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Annual Report 2003-2004

2004

भारतीय लाख अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
राँची - 834 010, झारखण्ड, भारत
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Front cover : Photograph showing pointed gourd, uncoated and coated, with lac resin - based formulation for improving shelf-life

Contents

PREFACE

Lac, cultivated on marginal and degraded uplands as also in forests serves as an assured source of livelihood for resource poor farmers inhabiting sub-hilly tracts of Jharkhand, Chhattisgarh, W. Bengal, Madhya Pradesh, Maharashtra, Orissa and U.P. The commodity is a raw material for a wide ranging target beneficiaries from tribal farmers, craftsman/ artisans to high-tech industrial houses, for application in surface coatings, fine chemicals, electrical insulation, etc. The institute endeavors harnessing science and engineering by interfacing research and extension initiatives to enhance productivity, quality, processing technology, use diversification and high value new product development for sustained growth of Indian lac.

During the year, the research programme was reorganized into six core programmes, viz i) Productivity and quality improvement, ii) Production improvement and crop management, iii) Processing and value addition, iv) Product development and use diversification, v) Technology assessment refinement and dissemination, vi) HRD for capacity building in lac production, processing and value addition. All the projects were grouped under appropriate core programmes for focussed approach.

The following technologies have been developed during the year.

Kusmi lac cultivation on *ber* (*Zizyphus mauritiana*)

***Ber* (*Zizyphus mauritiana*)** is an important lac host tree used by the cultivators for *baisakhi* crop of *rangeeni* strain. Both the strains of Indian lac insect (*Kerria lacca*) can thrive well and complete their life cycle on this host. The *kusmi* strain is more productive (0.6-0.8 g/m/day) and the quality of resin produced is superior. Winter crop of *kusmi* lac can be raised on the *ber* bost for increased productivity, quality and profitability. The institute has identified that the technology is most promising in terms of net profit (>5.00 lakhs/ year from a hectare of *ber* plantation).

Biological control of lac insect predators

The lepidopteran predators namely *Eublemma amabilis* and *Pseudohypatopa pulverea* damage lac crop to 30-40%. *Trichogramma chilonis* reared in lab released 4 times in field by means of

trichocards @ 100 parasitoids per *palas (Butea monosperma)* resulted in 4.5-6.0 times higher yields over control. The technology is field evaluated and ready for transfer. The input cost of the technology is about Rs. 1500/- ha in comparison to chemical control, costing about Rs. 5400/- ha (exploitation of 50% trees/ha).

New technology for higher yield of aleuritic acid from seedlac

Aleuritic acid is a higher value constitutent of lac, used for several fine chemicals and bio-active compounds. In the conventional process of alkaline hydrolysis and isolation yield is about 20% of seedlac. A new technology developed by ILRI offers following advantages:

i) Processing time reduced to 11 from 18 days

ii) Melting point increased from 95-97 to 98-100°C

iii) Molecular mass increased from 299 to 303

iv) Product cost reduced to 1200 from Rs. 1700/kg

Power operated lac scraper

Foreign materials like sand, soil, wooden twigs, etc. find their way into scraped lac when scraped manually. It reduces prices and adds to processing cost. The institute developed a power operated lac scraper costing about Rs. 12,000/-. The machine capacity is about 80-90 kg/day lac sticks compared to 10-15 kg/man/day. It reduces chances of foreign materials addition to the scraped lac besides reducing scraping cost by about Rs. 3/kg scraped lac.

Besides these the institute organized a good number of trainings on-farm and on-campus. The participants numbered 4,440 during the year. A recored revenue generation of Rs. 15 lakhs (approx) was earned. A total of Rs. 366.74 lakhs under Non-Plan and Rs. 91.78 lakhs under Plan was utilized. With increased delegation of power, administrative and financial transparency involvement of staff has been achieved in decision making with much better working environmnet developed during the year. Research output is expected to improve further during next year.

Bangali Baboo

Dr Bangali Baboo
Director

EXECUTIVE SUMMARY

Lac Production

- Continuous cropping of vegetable crops in between single and paired rows of *Flemingia semialata* during *kharif, rabi* and *zaid* seasons has increased significantly plant growth attributes of the host plants *viz*, plant height, basal girth, canopy spread, total and available shoot length for lac insect settlement, leaf numbers per bush and LAI (Leaf Area Index), resulting in 36.6% increase in total bio-mass (dry wt basis) production as compared to sole planted of the host plants.
- Release of egg parasitoid *Trichogramma chilonis* @ 50, 75 and 100 parasitoids per *palas* tree, four times during *katki* 2003 crop in the farmer's field (two areas) gave effective control of both the lepidopteran predators.
- Egg laying of the butterfly *Catopsilia pyranthe* on the leaves of the weed *plant Cassia occidentalis* (planted along with the bushy lac host plant *Flemingia macrophylla*) helped in the natural population build up of the egg parasitoid *Trichogramma chilonis.*
- A regression equation has been developed for calculating the total area using total number of leaves per plant as independent factors and leaf area as dependant character. The equation derived is Y= -1.237 + 0.1103 X (where Y = total bush leaf area (m^2) and X = total number of leaves / plant).
- The hosts i.e. *Flemingia semialata, Porho (Ficus cunia) and Gular, (F. racemosa)* could be raised through vegetative propagation. They showed root development in 50, 27 and 16 % cuttings of shoots respectively, in trench condition. All most 100% survival of plants has been observed in *F. semialata* after transplanting in field condition. These plants showed, on average, 70cm height, 5.7 number of shoots/bush and 4.8 no of floral inflorescence per shoot in 6 month old bushes.
- Experiments were conducted for air-layering of *kusum* (*Schleichera oleosa*). About 50% of layers of *kusum* showed root initiation with the treatment of IBA 100 ppm along with vermicompost, lanolin paste and sphagnum moss wrapped with ploythene sleeves as compared to 10 % rooting in control (FYM).
- An extensive survey for lac insects and hosts was taken up in Jharkhand, Panjab, Jammu and Kashmir and Rajasthan. Cultured and wild lac inset populations were recorded an various hosts, viz., *ber, palas, rain tree, kusum, pipal, pakur, bargad* and *Flemingia spp.* samples of lac insects, hervarium samples as well as seeds/ saplings or lac hosts were collected. Cultures from nature lac sticks have been set up for conservation and evaluation.
- Comparison of eleven stocks, under similar cultural conditions, revealed genetic variation with respect to important cultural parameters such as settlement density, survival, etc.
- Four productive *kusmi* breeds were evaluated an one year old shoots of *F. semialata.* The pro-

Mature aghani *lac on* Flemingia semialata

ductivity varied significantly among the stocks, ranging between 0.214 and 0.322 kg/m shoot length.

- Six cultivars of *Flemingia* spp. were evaluated for plant attributes from lac culture stand point. *F. macrophylla* was found better with regard to length or primary branch and number of inoculable branches per bush. Even through the average plant height or *F. semialata* was higher (66.7cm) compared to *F. macrophylla* (45.9-61.1cm), the number of inoculable branches per bush was lower its the case or former (2.0) compared to the latter (3.7-7.0).

