. Library of the Institute is a repository of scientific and technical information on Natural Resins and Gums. Besides catering to the needs of Scientists and Technologists of the Institute, it also renders services to other researchers, academicians and students as well as lac industrialists from all parts of the country.

Advance/Full Text/Abstracts access of 2000 journals from several publishers (200 journals from Designated Document Delivering Libraries and 1800 e-journals from participating publishers) has been made available online through CeRA Consortium to our scientists from this year.

The library maintains adequate linkages with leading reference libraries like National Library-Kolkata, NISCAIR-New Delhi for strengthening the information resources. It also supplies photocopies of rare research articles to NISCAIR, New Delhi from time to time against payment.

Revenue of Rs.6,688.00 was generated from the sale of publication and reprographic services. The library continued to exchange the Institutes publications with the scientific institutions in and out side the country.

Services provided by the library to its users.

- Online 'Today's Arrival'.
- Reprographic services.
- e-Journals access.
- CD searches.
- Document delivery services.
- Bibliographic services.
- Current awareness services.
- Inter library loan services for resource sharing.
- Sale of Institute publications.

Library holdings as on 31.12.2008

Documents	Additions	Total Holdings
Books	32	7627
Bound Journals	270	21209
Annual Report	74	4615
CD- Rom	03	123
ISI-Specification	13	145
Maps	-	37
Patents (Foreign)	-	327
Patents (Indian)	-	17
Thesis	01	08

Journals and Periodicals subscribed and received:

- Foreign Periodicals (Subscribed) -13
- Foreign Periodicals (Gratis/Exchange) -04
- Indian Periodicals (Subscribed) - 47
- Indian Periodicals (Gratis/Exchange) - 39

10.5 ESTATE SECTION

The Estate of the Institute takes care of essential services such as Security of the Institute premises, water and power supply as well as infrastructure development work of the Institute including the engineering research work. Various services provided by the sections during the year are as follows:

Civil and Water supply

A. Completion of work through CPWD / Other agencies

1) Renovation of Official building / Residential building

- Canteen (external portion)
- State section
- Organic laboratory II
- Quarter Type – III (1-8)
- Quarter Type – II (20-28)
- Toilet room of LPU.
- Surface coating lab.
- Lab. Room - 02 No. of PPD

2) New construction in the Institute Premises

- New scooter shed in factory campus.
- Enhancement of the height of the boundary wall.
- Foundation stone pillar in main campus.
- Deep bore well in factory campus.

B. Work carried out departmentally

- Snowcem of quarter Type II (1-12), Type IV (1, 2), Central store, Purchase section, Vehicle garages, boundary wall of both campuses.
- Roof treatment of Library building, Quarter Type II (25-32).

Total number of jobs entered in various units of Estate section are-:

- Pipe line work- 475 jobs
- Carpentry works- 386 jobs
- Welding work- 150 jobs
- Mechanical works- 446 jobs
- Turner work- 450 jobs

Electrical and Genset

- Maintenance of electrical system in the Institute premises. A total of 1050 jobs related to electrical work were entered in the job register and all of them have been attended.

- Rewiring of Organic lab II, storage study lab and Type V Hostel.
- CFL light fittings were done in place of tube lights in PPD, Conference Hall ans Stack hall of TOT Division.
- Relaying of under ground power cable for Director's office, TOT Division and Guest House.
- Replacement of old power displacement panel in front of RMU with MCB distribution panel.
- Painting and numbering of electric poles in main campus and factory campus.
- Installation and commissioning of 12 nos 75 KVA silent Gen-set in Estate section premises.
- Rewiring of Quarter Type III (21, 22, 23, 24, 27 and 28) Deparmentally by the wireman of Estate section.
- Installation of new copper earthing system for the transformer and 15 KVA Gen-set.
- Gen-set power connection to library through power cable.
- Fitting of new light system in main gate factory pump house and IRF.
- Dehydration of transformer oil and painting of transfer.

Other activies

- Total 100 nos of memento pieces were made.
- Iron scraps worth more than two lakhs were auctioned.
- Furniture models were made for displaying in War memorial hall, Ranchi.
- Approximately Rs 2 lakh were realized from Guest House and Trainee's Hostel.
- Ornamental plants / hedges were planted in front of the office buildings and were properly maintained so as to give an aesthetic look to the Institute premises.
- Whereever required pruining work of the unwanted branches of the trees were carried out.
- Emphasis were made to keep the campus neat and clean.

10.6 HEALTH CARE

The Institute is running its own Dispensary in the Campus. AMA Dr. Anil Kumar and lady doctor Dr. (Mrs.) Vipula Verma are working as a part time Medical Officer on contractual basis on alternate days. Most of the cases were handled in the dispensary itself and the complicated cases were referred to authorized hospitals in the city for expertise treatment. The dispensary is well equipped with all instruments / accessories to handle the cases of general / minor dressing, pulse rate weight, blood sugar. During the period, around 4,800 patients were attended in the IINRG dispensary and 205 patients were examined for blood sugar by Glucometer. Most of the medicines advised by the AMAs were made available to the patients from the dispensary itself.