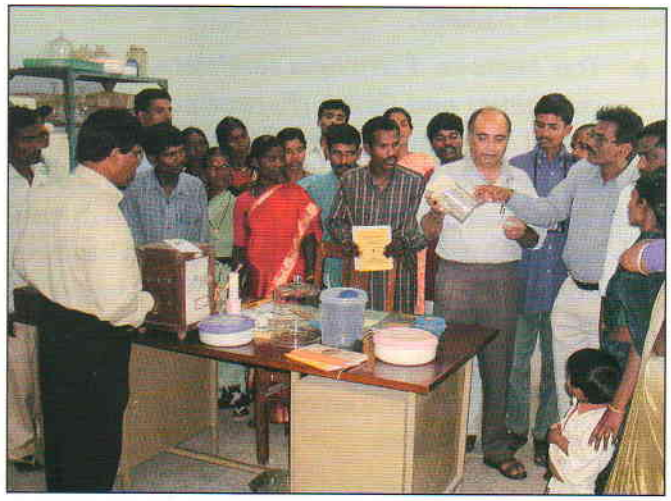
Lac Processing and Product Development

- New cyclic ureides, thioureide, thiosemicarbazide and hydrazide were synthesised for the first time from (*E*)-2-undecen-1,11- dioic acid, obtained from azelaic acid aidehyde (one of the periodate oxidation products of aleuritic acid) for possible antifungal, antibacterial, anticonvulsant and tranquilizing effects.
- (*Z*)-9- Hexadecenal, sex pheromone of *Helicoverpa armigera* (cotton boll worm) and rice - stem borer was synthesised in quantity (500 mg) from *erythro*-aleuritic acid. The compound along with 9,11- dodecadien-1-yl acetatte and 16-acetoxy - (*E*)-9-hexadecanoic acid synthesised from *threo* -aleuritic acid were evaluated for attracting/repelling activities on the adults of major lac predators *Eublemma* amabilis and *P. pulverea* in an olfactometer. Former two compounds showed strong attractant while last one showed strong repellent properties.
- Study on the changes in the different physico-chemical properties with storage was continued for both seedlac and shellac obtained from winter season (*aghani*) and summer season (*jethwi*) crops. Marked decrease was observed in flow and rise in cold alcohol insoluble, melt-viscosity of both seedlac and shellac during storage, indicating deterioration in the qualities due to polymerization of resin molecules. Degradation of summer crop was found to be more rapid compared to that observed for winter crop. Use of an antioxidant was found to check degradation of summer crop to some extent.
- Several lac-based formulations were developed for enhancing the post harvest life of garden fresh fruits and vegetables. While tomatoes failed completely to respond to the treatment and *litchi* showed indifferent response, treatments on pointed gourd, capsicum and garden peas resulted in increasing shelf lives by 10, 14 and 7 days respectively. Dewaxed, decolourised lac was used in all the cases and all the formulations were aqueous-based.
- The evaluation period of lac wax-based aqueous emulsion compositions carried out of CIPHET, Abohar, revealed that the compositions were effective in extending the post harvest life of kinnow fruit for 6 & 10 days more in ambient & cold conditions respectively. The polish compositions based on lac wax showed satisfactory performance as regard gloss & smoothness on leather and automobile surfaces.

Transfer of Technology

HRD

- The Institute organized one-week training programme on lac culture for twenty-three batches, comprising of 476 farmers. One-week training programme on lac was also imparted to fifty-nine agriculture students, State govt. functionaries and others.
- One-day training programme on lac culture and related aspects was organized for 599 participants comprising of farmers, students and entrepreneurs.



Farmers from Andhra Pradesh undergoing one-week training on lac cultivation

- Field education programmes were organized in Jharkhand, Chhattisgarh, Maharashtra, Madhya Pradesh and Andhra Pradesh at fifteen locations, in which 1424 farmers participated. Eleven on-farm training programmes were also organized in different States, benefiting 737 farmers.

Livelihood enhancement through lac culture

Two Jharkhand State sponsored schemes are being implemented for the demonstration of potential of economic upliftment through lac cultivation. More than 1100 farmers are benefited under these programmes in siz village clusters of Ranchi district. Training was imparted to the adopted farmers and critical inputs for scientific lac cultivation including broodlac, sprayer, tree pruner, etc were distributed among the adopted farmers. A new concept of risk cover has been introduced in lac cultivation, adopting recommended package of practices, with the support of agencies, PRADAN and Grameen Services Company, in one of the areas.

Publicity

- The Institute undertook publicity for promotion of lac technologies through various approaches. Stalls on lac were put up in eight exhibitions organized in Jharkhand, Bihar, West Bengal and Delhi. Sixteen exhibitions on lac were also put up in the field training camps on lac cultivation techniques.
- The Institute also publicized the lac technologies and success stories on lac culture through programmes in AIR, Ranchi ; DDK, Ranchi, E TV and Sahara TV.
- The institute publishes quarterly ILRI Lac Newsletter which is circulated among the stakeholders of lac. One training manual and six folders on lac technologies were published. Seven other extension literature were reprinted for wide circulation.

Events organized

- In order to sensitize the NGOs about boosting lac production, a "Farmer-NGO-Indutry Interface" was organized on Sept. 20, 2003, in which fifty-seven persons from different agencies actively participated.
- In view of the significant success achieve in economic upliftment of tribal farmers in Ormanjhi block, under a State-sponsored programme, a "Farmers' Meet" was organized in Dahu village on Sept 30, 2003, in which about 125 farmers participated.

New Sponsored Projects

Three new projects, sponsored by Dept. of Biotechnology, New Delhi, have been initiated. They are:

- Evaluation of bio-control agents and bio-rational approaches fro management of lac insect predators
- Biological, chemical and molecular characterization of lac insect-host plant relationship.
- Application of molecular fingerprinting for genetic characterization of races and species of lac insects.

INTRODUCTION

Historical

The Institute came into existence as a result of the recommendation of a two-member committee comprising of Mr. H. A. F. Lindsay and Mr. C. M. Harlow, appointed early in 1920 by the then Govt. of India to enquire into the conditions of the Indian lac trade and suggest measures for its all-round improvement. The report of the committee was published in 1921. They had recommended, besides other aspects, for intensive cultivation by significantly tested methods for sustained lac production. In view of this suggestion, the then lac merchants organised themselves into a private registered body, the Indian Lac Association for Research. The Association acquired land from the provincial government and the foundation of the Indian Lac Research Institute (ILRI) was laid on Sept. 20, 1924. It started functioning under the Founder Director, Mrs. Dorothy Norris.

Initially, the Institute consisted of an Entomological Section as the principal unit supported by a Biochemical Section which started functioning from 1925. Subsequently 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.

In 1930, on the recommendations of the Royal Commission for Agriculture, the Indian Lac Cess Act was passed by the Central Legislature. Under this Act, the Government of India constituted the Indian Lac Cess Committee which took over the Institute from "Lac Association" in 1931.

After the Second World War, the First and Second Review Committees set up in 1951 and 1956, formed broad research programmes with equal emphasis on fundamental and applied research. During the period, four Regional Field Research Stations were set up at Jhalda (W.B.), Damoh, Umaria (M.P.) and Mirzapur (U.P.) to take up regional problems. Later, Regional Testing Laboratories were also established to support lac manufacturers for quality control of different types of lac manufactured by them. These were set up at Gondia (Maharashtra), Jhalda (W.B.) in 1959, at Balarampur (W.B.) and Daltonganj (erstwhile Bihar) in 1961 and at Namkum (erstwhile Bihar) in 1962.

Indian Council of Agricultural Research (ICAR) took over the administrative control of the Institute on 1st April 1966, with the abolition of the Lac Cess Committee on this day. The Institute was strengthened and reorganized in December 1971, based on the recommendation of Sheshadri Committee, into five Divisions, *viz.*, Entomology, Chemistry, Agronomy & Plant Genetics, Technology and Extension.

The Institute

The ILRI is situated nine kilometers east of Ranchi city, on the Ranchi-Jamshedpur highway, at an altitude of about 650 m above sea level at 23°23' N latitude and 85°23'E longitude. The soils of the Institute are developed on granite gneiss showing advance stage of weathering. The soil of the plantation is lateritic type. The total estate of the Institute at Namkum, including experimental plantation (about 36.5 ha) covers an area of 49 ha. The area has ecologically mild salubrious climate; the mean minimum temperature varied between 6.7 °C in January and 23.5 °C in June and mean maximum temperature varied between 24.6 °C in January and 39.0 °C in May. The total rainfall during the period was 1355.8 mm of which the monsoon rainfall was 907.3 mm.

The Present Status

The ILRI has responded to the globalisation of industries and agricultural enterprises of the country as well as structural and functional reorganisation of ICAR. The Institute also has undergone structural changes and the priorities have been redefined. The erstwhile Divisions and Sections have been abolished and the scientific manpower has now been divided into three divisions, *viz.*, Lac Production, Lac Processing and Product Development and Transfer of Technology. The Institute runs two Regional Field Research Stations in Chhattisgarh and West Bengal.

For outstation experiments, areas and trees have been taken on long term lease. Infrastructure development in both physical and manpower has been initiated in a big way. A Cell for Agricultural Research Information System (ARIS Cell) provides the scientists, access to internet and e-mail facilities for communication and information retrieval.

Since its inception, the Institute has played a significant role in creating awareness among the tribals about the benefit of scientific methods of lac cultivation. It has persistently endeavoured to boost, optimise and disseminate appropriate technologies for scientific methods of lac cultivation and offers packages and practices for all major lac hosts. The Institute has been disseminating these technologies to the growers belonging to weaker sections, who cultivate lac in an area encompassing about 80,000 sq. km covering the states of Jharkhand, West Bengal, U.P., M.P., Chhattisgarh, A. P., Maharashtra and Orissa.

The industrial aspects have not been overlooked. The Institute has always polarised its scientific manpower as per the changing demand of the consumer industries. A number of products and processes have been developed. Previously the technologies used to be transferred free of cost to

the interested, on request. Now, a nominal fee is charged for the transfer of these technologies with the objective of meeting the target set for resource generation by the Council. The Institute has attained international recognition for its contribution in cultivation and utilisation aspects of lac.

The Mandate of the Institute is :

For Head quarters :

- To develop lac culture technologies, adopting existing or genetically improved lac insects and lac hosts
- To develop lac processing techniques for the industry
- To conduct researches for diversification of lac utilisation leading to pilot plant demonstration
- To transfer the technologies to farmers and entrepreneurs
- To act as a repository of information on lac production, processing and utilisation

For Regional Field Research Stations :

- To test the developed lac cultivation technologies under different agro-climatic conditions
- Brood lac production and exploitation of regional hosts
- Training of farmers for boosting lac production in agro-forestry system
- Entrepreneur awareness programme on regional basis

Organisational Set-up

The Institute is headed by a Director. The scientific manpower is deployed under three Divisions: i) Lac Production, ii) Lac Processing and Product Development and iii) Transfer of Technology.

Located in the main campus are :

The Divisions of Lac Production, Lac Processing & Product Development and Transfer of Technology; the Administrative, Finance & Accounts Sections; the Library; the Director's Cell; ARIS Cell and the Mechanical Section; besides, the Dispensary and residential quarters. Adjoining this, is a small campus housing the Processing Laboratory and staff quarters. The Institute has playgrounds in both the campuses.

The administrative wing comprises of Director's Office, Administrative Section, Purchase Section, Finance and Accounts Section and Central Stores. The technical support is provided by the following sections: Library, Director's Cell, ARIS Cell, Farm Unit and Maintenance & Workshop. The Auxiliary units are: Hindi Cell, Security, Medical and Estate Maintenance services.

Staff

The Institute has a sanctioned strength of 1 RMP, 55 scientific, 70 technical, 41 administrative and 101 supporting grade posts.

Budget

During 2003-2004, the non-plan expenditure was Rs. 424.26 lakhs, against a revised estimate of Rs. 434 lakhs, the plan expenditure was Rs. 98.16 lakhs against a revised estimate of Rs. 103.0 lakhs. The detailed figures are shown in the table given below.

Revenue Generation

During the period under report, a sum of Rs. 20.95 lakhs was earned as revenue through different programmes of various divisions and sections of the Institute.

Budget during 2003-2004 (in Rs. lakhs)

Head of account	Plan		Non-Plan	
	RE	Expenditure	RE	Expenditure
Establishment charges	-	-	349.45	344.26
T.A.	3.00	3.00	2.70	2.70
Other charges	64.00	61.25	73.35	70.23
Other Items (HRD, Seminar, etc.)	6.00	3.91	0.50	10.50
Works	30.00	30.00	8.00	6.57
Total	**103.00**	**98.16**	**434.00**	**424.26**

RESEARCH ACCOMPLISHMENTS

LAC PRODUCTION

Bio-rational approaches for management of lac insect predators

- Egg parasitoids namely *Trichogramma achaea, T. chilonis* (Indian and German strains), *T. exiguum, T. pretiosum* and *Telenomus remus* were procured from Bio-control Laboratory, Entomology Division, IARI, New Delhi and are being reared on alternative host (*Corcyra cephalonica*) eggs in the laboratory.
- Studies have been carried out on the effect of storage on the eggs of *Pseudohypatopa pulverea* and *Eublemma amabilis* in the laboratory for their vitality and hatching. Studies have indicated that the lepidopteran eggs remained viable till ten days of storage in refrigerator at 8-10°C.
- It has been observed that the butterfly *Catopsilia pyranthe* lays eggs in large numbers on the leaves of the weed plant *Cassia occidentalis* (found in abundance in the region). Eggs collected from the weed plant has been found to be parasitized by the egg parasitoid *Trichogramma chilonis* in nature, which has also been reported to be parasitizing the eggs of the lac insect predator *Eublemma amabilis*. To exploit the beneficial effect of the weed plant and common egg parasitoid, *C. occidentalis* seedlings were planted along the borders of a plot with *rangeeni* lac (rainy season katki 2003 crop) on the bushy lac host plant *Flemingia macrophylla*. The *katki* crop was harvested during November 2003 and 1 kg. lac stick samples caged for recording the lac insect predator population. Results have indicated that emergence of the predators *E. amabilis* or *P. pulverea* were very few in the experimental plot in comparison to control plot where the population of *E. amabilis* and *P. pulverea* were 57 and 6 respectively. This indicates the management of lac insect predators utilizing natural weed plants along with lac host plants.
- The biological insecticide *Delfin – Bacillus thuringiensis* sub. sp. *kurstaki*, Serotype 3a, 3b SA 11 WG was evaluated during *kusmi* winter (*aghani*) 2003-04 crop season in the farmer's field at Putidih (Dist. Purulia, West Bengal).