10.7 AGROMETEOROLOGY

Agro-meteorology Unit of the Institute is situated at 23^{0}23' N latitude, 85^{0}23'E longitude and 650 m altitude. During the year 2008, different weather parameters recorded by the unit are presented in Table 1. Total rainfall recorded was 1477.8 mm, which was 0.8 % less than the previous year (1489.7 mm). The highest rainfall (486.9 mm) was recorded during the month of July and the lowest (0.3 mm) in the month of October. July month experienced 29 days rainfall. The maximum one day rainfall (171 mm) was recorded on 18th June. Monsoon months (June to September) alone accounted for 1386.6 mm (93.8 %) of the total yearly rainfall. November and December months of the year witnessed no rainfall. The highest mean maximum temperature (39.9^{0}C) was observed in the month of april and the lowest mean minimum temperature (8.7^{0}C) during January. May 1st and December 1st were recorded as the hottest and the coldest day of the year with a temperature of 42.5^0 C and 2.2^0 C, respectively.

Meteorological data recorded at Agro-Met Unit of the Institute during 2008

Month	Mean Temperature (^{0} C)		Mean Relative Humidity (%)		Total Rainfall (mm)
	Maximum	Minimum	7.00 a.m.	2.00 p.m.	
January	24.3	8.7	69	42	12.2
February	27.1	9.8	61	37	10.8
March	36.6	17.8	56	35	16.7
April	39.9	21.7	49	30	11.3
May	38.9	21.3	53	31	39.9
June	32.8	21.8	81	69	341.9
July	30.4	22.5	88	78	486.9
August	30.8	22.7	87	78	309.2
September	31.7	21.5	84	70	248.6
October	31.1	18.4	74	58	0.3
November	29.0	10.5	80	50	0.0
December	27.4	9.1	66	48	0.0
			Total Rainfall (mm)		**1477.8**

11. संस्थान राजभाषा प्रकोष्ठ की गतिविधियाँ

भारत सरकार के राजभाषा विभाग (गृह मंत्रालय) द्वारा तैयार किए गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम एवं नियमों के संबंध में भारतीय कृषि अनुसंधान परिषद नई दिल्ली से समय–समय पर प्राप्त निर्देशों पर अनुवर्ती कार्रवाई तथा सरकारी कार्य में हिन्दी को और गति प्रदान करने के लिए संस्थान में राजभाषा प्रकोष्ठ की स्थापना की गई है। इसमें एक तकनीकी अधिकारी (रा.भा), एक अंशकालीन तकनीकी सहायक तथा एक अंशकालीन पदचर कार्यरत है। संस्थान में राजभाषा संबधी क्रिया–कलापों की समीक्षा के लिए संस्थान के निदेशक की अध्यक्षता में राजभाषा कार्यान्वयन समिति गठित की गई है जिसमें विभागों/अनुभागों के अध्यक्ष, सदस्य तथा तकनीकी अधिकारी (रा.भा) सदस्य सचिव है।

संस्थान 'क' क्षेत्र में है, इसे राजभाषा अधिनियम की धारा 10 (4) के अर्न्तगत केन्द्रीय गजट में प्रकाशित किया जा चुका है। संस्थान के चार अनुभागों को शत प्रतिशत कार्य हिन्दी में करने हेतु विनिर्दिष्ट किया गया है एवं प्रवीणता प्राप्त सभी अधिकारियों/कर्मचारियों को अपना–अपना कार्य हिन्दी में करने हेतु व्यक्तिशः आदेश दिये गये है। राजभाषा नियम के प्रावधानों के अनुपालन एवं दैनिक कार्य में हिन्दी के प्रयोग में प्रगति लाने तथा इसे सर्वगाह्य बनाने के लिए **राजभाषा प्रकोष्ठ** द्वारा निम्नलिखित कार्य सम्पादित होते हैं।

राजभाषा कार्यान्वयन समिति की तिमाही बैठकों का आयोजन, कार्यसूची एवं कार्यवृत की तैयारी तथा बैठकों में लिए गये निर्णयों पर अनुवर्ती कार्रवाई। वार्षिक रिपोर्ट का सारांश, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा, सूचना एवं पत्राचार हेतु विभिन्न सामग्रियों का अनुवाद, हिन्दीतर अधिकारियों और कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण एवं नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों द्वारा आयोजित विभिन्न हिन्दी प्रतियोगिताओं एव कार्यशालाओं में सहभागिता हेतु प्रेरित करना।

संस्थान के दैनिक कार्य में हिन्दी के प्रयोग में प्रगति एवं इसे सर्वग्राह्य बनाने के लिए **राजभाषा प्रकोष्ठ** द्वारा निम्नलिखित कार्य सम्पादित होते है।

- संस्थान राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन, कार्यसूची एवं कार्यवृत की तैयारी एवं बैठकों में लिए गये निर्णयों पर अनुवर्ती कार्रवाई।
- वार्षिक रिपोर्ट का सारांश, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा, सूचना एवं पत्राचार हेतु विभिन्न सामग्रियों का अनुवाद।
- हिन्दीतर अधिकारियों और कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण एवं नगर राजभाषा कार्यान्वयन समिति के सदसस्य कार्यालयों द्वारा आयोजित विभिन्न हिन्दी प्रतियोगिताओं एवं कार्यशालाओं में सहभागिता हेतु प्रेरित करना।
- हिन्दी दिवस, हिन्दी चेतना मास एवं योजनानुसार नगर स्तरीय राजभाषा संबंधी प्रतियोगिता एवं कार्यशाला का आयोजन करना।
- संदर्भ सहित्य, हिन्दी पत्रिका, शंब्दकोश, एवं तकनीकी शब्दावली के उपार्जन हेतु कार्य।
- द्विभाषी मुहारों, नामपटट्, पत्रशीर्ष (लेटरहेड) के निर्माण में सक्रिय सहयोग करना।
- प्रचार सामग्रियों के हिन्दी रुपान्तर एवं समारोहों के समाचार संकलन का कार्य।
- विभागीय विषय पर तकनीकी शब्दावली का निर्माण।
- हिन्दी में वैज्ञानिक गोष्ठी के साथ–साथ प्रशासनिक तथा तकनीकी वर्ग के लिए कार्यशाला का आयोजन।
- निदेशक महोदय की अध्यक्षता में वर्ष 2008 में संस्थान राजभाषा कार्यान्वयन समिति की **चारों तिमाही बैठकों** का आयोजन निम्नलिखित तिथियों को किया गया तथा प्रगति की समीक्षा की तिमाही रिर्पोट एवं कार्यवृत परिषद् सहित अन्य संबंधित कार्यालयों में प्रेषित की गई।

  (क) दिनांक **24.03.2008**
  (ख) दिनांक **13.06.2008**
  (ग) दिनांक **06.09.2008** एवं
  (घ) दिनांक **10.12.2008**

जिसके अर्न्तगत निम्नलिखित प्रमुख चर्चायें हुई तथा सर्वसम्मति से निर्णय लिए गए :–

- वार्षिक कार्यक्रम–2008–09 के प्रस्ताव पर चर्चा।
- संस्थान में हिन्दी में मूल रुप से पत्राचार बढाने के लिए :–

(क) सरकारी काम काज मूल रुप से हिन्दी में करने हेतु संस्थान में नकद पुरस्कार योजना लागू की गई, इसमें वैज्ञानिक, तकनीकी एवं प्रशासकीय वर्ग के कुल 17 अधिकारियों/कर्मचारियों ने भाग लिया।

(ख) हिन्दी में श्रृतिलेखन (डिक्टेशन) देने के लिए पुरस्कार योजना संस्थान में लागू की गई।

(ग) समय–समय पर हिन्दी के प्रयोग को प्रोत्साहित करने के लिए विभिन्न प्रकार की हिन्दी प्रतियोगिताओं को आयोजन किया गया।

राजभाषा प्रकोष्ठ की उपलब्धियाँ–2008

- **लाख शब्दावली**– का संशोधित एवं वृहत रुप तैयार किया गया।
- **भारतीय प्राकृतिक राल एवं गोंद संस्थान– एक नजर में** का हिन्दी रुपान्तर।
- **प्राकृतिक राल एवं गोंद– भा.प्रा.रा.गों. सं. समाचार पत्रिका** का सम्पूर्ण अनुवाद एवं वार्षिक प्रतिवेदन के सारांश का हिन्दी अनुवाद किया गया।
- **राष्ट्रीय परिप्रेक्ष्य में जल संरक्षण की स्थिति एवं कृषि में इसका महत्व** विषय पर संस्थान में 19–20 सितम्बर 08 को दो दिवसीय **राष्ट्रीय हिन्दी संगोष्ठी** का आयोजन किया गया।
- दिनांक 01.11.2008 को **सरकारी कार्यालयों में क्रय संबंधी प्रावधान** विषय पर हिन्दी कार्यशाला का आयोजन किया गया, जिसमें कार्यालय प्रधान, श्री कवल किशोर प्रसाद ने व्याख्यान दिया। इस कार्यक्रम में 39 अधिकारियों/कर्मचारियों ने भाग लिया।
- संस्थान की वार्षिक हिन्दी पत्रिका **लाक्षा** 2008 के प्रवेशांक का प्रकाशन मार्च, 09 में किया गया।
- संस्थान के आगत–निर्गत पत्रों का विस्तृत (अनुभाग/विभाग व क्षेत्रवार) विवरण तैयार कर विहित प्रपत्र में तिमाही रिपोर्ट तैयार की गयी तथा परिषद् समेत सभी संबंधित कार्यालयों को प्रेषित की गयी।
- वैज्ञानिक उपकरणों से जुड़े कम्प्यूटरों को छोड़कर संस्थान के सभी कम्प्यूटरों में हिन्दी फॉन्ट लगा दिये गये हैं।
- परिसर के कुछ अन्य वृक्षों पर वानस्पतिक नाम के साथ द्विभाषी नामपट्ट लगवाये गये।
- संस्थान के 85वें स्थापना दिवस 20 सितम्बर, 2008 को Remote Sensing in agriculture विषय पर व्याख्यान कार्यक्रम तथा स्थापना **दिवस समारोह** का आयोजन किया गया।
- **सतर्कता जागरुकता सप्ताह** के अवसर पर दिनांक 14.11.08 को प्रशासनिक पारदर्शिता के लिए सतर्कता जागरुकता विषय पर व्याख्यान का आयोजन किया गया।
- **कौमी एकता सप्ताह** के समापन समारोह का आयोजन किया गया।
- वर्ष 2008 में राजभाषा प्रकोष्ठ की पहल पर विज्ञान एवं साहित्य से जुड़े 35 हिन्दी पुस्तकों का उपार्जन किया गया।