  The *aghani* crop raised on *kusum* and *ber* trees were sprayed with *B. thuringiensis* emulsion once during September 2003, at sixty day stage of the crop (*i.e.* two months after crop inoculation). Few trees were also sprayed with the recommended insecticide dichlorovos (*Nuvan*) for comparison. Preliminary observations revealed that the *B. thuringiensis* sprayed trees had better growth and development of lac insects and lesser amount of nibbling by the birds. Samples drawn at crop maturity indicated higher crop yield in the *B. thuringiensis* sprayed trees in comparison to the insecticide (dichlorovos) and control trees. The data are presented below:

Treatment	Host	Weight of stick/ m lac encrustation (g)
Bacillus thuringiensis	*Ber*	1000
	Kusum	666
Dichlorovos	*Ber*	722
	Kusum	611
Control	*Ber*	333
	Kusum	166

a) Field evaluation of beneficial parasitoids

For evaluation of the egg parasitoids under farmer's field condition, participatory research was undertaken involving the farmers of two villages Kharsidag (District Ranchi, Jharkhand) and Putidih (District Purulia, W. Bengal) and in the Institute Farm. *Trichogramma chilonis* parasitoids reared in the laboratory were released in the field by means of tricho-cards @ 50, 75 and 100 parasitoids per *palas* (*Butea monosperma*) tree in all the three experimental areas during the rainy season *(katki)* 2003 crop. The release of egg parasitoids were carried out during the 4th, 6th, 10th and 11th week after crop inoculation. The experiment consisted of four treatments replicated five times. At the time of crop maturity, samples in form of mature lac sticks were drawn from different treatments and caged in cardboard boxes (30x20x12cm) fitted with two glass tubes. The emergence of predators and parasitoids from the caged lac stick samples were recorded daily

Table 1. Effect of release of egg parasitoid *(Trichogramma chilonis)* on the predatory insect population and crop yield in different areas during *katki* 2003 on *palas* tree.

Treatment (Release/ tree)	KHARSIDAG			NAMKUM			PUTIDIH		
	Predator population per kg. sample		Yield (kg) per kg. input	Predator population per kg. sample		Yield (kg) per kg. input	Predator population per kg. sample		Yield (kg) per kg. input
	*E. a.**	*P. p.**		*E. a.*	*P. p.*		*E. a.*	*P. p.*	
50 insects/ tree	39	21	5.78	88	17	1.23	138	12	2.14
75 insects/ tree	34	24	6.72	65	15	2.77	131	09	3.58
100 insects/ tree	33	20	6.16	66	15	2.13	105	03	4.68
Control (no release)	134	121	0.90	129	31	0.38	213	22	1.27

* *E.a. - Eublemma amabilis; P.p. - Pseudohypatopa pulverea.*

for the next sixty days.

The number of predators (*Eublemma amabilis* and *Pseudohypatopa pulverea*) emerging out of the caged lac sticks and yield under various treatments has been depicted in Table 1. It is evident from the table that the predator population in the released trees is significantly lower in comparison to the control in all the three areas. The crop yield under various treatments is also better in comparison to control. It is evident that the *Pseudohypotopa pulverea* population in Namkum and Putidih is lower in comparison to *E. amabilis* population.

The egg parasitoid *Trichogramma brasiliense* was released for evaluation during the *summer season (jethwi)* 2003 crop raised on *kusum* trees at ILRI farm. The egg parasitoids were released @ 100, 200 and 300 insects/ *kusum* tree during the 6th & 10th week after inoculation only due to dearth of egg parasitoids. Lac stick samples of 1 kg. from each treatment at the time of crop maturity are collected and caged in wooden boxes fitted with glass tubes for recording the emergence of predators and parasitoids. The total number of emerged lac insect predators from caged samples have been depicted in Table 2.

Table 2. Effect of release of egg parasitoid *Trichogramma brasiliense* on the predatory insect population during *jethwi* 2003 crop on *kusum*.

Treatment	Predator population per kg. lac stick sample	
	Eublemma amabilis	*Pseudohypatopa pulverea*
100 insects/ tree	24	52
200 insects/ tree	08	30
300 insects/ tree	10	30
Control (no release)	78	174

It is evident from the table that the predatory population is significantly low in all the treatments in comparison to control (no release).

b) Chemical control of pests of lac insect

i) Treatment of broodlac

Experiment was carried out to assess whether incidence of insect parasitoids and predators can be reduced by dipping broodlac in emulsions of some newer insecticides as tested in case of already recommended endosulfan.

Broodlac from *palas* tree was randomly selected and dipped for 2 minutes in different concentrations of insecticides. After air drying, bundles of 50 g were put inside 60 mesh nylon net bag and inoculated on *palas* tree for raising *baisakhi* crop. For control, the broodlac was dipped in plain water and also without dipping. Overall ten treatments with four replications were kept for observations on lac insect mortality and emergence of different species of insect parasites and predators. The observations were taken after 45 days of treatment. Following results have been obtained.

(a) In view of safety of the insecticide, profenfos (*Curacron 50 EC.*) towards later stage of development *i.e.* just before adult maturity and its effect on chrysopa sp., three concentrations (0.075, 0.05 and 0.025%) in water were used for studying the dipping effect. The result indicated that profenfos is not suitable for broodlac treatment as there was no emergence of young ones from any of the concentrations evaluated.

(b) Four dosages of ethofenprox (*Nukil 10 EC*) viz; 0.02, 0.015, 0.01 and 0.005% were used for

broodlac treatment. All the concentrations were fully safe, as lac insects settled and developed normally, but incidence of insect parasites and predators was not affected as there was no difference between control and the treatments.

ii) Evaluation of insecticides and fungicides

In order to develop spray schedule and also assess the effect of antibiotic (if any) for saving summer season (*baisakhi*) lac crop, experiment was carried out with four treatments *viz.*, *Endosulfan + Carbendazim*- 4 and 2 sprays; Endosulfan + *Carbendazim* + *Kasugamycin* 3% S.L; *Carbendazim + Kasugamycin* 3% S.L. and *Carbendazim,* each replicated five times. The standing lac culture crop on *palas* tree was sprayed with the above mentioned insecticide and fungicides. The crop developed normally up to 1st week of March but due to heavy incidence of insect parasites in all the treatments, further observations could not be taken up. Examination of survived lac culture sample in first week of April revealed heavy incidence of parasitisation of the female cells (67%).

iii) Ovicidal action of insecticide

Ovicidal action of ethofenprox was evaluated against the two lepidopteran predators *viz*; *Eublemma amabilis* and *Pseudohypatopa pulverea* with 5 concentrations *viz*; 0.01, 0.005, 0.0025, 0.00125 and 0.000625%. Clusters of eggs laid on paper were dipped for 30 seconds in the above concentrations of insecticide emulsions, dried in air and kept under observation for one week after the treatment, for hatching. In control, plain water was used for dipping. In case of eggs of *Eublemma amabilis*, cent per cent hatching was inhibited with 0.01% and 92.3% with 0.005%, only 7.7% eggs remained unhatched with 0.000625%. In control only 1.7% eggs remained unhatched. However, for *P. pulverea* hatching did not take place even with lowest dose tried 0.000625%.

Nutrient management in soil for maximising lac yield

The experiment was continued as per the layout presented last year. Nitrogenous fertilizer in the form of organic and inorganic were applied as per schedule. *Palas* trees under study were pruned in April 2003. After pruning, growth parameters were recorded at 30 - day intervals. New shoots emerged during May in almost all the pruned *palas* trees.

Maximum number of new leaves per tree was found in the treatment where 60 g of inorganic nitrogen were provided (T_8) and was found at par with the treatment where even more nitrogenous fertilizer were given; the treatments did not differ significantly (Table 3).

Maximum length of new shoots was found to be 52.9 cm in the treatment where 80 g of nitrogen was applied (T_5) and was highly significant at 5%, whereas maximum number of shoots were recorded with use of highest levels of inorganic nitrogen (80 x100g), significant at 5%. Maximum girth in new shoots was 3.87 cm where 80 g of inorganic nitrogen was applied.

Table 3. Effect of inorganic and organic sources of nitrogen on growth parameters of *palas* and lac yield.

	Number of leaves / tree	Av. length of new shoots/tree (cm)	Number of shoots/ tree	Av. maximum girth of shoots (cm)	Scraped lac yield per plant during *katki* (g)
Control	423	36.0	47	3.12	49.0
T_2	653	39.9	71	3.32	56.5
T_3	637	51.5	64	3.65	65.7
T_4	469	45.2	58	3.25	81.2
T_5	558	52.9	64	3.25	51.2
T_6	575	46.2	60	3.35	56.5
T_7	597	45.8	58	3.45	75.7
T_8	704	48.3	71	3.40	47.5
T_9	669	39.5	76	3.87	58.5
T_{10}	650	51.0	76	3.67	72.2
CD at 5%	NS	7.4	3	NS	2.94

Brood lac was also inoculated during July 2003 @ 25 g per meter shoot length for *katki* crop. During *katki* crop partial harvesting was done and rest broodlac was inoculated on *palas* tree. During the partial harvesting the scraped lac yields ranged between 49.0 and 81.2g/bush, which was not satisfactory.

Management of *Flemingia semialata* for sustainable *kusmi* lac production under different geometry and irrigation

The bushy lac host plant *Flemingia semialata* was planted under 10 different geometries and inoculation was made for winter (*aghani*) crop during 2001-02. After the harvest of the crop, some promising geometries have been identified and others rejected as they were uneconomical. So considering these 5 promising geometries, a new trial (experiment) has been chalked out under Randomized Block Design with 4 replications. The geometry details are presented in Table 4.

Table 4. Geometry and plant population details of *Flemingia semialata* plantation.

Treatment	RxR distance (m)	PxP distance (m)	Total number of plants / ha
T_1	0.5	0.5	40,000
T_2	0.5 (one row skipped)	0.5	30,000
T_3	1.0	1.0	10,000
T_4	1.5	1.0	6,667
T_5	2.0	1.0	5,000

The experiment has been executed under two sets, one for winter season crop and the other for summer season crop. *Flemingia semialata* under drip irrigation were inoculated for winter *(aghani)* crop @ 50g brood/bush (having 5-6 shoots). Irrigation through drip was operated once and twice in a week as per the treatment (for two months only). These treatments are to be compared with each other and also with plants grown under rainfed conditions. The crop will be harvested in Jan-Feb.

Estimation of leaf area of *Flemingia semialata* through uni or multivariate regression analysis

A regression equation was developed after analyzing the data on leaf area of 20 bushes, selected randomly. The leaf area of the plant was measured using a Leaf area meter. Besides leaf area several other parameters were also recorded and correlation was established between the parameters (No. of leaves/ plant, no. of shoots, etc.) as independent factors/ characters and leaf area as dependent factor. Maximum coefficient of determination (R^2-0.9740) was obtained between total number of leaves per plant and leaf area of the plant. The equation follows as Y = -1.237 + 0.1103 X (where Y = total leaf area of the bush (m^2) and X = total no. of leaves in the bush).

Thus, the whole leaf area can be calculated without destruction. Leaf area has got direct relationship with food manufacturing capacity of the plant and support to the lac insect.

Integration of *Flemingia semialata* with horticultural crops for sustainable lac production under irrigated condition

The study was taken up with the objective to integrate *Flemingia semialata* with horticultural crops for sustainable lac production under irrigated condition.

An experiment was laid out in Randomised Block Design with fourteen treatments including two sole cropping schedules of vegetable crops and replicated three times. The first schedule of vegetable crops consisted of okra (*Abelmoschus esculentus*) - garlic (*Allium sativum*) – bitter gourd (*Momordica charantia*) for *kharif, rabi* and *zaid* seasons respectively. Similarly, the second schedule was ginger (*Zingiber officinale*) - tomato (*Lycopersicon esculentum*) - bottle gourd (*Lagenaria siceraria*) for the respective period. Two systems of planting for *F. semialata* were adopted *i.e.*, normal planting at 1.0m uniform row spacing (single row) and paired row planting at 0.5/ 1.0m row spacing.

Observations taken on growth attributes of *F. semialata* after one year of planting have been given in Tables 5 & 6. It is seen from the tables that host plant growth attributes were significantly influenced by growing of intercrops in between single and paired rows of the host plants. Perusal of data presented in Table 5 shows maximum value of plant height, basal girth, canopy spread (E-W), total and available shoot length for lac insect settlement under treatment (T_7) where *F. semialata* was planted in

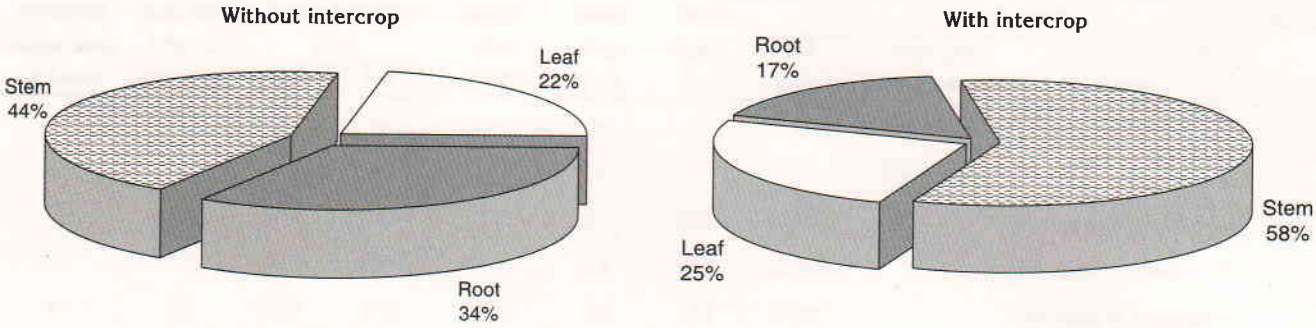
Table 5. Growth attributes of *F. semialata* as influenced by different treatments.