हिन्दी दिवस समारोह–2008

हिन्दी चेतना मास समापन एवं हिन्दी दिवस समारोह

भारतीय प्राकृतिक राल एवं गोंद संस्थान में हिन्दी चेतना मास समापन एवं हिन्दी दिवस समारोह का आयोजन 14 अक्तूबर 2008 को अपराह्न 02.30 बजे प्रौद्योगिकी हस्तान्तरण विभाग के व्याख्यान कक्ष में किया गया। समारोह में मुख्य अतिथि के रुप में उपस्थित डॉ० जय प्रकाश पाण्डेय, प्राध्यापक, हिन्दी विभाग, संत जेवियर्स महाविद्यालय, राँची ने संस्थान के अधिकारियों/कर्मचारियों को संबोधित करते हुए कहा कि हिन्दी का प्रसार कमोबेश भारत के सभी राज्यों के साथ–साथ दुनियां के ढ़ेर सारे देशों में हो गया है। उन्हों ने इसकी व्यापकता बनाए रखने के लिए सभी हिन्दीभाषियों एवं जानकारों को जागरुक रहने की आवश्यकता बताई। डॉ० पाण्डेय ने कहा कि हिन्दी एक सरल एवं समृद्ध भाषा है तथा इसका उच्चारण बिल्कुल सहज है।

समारोह का शुभारंभ मुख्य अतिथि द्वारा दीप प्रज्जवलन के साथ हुआ तथा संस्थान के प्रभारी निदेशक डॉ अजय भट्टाचार्य ने पुष्पगुच्छ के देकर अतिथि का स्वागत किया। अपने स्वागत भाषण में डॉ अजय भट्टाचार्य ने मुख्य अतिथि के प्रति आभार प्रकट किया तथा बताया कि संस्थान में कार्यालय कार्य के साथ वैज्ञानिक क्षेत्र में भी राजभाषा हिन्दी का प्रयोग काफी लम्बे समय से किया जा रहा है एवं हिन्दी का प्रयोग काफी लम्बे समय से किया जा रहा है तथा नियमित अन्तराल पर हिन्दी तथा द्विभाषी पुस्तिकाओं का प्रकाशन होता रहता है। डॉ भट्टाचार्य ने कहा कि संस्थान में लगभग सारे प्रशिक्षण कार्यक्रम हिन्दी में आयोजित किए जाते है। उन्होंने कहा कि संस्थान के पुस्तकालय में बड़ी संख्या में हिन्दी पुस्तकें, पत्रिकाएं एवं साहित्य उपलब्ध है। उन्होंने संस्थान के सभी अधिकारियों/कर्मचारियों से हिन्दी में अधिकाधिक कार्य करने की अपील की।

संस्थान में हिन्दी कार्य से संबंधित प्रतिवेदन प्रस्तुत करते हुए डॉ अंजेश कुमार ने प्रगति का व्यौरा दिया। विविध कार्यक्रम के अन्तर्गत श्री सी.एल. मीना, श्री कवल किशोर प्रसाद एवं डॉ अंजेश कुमार ने कविता, संस्मरण एवं हास्य रचनाएं प्रस्तुत की। इस अवसर पर आयोजित की गई हिन्दी टिप्पण, प्रारुप लेखन, निबंध, पर्याय, श्रुतिलेख व अन्ताक्षरी प्रतियोगिताओं के विजेताओं को मुख्य अतिथि के द्वारा पुरस्कार प्रदान किया गया। विजेताओं में डॉ संजय श्रीवास्तव, डॉ एम.जेड.सिद्दिकी, श्री एम.एफ. अंसारी, सर्वश्री विनोद कुमार सिंह, मदन मोहन, विनोद कुमार, कवल किशोर प्रसाद, कामेश्वर उरॉव, अर्जुन गोप, कृष्ण मुरारी कुमार, अनिल कुमार सिन्हा, विरेन्द्र कुमार सिंह आदि शामिल है। कार्यक्रम का संचालन तकनीकी अधिकारी, डॉ अंजेश कुमार तथा धन्यवाद ज्ञापन हिन्दी दिवस समारोह आयोजन समिति के अध्यक्ष एवं प्रधान वैज्ञानिक डॉ अजय कुमार सिंह ने किया। इस अवसर पर ताजा हिन्दी प्रकाशनों की एक प्रदर्शनी की एक प्रदर्शनी भी लगाई गई।

राष्ट्रीय हिन्दी संगोष्ठी

राष्ट्रीय परिप्रेक्ष्य में जल संरक्षण की स्थिति एवं कृषि में इसका महत्व विषय पर संस्थान में आयोजित दो दिवसीय **राष्ट्रीय हिन्दी संगोष्ठी** के उद्घाटन सत्र में मुख्य अतिथि पद से बोलते हुए भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के **उप महानिदेशक (प्राकृतिक संसाधन प्रबन्धन) डॉ. ए. के. सिंह** ने वर्तमान में विश्व में जल की स्थिति को दर्शाते हुए जल की सर्वभौमिक समस्या पर प्रकाश डाला। उन्होंने भारत में जल की स्थिति पर चर्चा करते हुए कहा कि हमारी स्थिति उत्साहवर्द्धक नहीं है। जल के बेतरतीब खर्च से शुद्ध जल की समस्या बढ़ती जा रही है। डॉ. सिंह ने बताया कि बरसात का जल शुद्ध जल का बहुत बड़ा स्रोत है। बरसात की दृष्टि से हमारी स्थिति अच्छी है। उन्होंने जल संकट एवं जल की वर्तमान स्थिति पर चर्चा करते हुए इसके संरक्षण पर जोर दिया। उन्होंने जल में आर्सेनिक की समस्या की जानकारी दी एवं शहरी वेस्टवाअर का कृषिकार्य से जुड़े उपयोग पर जोर दिया।

अपने व्याख्यान में उन्होंने जल संरक्षण से संबंधित वैज्ञानिक पहलू से लेकर सामाजिक पहलूओं पर भी डाला। उन्होंने बताया कि आज एक तरफ जलस्तर तेजी से घटता जा रहा है और दूसरी ओर बढ़ती जनसंख्या और उद्योग एवं कृषि में इसकी आवश्यकता बढ़ रह है। जल स्तर की स्थिति यदि यही रही तो आने वाले दिनों में पीने के लिए हमारे पास पर्याप्त पानी होगा। उन्होंने जल की समस्या के अनेक कारणों का जिक्र किया और उस समस्या से कैसे निबटा जा सके उस पर प्रकाश डाला। डॉ सिंह ने बताया कि जल संरक्षण के तरीकों के बारे में तो अक्सर बताया जाता है किन्तु इसे प्रयोग रुप देने के लिए आवश्यकता है आधारभूत सामग्रियों के उपलब्धता की। एक आम आदमी इसके बिना आधुनिक तकनीक इस्तेमाल कर पाने में अक्षम है, जिससे जल संरक्षण का मार्ग प्रशस्त हो।

अतिथियों का स्वागत करते हुए संस्थान के निदेशक **डॉ. बंगाली बाबू** ने इस विषय को आज की एक महत्वपूर्ण समस्या बताते हुए कहा कि यहाँ वर्षा की बहुतायत के बावजूद भी गर्मी में जल की समस्या बनी रहते है, इसे जल संरक्षण से ही दूर किया जा सकता हैं। डॉ. बाबू ने कहा कि संगोष्ठी में जल संकट के कारणों एवं निदान तलाशने की ओर विचार–विमर्श हो सकेगा ऐसी आशा है।

संगोष्ठी को तीन तकनीकी सत्रों में बाँटा गया था। तकनीकी सत्रों में जल की स्थिति, संचयन, रेगिस्तानी क्षेत्रों में जल स्तर की स्थिति, पेयजल संकट, कृषि कार्यों में अपनायी जाने वाली सिंचाई प्रणाली, झारखण्ड में कृषि की दृष्टि से जल का उपयोग, कृषिजनित यंत्रों का सिंचाई प्रणाली में उपयोग, नदियों में बढ़ती गाद की समस्या एवं प्रदूषण इत्यादि विषयों पर जल

अभियांत्रिकी के विशषज्ञों/अन्य अधिकारियों द्वारा **सोलह** आलेख प्रस्तुत किये गए। प्रथम तकनीकी सत्र की अध्यक्षता **डॉ अश्वनी कुमार, निदेशक,** पूर्वांचल जल प्रौद्योगिकी केन्द्र, भुवनेश्वर ने की तथा विभिन्न कृषि पारिस्थितिकी यन्त्रों के तहत नहरी क्षेत्रों में जल प्रबंधन विषय पर व्याख्यान दिया। द्वितीय तकनीक सत्र की अध्यक्षता **डॉ अनिल कुमार, प्राध्यापक एवं अध्यक्ष,** कृषि अभियांत्रिकी विभाग, बिरसा कृषि विश्वविद्यालय, राँची ने किया। तृतीय तकनीकी सत्र की अध्यक्षता **डॉ शिवेन्द्र कुमार, प्रमुख एवं प्रधान वैज्ञानिक,** वागवानी एवं कृषि वानिकी शोध कार्यक्रम, रॉची ने की। विचार मंथन समापन सत्र में मुख्य अतिथि के रुप में उपस्थित डॉ पीतम चन्द्रा, सहायक महानिदेशक (पी.इ.) भा.कृ.अ.प. ने विभिन्न उपायों को कारगर ढंग से लागू करने पर जोर दिया। उन्होंने प्रत्येक व्यक्ति से अपने स्तर पर लोगों को जागरुक करने का आह्वान किया। सत्र की अध्यक्षता करते हुए **संस्थान के निदेशक डॉ बंगाली बाबू** ने कहा कि संस्थान में जल संरक्षण से जुड़े विशेषज्ञों के अभाव के बावजूद भी हमारे जीवन में महत्वूपर्ण रुप से आवश्यक है। इस विषय पर विचारोत्तेजक एवं सार्थक विचार विमर्श हुआ है तथा विशेषज्ञों ने इनसे जुड़ी समस्याओं पर विस्तृत रुप से प्रकाश डाला है एवं समाधान सुझाएं हैं। उन्होंने संगोष्ठी के आयोजन से जुड़े अधिकारियों के प्रति आभार प्रकट किया।

इस राष्ट्रीय संगोष्ठी में राज्य के बाहर से आए विभिन्न कार्यालयों/ प्रांतों के 26 विशेषज्ञों समेत झारखण्ड एवं संस्थान के कुल पैसठ प्रतिनिधियों ने भाग लिया। संगोष्ठी के **संयोजक डॉ. केवल कृष्ण शर्मा, प्रधान वैज्ञानिक** ने बताया कि झारखण्ड में जल संरक्षण एवं संचयन के प्रति लोगों को जागरुक करने में यह कार्यक्रम सहायक होगा। संगोष्ठी का संचालन डॉ. अंजेश कुमार, तकनीकी अधिकारी (रा.भा.) ने किया।