Treatment	Treatments			Plant Height (cm)	Basal girth (cm)	Tillers/ bush (Nos.)	Canopy spread (cm)		Total shoot Length/ bush (m)	Inoculable shoot length/ bush (m)
	Host plant planting pattern	Vegetable crops schedule	Lac crops				N-S	E-W		
T_1	-	Schedule I	-	-	-	-	-	-	-	-
T_2	-	Schedule II	-	-	-	-	-	-	-	-
T_3	*F. semialata* at single row	-	Winter	93.9	5.0	4.7	20.3	21.6	3.1	1.5
T_4	*F. semialata* at single row	-	Summer	83.4	4.2	4.1	18.9	19.1	2.7	1.5
T_5	*F. semialata* at paired row	-	Winter	86.1	5.1	4.6	21.9	25.0	3.0	1.6
T_6	*F. semialata* at paired row	-	Summer	87.2	4.7	4.6	21.8	23.1	2.3	1.4
T_7	*F. semialata* at single row	Schedule I	Winter	116.8	6.0	5.3	39.5	44.5	5.2	3.2
T_8	*F. semialata* at single row	Schedule I	Summer	110.8	5.6	5.3	43.0	43.7	4.7	3.0
T_9	*F. semialata* at single row	Schedule II	Winter	115.0	4.8	5.5	35.8	36.3	5.1	3.2
T_{10}	*F. semialata* at single row	Schedule II	Summer	107.2	4.6	4.3	34.1	29.6	3.2	2.1
T_{11}	*F. semialata* at paired row	Schedule I	Winter	108.5	5.1	3.9	37.3	39.0	3.2	1.9
T_{12}	*F. semialata* at paired row	Schedule I	Summer	116.6	5.6	5.0	32.1	36.2	4.7	2.5
T_{13}	*F. semialata* at paired row	Schedule II	Winter	103.9	4.6	5.0	34.0	34.4	3.7	2.2
T_{14}	*F. semialata* at paired row	Schedule II	Summer	106.1	5.0	4.8	30.4	32.7	3.9	2.3
CD at 5%	-	-	-	19.9	0.81	NS	7.85	NS	1.47	0.91

Table 6. Leaf number, leaf area index, root growth and biomass of *F. semialata* under different treatments.

Treatment No.	Treatments			Leaves/ bush (No.)	LAI	Main Root Length of bush (cm)	Number of rootlets/ bush	Total roots & rootlets length/bush (m)	Total dry biomas/ host plant (kg.)
	Host plants planting pattern	Vegetable crops schedule	Lac crops						
T_1	-	Schedule I	-	-	-	-	-	-	-
T_2	-	Schedule II	-	-	-	-	-	-	-
T_3	*F. semialata*, single row	-	Winter	107.8	13.7	98.3	30.0	9.9	0.42
T_4	*F. semialata*, single row	-	Summer	134.2	17.2	85.0	21.3	7.1	0.51
T_5	*F. semialata*, paired row	-	Winter	103.3	11.8	88.3	26.0	7.9	0.43
T_6	*F. semialata*, paired row	-	Summer	114.3	13.8	90.0	27.0	7.6	0.46
T_7	*F. semialata*, single row	Schedule I	Winter	147.3	18.7	106.6	38.3	12.3	0.92
T_8	*F. semialata*, single row	Schedule I	Summer	192.0	25.4	115.0	29.7	9.9	0.81
T_9	*F. semialata*, single row	Schedule II	Winter	167.3	21.4	113.3	26.0	8.7	0.80
T_{10}	*F. semialata*, single row	Schedule II	Summer	154.7	19.9	107.3	27.7	8.1	0.80
T_{11}	*F. semialata*, paired row	Schedule I	Winter	134.8	15.9	96.6	29.7	10.0	0.54
T_{12}	*F. semialata*, paired row	Schedule I	Summer	202.5	25.9	100.0	34.7	11.0	0.47
T_{13}	*F. semialata*, paired row	Schedule II	Winter	161.2	19.8	89.3	29.3	8.2	0.56
T_{14}	*F. semialata*, paired row	Schedule II	Summer	159.2	20.9	95.0	27.0	10.8	0.42
CD at 5%	-	-	-	49.63	7.25	NS	NS	NS	0.48

Fig. 1. Contribution of different plant components to the biomass of *F. semialata, with and without intercrops*



single row (1.0 x 1.0m) with schedule I vegetable crops and winter season lac crop. Leaf numbers per bush and LAI (Leaf area index) after one and half year of planting of *F. semialata* were also significantly increased by growing of intercrops. It is evident from the data (Table 6) that root growth and development of the host plants were also better due to utilization of interspaces by inter crops, however, its effect was found to be not significant. Continuous cropping of vegetable crops during *kharif, rabi* and *zaid* seasons in between single and paired rows of *F. semialata* showed 36.6% increase in total biomass production (dry wt.) as compared to sole planted of the host plants. The contribution of different plant components of *F. semialata* as affected by different treatments has been depicted in Fig 1.

Two cropping schedules of vegetable were followed as inter and sole crops. The percent reduction in plant population and yield of vegetable intercrops to sole crops in single and paired rows of *F. semialata* has been given in Table 7. Since plant population of vegetable crops as intercrops was reduced to the tune of 42.9 to 60.4% as compared to sole vegetable crops due to the host plants, the crop yield was also reduced accordingly. However, in *zaid* crop season, the yield reduction was not so high as compared to that of in plant population (Table 7). *F. semialata* plants were inoculated with *kusmi* strain of lac insects in the last week of July, 2003 for raising winter lac crop *aghani* 2003-04).

Improvement in lac host plant propagation techniques

A) Vegetative propagation of *Flemingia semialata*

Flemingia semialata (Leguminosae: Papilionaceae) a shruby host of *kusmi* lac insect strain, *Kerria lacca* (Kerr), is now known to be a promising host plant for raising *aghani* (winter) season crop. The productivity and quality potential of this host has now being considered to be at par with lac on

Table 7. Percent reduction in plant population and yield of vegetable inter crops to sole crops in single and paired rows of *F. semialata*.

Vegetable crops	Crop seasons	Reduction in plant population		Reduction in yield	
		Single row	Paired row	Single row	Paired row
Okra (*Abelmoschus esculentus*)	*Kharif*	42.9	57.1	35.1	57.1
Ginger (*Zingiber officinale*)		60.4	60.4	30.9	55.6
Tomato (*Lycopersicon esculentum*)	*Rabi*	50.0	50.0	56.3	55.9
Garlic (*Allium sativum*)		55.8	55.8	42.5	42.5
Bottle gourd (*Lagenaria siceraria*)	*Zaid*	50.0	50.0	25.1	35.6
Bitter gourd (*Momordica charantia*)		50.0	50.0	34.8	35.0

kusum, Schleichera oleosa, a major conventional host of lac growing regions of the country.

Efforts are being made to regenerate this host for more than a decade, through vegetative propagation *i.e.* by shoot cuttings. To utilise this host of lac insect as an alternate and more economical host of *kusmi* strain, the study has been taken up for development and multiplication of superior genotypes / varieties, for bringing down the long gestation period and to have a uniform host plant population on plantation basis, for more uniform and improved rearing of the lac insect. Experiments carried out in this direction in past, however, mostly failed and in few rare cases, when some rooting was achieved, it was very low and inconsistent. Now under the present study, success has been achieved in raising the plants through shoot cuttings under trench condition covered with polythene sheets during summer season.