- संस्थान के सहायक निदेशक (रा.भा.) श्री लक्ष्मी कान्त का परिषद् के उपनिदेशक (रा. भा) के रुप में पदोन्नती के फलस्वरुप उन्होंने सितम्बर 2008 में कृषि भवन स्थित भरतीय कृषि अनुसंधान परिषद्, नई दिल्ली मुख्यालय में योगदान दिया।
- "बेहतर पर्यावरण के लिए भारतीय कृषि" विषय पर भारतीय कृषि अनुसंधान संस्थान, पूसा, नई दिल्ली में 16–17 दिसम्बर को आयोजित राष्ट्रीय हिन्दी संगोष्ठी में संस्थान का प्रतिनिधित्व डॉ अंजेश कुमार, तकनीकी अधिकारी (रा.भा) ने किया।
- भारत संचार निगम लिमिटेड, राँची द्वारा दिनांक–26.11.08 को आयोजित नगर स्तरीय हिन्दी प्रश्नोत्तरी प्रतियोगिता में संस्थान का प्रतिनिधित्व श्री बिनोद कुमार, टी–4 एवं श्री कृष्ण मुरारी कुमार, क. लिपिक ने किया तथा उन्हें प्रोत्साहन पुरस्कार प्रदान किया गया।

संस्थान का स्थापना दिवस

संस्थान के 85 वें स्थापना दिवस 20 सितम्बर 2008 को एक समारोह का आयोजन किया गया जिसके मुख्य अतिथि डॉ. ए.टी.जयशीलन, निदेशक झारखण्ड स्पेस अप्लीकेशन सेन्टर तथा विशिष्ट अतिथि डॉ. नागेन्द्र शर्मा, पूर्व कुलपति, शेरे कश्मीर कृषि एवं प्रौद्योगिकी विश्वविद्यालय, जम्मु थे। **डॉ. जयशीलन ने रिमोट सेंसिग इन एग्रीकल्चर** विषय पर बोलते हुए कहा कि देश के सर्वागिण विकास में रिमोट सेंसिंग तकनीक के उपयोग की जरुरत है। डॉ. नागेन्द्र शर्मा ने कहा कि प्राकृतिक राल एवं गोंद के क्षेत्र में अपार संभावनाएं है। समारोह की अध्यक्षता करते हुए संस्थान के निदेशक डॉ. बंगाली बाबू ने संस्थान की उपलब्धियों पर प्रकाश डाला।

समारोह का संचालन एवं धन्यवाद ज्ञापन डॉ. अजेश कुमार ने किया।

सतर्कता जागरुकता सप्ताह

सतर्कता जागरुकता सप्ताह के अन्तर्गत संस्थान में दिनांक– 14.11.08 को एक व्याख्यान कार्यक्रम का आयोजन किया गया जिसमें केन्द्रीय अन्वेषण व्यूरो, राँची के पशुपालन व निगरानी कोषांग के पुलिस अधिक्षक, श्री आर.सी.चौधरी ने **प्रशासनिक एवं वित्तीय पारदर्शिता के लिए सतर्कता जागरुकता** विषय पर व्याख्यान दिया। कार्यक्रम की अध्यक्षता संस्थान के निदेशक डॉ. बंगाली बाबू ने की। कार्यक्रम का संचालन एवं धन्यवाद ज्ञापन डॉ. अजेश कुमार ने किया।

संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठकों में लिए गए निर्णय एवं की गई कार्रवाई

क्रम सं.	लिए गए निर्णय	अनुपालन/की गई कार्रवाई
1.	संस्थान के परिवर्तित नाम के अनुरुप बोर्ड की तैयारी।	संस्थान के परिवर्तित नाम के अनुरुप बोर्ड की तैयारी की गई।
2.	द्विभाषी मुहरों का निर्माण।	द्विभाषी मुहरों का निर्माण किया गया है अपितु कुछ और मांग–पत्र विलम्ब से प्राप्त हुए है जिनपर कारवाई की जा रही है।
3.	सभी कम्प्यूटरों में हिन्दी सॉफ्टवेयर लगाना।	वैज्ञानिक उपकरणों से जुड़े कंप्युटरों को छोड़कर सभी कंप्यूटरों में हिन्दी फॉन्ट लगा दिए गए हैं
4.	संस्थान परिसर के शेष वृक्षों में द्विभाषी नाम–पट्ट लगाना।	संस्थान परिसर के कुछ अन्य वृक्षों पर भी वानस्पतिक नाम के साथ द्विभाषी नाम–पट्ट लगा ए गए हैं।
5.	राष्ट्रीय हिन्दी संगोष्ठी का आयोजन।	राष्ट्रीय हिन्दी संगोष्ठी का 19–20 सितम्बर 2008 आयोजन किया गया।
6.	संस्थान की हिन्दी पत्रिका **लाक्षा** का प्रकाशन।	संस्थान की हिन्दी पत्रिका लाक्षा का प्रकाशन मार्च 2009 में कर लिया गया है।
7.	हिन्दी प्रतियोगिताओं का आयोजन।	संस्थान में टिप्पण, प्रारुप लेखन, निबंध, श्रुतिलेख, अंताक्षरी इत्यादि हिन्दी प्रतियोगिताओं का आयोजन किया गया।
8.	हिन्दी चेतना मास एवं हिन्छी दिवस का आयोजन।	हिन्दी चेतना मास एवं हिन्दी दिवस का आयोजन किया गया।
9.	हिन्दी कार्यशाला/संगोष्ठी का आयोजन।	प्रशासनिक विषय हिन्दी कार्यशाला एवं वैज्ञानिक विषय पर संगोष्ठी का आयोजन किया गया।

12. PERSONNEL

Sanctioned strength of Scientific, Technical, Administrative and supporting staff as on 31.12.2008