The ability of cuttings to regenerate plants vary with plant species. All types of cuttings, ranging from normal pencil thickness to apical portion of shoots, soft to semi - hard and hard, with and without rooting hormones have been tried for initiating rooting.

During the month of March 2003, trenches (1m x 1m x 3m) were prepared and covered with transparent polythene sheets. Watering the walls of trenches, twice a day at one day interval, was found to be suitable for maintaining 50 to 70% humidity within the trenches during 15th April to July 2003.

The cuttings from shoot / branches of 18 month old bushes of *F. semialata* consisting of basal diameter ranging from 1.5 to 2.5 cm, having internode length of 1.5 to 4.5 cm and shoot length of 0.75 to 1.5 m were utilized. The shoot cuttings were of 30 to 35 cm with 4 to 5 inter-nodes. The basal 1 to 2 nodes were kept under the soil zone leaving 2 to 3 node above the soil zone during the months of April - May. Poly bags (10 cm x 20 cm) were filled with garden soil, sand and either of vermi-compost / compost (1:1:1). The base of trenches were filled with brick for soling and 6 cm sand for keeping the filled poly bags in erect position. The basal end of cuttings (6 to 8 cm) were dipped in four concentrations of hormones, ranging from 0 to 1000 ppm (increase in increments of 250 ppm) of IBA, IAA and NAA. It was observed that the shoot cuttings having basal portion with shorter length of internodes and diameter ranging from 1.5 to 2.5 cm were suitable for early sprouting, *i.e.* after 15 to 20 days of pegging in the soil media within polythene bags. After 60 to 75 days of sprouting, the region of the basal portion (1.5 to 6.5 cm) of the cuttings produced profuse rooting with 12 to 30 number of primary roots, 2-11 number of sub-roots / subsidiary root. Besides this, initiation of 1 to 3 root nodules on some of the tertiary roots was also observed.

The plants raised through cuttings have attained the height of 20 to 52 cm with 6 to 15 leaves, 3 to 9 axillary vegetative buds and 1.5 to 10.5 cm length of inter nodes per shoot. In general about 50% of these cuttings showed effectiveness in producing viable plants for field transplanting during August- September. The transplanted plants showed cent per cent survival under field condition.

The shoot cuttings of *palas, kusum, Ficus spp.* were also tried. The cuttings of *palas* and *kusum* did not show any rooting, even after showing 8 to 12 cm sprouts. Rooted plants of *Ficus racemosa, F. cunia* were transplanted in the field for studying their survival.

B) Airlayering in *kusum, Schleichera oleosa*

- About 50% of layers of *kusum* showed root initiation with the treatment of IBA (100 ppm) along with vermi-compost, lanolin paste and sphagnum moss wrapped with polythene sleeves as compared to 10 % rooting in control (FYM).
- Callus formation was recorded in 95.2 % air layers with combination of IBA 200 ppm, vermi-compost and sphagnum moss and 60 % callus formation in control .
- The initiation of rooting was found very erratic throughout the period of layering due to lack of rain fall during June/July.

C) Seed viability of lac host plants

The seed viability was recorded to be 100% in *Albizzia lucida, (galwang)* during May; 95% in *Schleichera oleosa, (kusum)* during August, 45 - 50% in *Flemingia semialata* during April; 95% in *Acacia catechu (khair)* during May and 70% in *Zizyphus mauritiana (ber)* during June .

D) Seed Production

Lay out of an experiment in RBD with 4 replications and 7 treatments was carried out for studying the effect of insecticides / acaricides on the seed production in *F. semialata* during June/ July. The treatments consisted of 1st & 2nd spraying of endosulfan and chlorpyriphos @ 0.05% at flower initiation stage, 3rd & 4th spray after 25 -30 days after 1st spraying and 5th & 6th spray at 55-60 days after 1st spraying along with control (without spraying). Transplanting of seedlings has been completed during September 2003 after raising the seedlings in nursery beds. Plants are developing well.

Collection, maintenance, conservation and evaluation of lac insects and host plants and their genetic improvement

A. Survey and collection of lac insects and host-plants

Exhaustive survey of selected areas in five districts of Jharkhand during February 3rd to 10th 2003, six districts of Punjab and Jammu & Kashmir during 22nd June to 3rd July 2003 and four districts in Rajasthan during November 15th to 24th 2003 were undertaken to gather information on availability of lac insects and their host plants and to collect the available material for establishing and maintaining at the ILRI (Table 8).

Table 8. Areas covered during the survey for lac insects and their hosts

Sl.	State	District (Areas) covered
1	Jharkhand & West Bengal	**Dumka** (Masalia, Kathalia, Kunda, Nala, Kusumdih, Jhajharpada, Sainthia, Seori, Rampur Haat in WB, Gopikander & Jeetpur), **Pakur** (Kathalpada, Berhet, Teelo, Boreo and Dhulian in WB and villages en route to Sahebganj), **Sahebganj** (Paharpur, Mirja chouki, Lalmatia and villages en route to Godda), **Godda** (Poreya haat, Saraiya and villages en route to Deoghar) and **Deoghar** and villages en route to Ranchi)
2	Punjab	**Ludhiana** (Mullanpur and Padewal villages and areas in and around the city), **Amritsar** (areas in and around the city), **Gurdaspur** (areas in and around the city), **Hoshiarpur** (areas in and around the city), **Patiala** (Regional Fruit Research Station of PAU, campus of Punjabi University and areas in and around the city)
3	Jammu & Kashmir	**Jammu** (Batehra, Akhnoor and villages en route to Akhnoor)
4	Rajasthan	**Jodhpur** (areas in and around the city), **Beawar** (areas in and around the city), **Ajmer** (areas in and around the city) and **Udaipur** (Jhalod and areas in and around the city).

In Jharkhand, among the major lac host plants, *Butea monosperma (palas)* and *Zizyphus maurtiana (ber)* are present in abundance in the entire area surveyed. *Schelchera oleosa (kusum)* is scattered and limited to small pockets, and is not utilized for lac cultivation. Availability of lac insects in nature was scanty and cultivation of lac has also been abandoned in most of the areas except in some pockets (Littipada Block) of Pakur and adjoining areas (Dhulian) of Malda district in West Bengal. *Z. mauritiana* is the most preferred tree for lac cultivation.

In the past, lac cultivators in West Bengal would either take trees on lease (Rs.100-200 / tree of *ber*) or provide broodlac to the needy, on sharing basis (at crop harvest half of the crop was retained by the owner of the tree and rest half was traded in *lieu* of broodlac provided). However, presently both these practices have been abandoned.

Interaction with villages revealed that the following were the important reasons for abandoning lac cultivation:

- Lac crop died over a large area due to unknown reasons and could not be restarted due to non-availability of broodlac.
- Marketing problems (there is no buyer).
- Villagers are not aware about scientific methods of lac cultivation.
- Farmers are interested in taking up lac cultivation but are unable to do so because of high cost of the broodlac.

Various samples of seeds / pods / samplings of different lac host plants and immature stage of lac insect collected during the survey are given in Tables 9 & 10, respectively.

Several trees of *palas* were found attacked / infested with an unidentified parasitic plant at Jhajharpada, Kathalia (Dumka). The presence of the parasite on *palas* was quite common. The affected twigs/ branches dry up and in one instance the whole tree was observed to be dead.