Scientific

R.M.P.	01
Principal Scientist	04
Senior Scientist	11
Scientist	31
Total	47

Technical	
Category-I	41
Category-II	21
Total	**62**

Administrative	
A.O.	01
F.& A.O.	01
A.A.O.	02
A.D.(O.L.)	01
Sr.P.A.	01
Security Officer	01
P.A.	02
Assistant	09
Sr.Clerk	13
Jr.Clerk	03
Steno Gr.III	01
J.A.O.	01
Total	**36**

Supporting	
SSG-IV	10
SSG-III	20
SSG-II	34
SSG-I	25
Total	**89**
Grand Total	**234**

Cadre	Sanctioned	In position
Scientific	47*	30*
Technical	62	57
Administrative	36	29
Supporting	89	72
Total	234	188
* Including RMP		

Dr. Bangali Baboo — **Director**

Lac Production Division — **Disciplines**

Dr. R.Ramani, P.S. & Head	Agril. Entomology
Dr. A.K.Singh, P.S.	Plant Pathol.
Dr. K.K.Sharma, Sr. Scientist	Agril. Entomology
Sri S.C.Srivastava, Sr.Sci.	Plant Breeding
Dr. Soumen Ghosal, Sr. Sci.	Agronomy
Dr. Md. Monobrullah, Sr. Sci.	Agril. Entomology
Sri Y.D.Mishra, Sc.(SG)	Agril. Entomology
Sri D.Saha, Sc. (Sr.Scale)	Biotechnology
Sri R.K.Singh, Scientist	SWCE
Sri Anees, K, Scientist	Plant Biochemistry
Mrs Thamilarasi, K, Scientist	Biotechnology
Sri R.L.Ram, T-5	F/F Tech.
Sri M.L.Ravidas, T-5	F/F Tech.
Sri P.A. Ansari, T-5	F/F Tech.
Sri Binod Kumar, T-5	F/F Tech.
Sri R.K.Swansi, T-4	F/F Tech.
Sri D.W.Runda, T-4	F/F Tech.
Sri S.K.Tripathi, T-2	F/F Tech.
Sri Bhupal Kumar, T-1	Lab. Tech.
Sri K.A. Nagruwar, T-1-3	F/F Tech.

Processing and Product Development Division

Sri Murari Prasad, P.S. and I/c	Chemical Engg.
Dr. R.N.Majee, P.S.	Org. Chem.
Dr. K.P.Sao, P.S.	Physics
Dr. S. Srivastava, Sr.Sci	Org. Chem.
Dr. M.Z.Siddique, Sr. Sci.	Org. Chem.
Dr. Divya, Sr. Scientist	Org. Chem.
Sri S.K.Pandey, Sci.(Sr.Scale)	Mech. Engg.
Sri S.K.Giri, Sci (Sr Scale)	A.S.&P.E.
Sri M.F.Ansari, Sci (Sr Scale)	Org.Chem.
Sri S.K.S.Yadav, Scientist	Org.Chem
Sri D.D.Singh, (T7-8)	Lab. Tech.
Sri T.K.Saha, T-6	Lab.Tech
Sri K.K.Prasad, T-6	Lab. Tech.
Sri Jagdish Singh, T-6	Lab. Tech.
Sri Bhola Ram, T-5	Lab.Tech.
Sri B.P.Ghosh, T-5	Lab.Tech.
Smt. Prabha Devi, T-4	Lab.Tech.
Sri Binod Kumar, T-2	Lab.Tech.
Sri S.K.Tirkey, T-2	Lab.Tech.
Sri Ajay Kumar, T-2	Lab.Tech.

Transfer of Technology Division

Dr. A.Bhattacharya, P.S.&Head	Agril.Ento.
Dr. B.P.Singh, P.S.	Agronomy
Dr. K.M.Prasad, PS	Org.Chem.
Dr. A.K.Jaiswal, PS	Agril.Ento.
Dr. N.Prasad, Sr.Sci.	A.S.&P.E.
Dr. J.P.Singh, Sr. Sci	Agril. Ento.
Dr. G.Pal., Sc.(Sr.Scale)	Agri.Eco
Sri P.M.Patil, Sc.(SS)	Phys.Chem.
Sri R.N.Vaidya, T-6	F/F Tech.
Sri R.P.Srivastava, T-5	Photographer
Sri D.K.Singh, T-5	F/F Tech.
Sri A.K.Sinha, T-5	F/F Tech.
Sri SB Azad, T-4	F/F Tech.
Smt. Ratna Sen, T-4	Lab. Tech.
Sri P.Patamajhi, T-4	F/F Tech.
Sri R.K.Rai, T-2	Lab. Tech.
Sri Anup Kumar, T-2	Lab. Tech.
Sri Madan Mohan, T-2	Lab. Tech.

Research Management Unit

Dr. N.Prasad, PS	I/c RMU
Sri A.K.Sahay, T7-8	F/F Tech.
Sri D.Ganguly, T-6	Lab. Tech.
Sri K.M.Sinha, T-6	Lab. Tech.
Shri Sunil Kumar, T-4	Lab. Tech.

Quality Evaluation Lab (Under PPD Div)

Dr. S. Srivastava, Sr.Sci.	I/c RTL
Sri D.Ghosh,T7-8	Lab. Tech.
Sri B.K.Singh, T-2	Lab. Tech.

Library

Sri V.K.Singh, T7-8 I/c Lib.	Lib. & Documentations.
Sri Binod Kumar, T-4	Lib. & Documentations.

Institute Research Farm

Sri L.C.N.Shahdeo, T7-8	F/F Tech.
Sri M.Surin, T-1-3	F/F Tech.
Sri Satish Kumar,T-2	F/F Tech.
Sri S.K.Mukherjee,T-2	F/F Tech.

Estate

Sri A.K.Yadav,	Sec. Officer
Sri H.L.Bhakta,T-4	Workshop Tech.
Sri Binoy Kumar, T-3 (JE)	Workshop Tech.
Sri I.D.Das, T-2	Workshop Tech.
Sri Arjun Sharma, T-2	Workshop Tech.
Sri R.K.Ravi, T-2	Workshop Tech.
Sri K.Tirkey, T-2	Workshop Tech.
Sri B.S.Choudhary, T-2	Workshop Tech.
Sri P.V.D.Tirkey, T-2	Workshop Tech.
Sri Rama K. Singh,T-1	Workshop Tech.
Sri Anil Kr. Sharma,T-1	Workshop Tech.
Sri K.K.Deonath, Jr.Clerk	Admin.

Hindi Cell

Dr. Anjesh Kumar, T-5	Press & Editorial

Dispensary

Dr. A.K.Jaiswal	I/c Dispensary
Dr. Anil Kumar	A.M.A.(Part time)
Dr. Vipula Verma	A.M.A.(Part time)
Sri Chittaranjan Kr Singh	Pharmacist (T-3)

Admin.I

Sri K.K. Prasad, I/c	A.O.
Sri P.Singh	AAO
Sri S.C.Lal	Asstt.
Sri R.N.Mahto	Asstt.
Sri A.K.Tripathi	Sr.Clerk
Sri R.K.Toppo	Sr.Clerk
Sri K. Murari Kumar	Jr.Clerk
Sri Bandhu Mahto	Jr.Clerk

Admin.II

Sri Deepak Ghosh	I/c D.D.O.
Sri W.Guria	Asstt.
Sri B.K.Rajak	Asstt.
Sri Bihari Sahu	Sr.Clerk
Sri Samal Kumar	Sr.Clerk (Cashier)
Sri B.N.Gope	Sr.Clerk

Admin. III

Sri N.C. Parija, AAO (Deputation)	Incharge (Pur.Sec.)
Sri Ravishanker	Asstt.
Sri Thibu Minz	Asstt.
Sri Kameshwer Oraon	Asstt.

Steno Pool

Sri R. Ravidas	Sr PA to Director
Smt S. Prasad	PA
Sri A.K. Sinha	PA
Sri S.K. Yadav	Steno Gr. III

Finance and Accounts Section

Sri Rajesh Sahay	F &A O
Sri C.L.Meena	J.A.O.
Sri Vijay Ram	Asstt.
Sri Anant Pandey	Asstt.
Sri Arjun Gope	Sr.Clerk
Sri K.P.Kashi	Jr.Clerk

Transport

Sri Rajesh Sahay, F&AO	Chairman
Sri J.Tewari, T-2	Driver
Sri Arbind Kumar,T-2	Driver
Sri Mandeshwer Singh,T-2	Driver
Sri R.K.Yadav, T-2	Driver

Promotions

Sl. No	Name and Designation	Promoted to the post of	Date of promotions
1.	Dr AK Jaiswal, Sr Sci	Principal Scientist	27. 07. 2006
2.	Dr KK Sharma, Sr Sci	Principal Scientist	27. 07. 2006
3.	Dr S Ghosal, Sci (SS)	Sr Scientist	06.03.2005
4.	Dr SK Giri, Scientist	Scientist (SS)	15. 11. 2005
5.	Dr Dipnarayan Saha, Scientist	Scientist (SS)	20. 11. 2005
6..	Shri AK Sahai, T6	TO (T-7-8)	03. 02. 2005
7.	Shri LCN Shahdeo, T6	TO (T-7-8)	03. 02. 2005
8.	Shri DD Singh, T6	TO (T-7-8)	03. 02. 2005
9.	Shri Deepak Ghosh, T6	TO (T-7-8)	03. 02. 2005
10.	Shri VK Singh, T6	TO (T-7-8)	03. 02. 2005
11.	Shri PA Ansari, T-4	T-5	01. 01. 2006
12.	Dr Anjesh Kumar, T-4	T-5	29. 06. 2006
13.	Shri Binod Kumar, T-4	T-5	01. 07. 2006
14.	Shri Satish Kumar, T-2	T-3	05. 06. 2006
15.	Shri Bandhu Matho, S.G.II	L.D.C	17. 04. 2008

Transfers to the Institute

- Shri T Gurumoorthy, Admn Officer joined at this Institute on 01. 01. 2008.
- Shri NC Parija, Assistant (CRRI, Cuttack) joined at this Institute as AAO (on deputation) on 12 May 2008.
- Shri Ashok Ghosh, joined at this Institute as Admn Officer on 8 September, 2008.

Appointments during 2008

Sl. No	Name & designation	Date of appointment
1.	Shri Anees K, Scientist (Biochemistry)	04.07.2008
2.	Mrs Thamilarasi K, Scientist (Biotech.)	03.11.2008

Retirements

Sl. No	Name & designation	Date of retirement
1.	Shri Mangra Oraon, SG III	29. 02. 2008
2.	Smt Bedana Deogharia, SG IV	31. 03. 2008
3.	Shri Tunwan Oraon, S.G. IV	30. 04. 2008
4.	Shri T. Gurumurthy, A.O.	31.05. 2008
5.	Shri BP Ghosh, T-5	31.12.2008

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