Among the major lac-host plants in Punjab, only *ber* (*Zizyphus mauritiana*) was found in abundance. However, the presence of lac insect population was very rare, as almost all the natural population of the *ber* trees has been replaced with

the fruit yielding improved varieties. These *ber* trees are regularly pruned in April / May which does not allow natural infection of the lac insect population. Moreover, in case of lac insect infesting the *ber* tree, it is deliberately killed with frequent pesticide spraying. Other major lac-hosts like *palas* (*Butea monosperma*) and *kusum* (*Schleichera oleosa*) are very rare. Minor host plants as *pipal* (*Ficus religiosa*), rain tree (*Albizia saman*) and *Acacia* spp. are present in quite a number, but no lac insect was observed on these trees. In Hoshiarpur and Gurdaspur areas people have adopted agro-forestry practices involving Poplar / Eucalyptus or other horticultural trees with agricultural crops.

In Jammu region, *palas*, *ber*, *Ficus* spp., rain tree, etc. are present in abundance but lac was observed on *ber* tree only. Mature leaves and tender twigs of *palas* are chopped off by the people in February / March for fodder to buffaloes. Similarly, the cattle also relish leaves and tender twigs of raintree. Scope of introduction of lac cultivation in Punjab is very limited as host trees are not available but their integration with agriculture can be tried. But, Jammu region has got a very good potential for systematic cultivation of lac as mixed plantation of *palas* and *ber* are available in plenty and are mostly un-exploited.

Various samples of seeds / pods / samplings of different lac host plants and lac insects collected during the survey are given in the Table 11.

Lac is fairly common in all the areas surveyed in Rajasthan, except Jodhpur. Yellow mutant of lac insect is prevalent, though crimson lac insect was also found at Jhalod (Udaipur). *Ber* (*Zizyphus mauritiana*), *pipal* (*Ficus religiosa*), *bargad* (*F. bengalensis*) and *pakur* (*F. infectoria*) were the host trees on which lac was observed. Other known lac hosts like *Butea monosperma*, *Acacia* spp. and *Leucunia leucocephala* are present in abundance but lac insect was not found on any of these. People regularly chop off the tender branches and leaves of these trees to feed their cattle especially during summer (Feb./March onwards) which could be one of the reasons for non-availability of lac insect on these trees.

Table 9. Lac host plants (seeds / saplings) collected during the survey.

Sl.No.	Date	Place (District)	Name of plant	Collection	Remarks
1	4.2.03	Rampur Haat 35th km. Stone (Dumka)	*Flemingia spp.* (?)	Seed & sapling	Small number of localized plants in a pocket.
2	5.2.03	Kathalia (Dumka)	*Albizzia saman (Rain tree)*	Pods	Species not very common in the locality.
3	6.2.03	Dumka	*Zizyphus mauritiana (ber)*	Seeds	*Ber* orchard about 5 km. from Dumka. Many trees were infested. Infestation was of recent occurrence.
4	6.2.03	Kathalpada, Littipada (Pakur)	-do-	Seeds	Purposely inoculated *ber* plant.
5	7.2.03	Teelo (Sahebganj)	*Butea monosperma (palas)*	Sapling	-
6	7.2.03	Paharpur (Sahebganj)	*Flemingia chhapar* (?)	Sapling	Widespread but limited to that locality only.
7	8.2.03	Godda	*Z. mauritiana (ber)*	Seeds	
8	8.2.03	Dumaria (Deoghar)	*B. monosperma (palas)*	Sapling	Another single tree yielding white flowers (told by a villager) has been marked for further collection

Table 10. Lac insects stages collected during the survey.

Sl. No.	Date	Place	District	Name of species	Collection	Remarks
1	5.2.03	Nala	Dumka	*Kerria sp.*	Immature stage	Yellow lac insect on two three twigs on a single *palas* tree. Recent infestation.
2	6.2.03	Dumka	-do-	*Kerria sp.*	Immature stage	From *ber* orchards; almost 20% plants were infested.
3	6.2.03	Nutan Molancha, Dhulian	Malda (W.B.)	*Kerria sp.*	Immature stage	*Ber* plant purposely infested

Table 11. Lac host plants (seeds / saplings) and lac insect collected from Punjab and Jammu & Kashmir.

S1.No	Date	Place	District	Name of plant/insect	Collection	Remarks
A. Lac host Plants						
1.	25.6.03	PAU Campus, Ludhiana	Ludhiana	*Butea monosperma*	Pods and sapling	Very few plants in the area
2.	25.6.03	PAU Campus, Ludhiana	Ludhiana	*Schleichera oleosa*	Unripe seeds	Very few plants in the area
3.	29.6.03	Akhnoor	Jammu	*Butea monosperma*	Sapling	Large concentration of the trees
B. Lac Insect						
1.	24.6.03	PAU Campus, Ludhiana	Ludhiana	*Kerria* sp.	Mature lac insect on *ber*	Only two/three twigs of one old tree were infected
2.	26.6.03	Golden Temple, Amritsar	Amritsar	*Kerria* sp.	Dead lac insect on *ber*	Three *ber* trees present in the complex with dead lac insect
3.	29.6.03	Batehra (Jammu Akhnoor road)	Jammu	*Kerria* sp.	Mature lac insect on *ber*	*Ber* tree was fully infested with lac insect
4.	29.6.03	Near Madhopur TCP (Jammu - Akhnoor road)	Jammu	*Kerria* sp.	Mature lac insect on *ber*	Mixed population of yellow and crimson lac insects on *ber* tree
5.	1.7.03	*Ber* Orchard of RFRS	Patiala	*Kerria* sp.	Mature lac insect on *ber*	Only two/three twigs of one old tree were infected

Though, use of lac in making bangles and polishing wooden toys is quite common in Udaipur and Ajmer, people are not aware about systematic lac cultivation and its uses in other spheres. Some localities in Udaipur where *palas* and *ber* are present in fair concentration hold promise for introduction of lac cultivation.

Various samples of seeds / pods / saplings of different lac host plants and lac insects collected during the survey are given in the Table 12.

B. Maintenance and evaluation of lac insect stocks

Lac insects collected from different parts of the country and the existing germplasm have been maintained on potted plants of *Flemingia macrophylla* (Table 13). Some of them were evaluated for density of settlement, mortality at 21 days stage, male proportion and survival at crop maturity during rainy season crop. Observations recorded are presented in Table 14.

C. Lac insect and host-plant interaction and lac insect breeding

Observations recorded were similar to those reported last year. F -18 progeny of the yellow trivoltine and F-31 progeny of inbred *rangeeni* lac insect is being maintained for further studies.

Four productive breeds of *kusmi* lac insects were inoculated on one year shoots of *Flemingia semialata* with a view to find out most suitable breed for lac production on this host. The experiment was conducted in RBD with four treatments replicated six times. Pest management schedules were followed as per recommendation for *kusmi* lac crop. Brood lac and sticklac data obtained on harvesting is presented in the Table15. Perusal of results indicated significant difference in the brood lac productivity of different breeds on this host.

D) Evaluation of *Flemingia spp.*

The plant attributes such as no. of shoots/ bush, no. of inoculable shoots, average length of shoots, length of lac coverage /shoot and diameter of shoots showed significant differences and their heritability in broader sense varying between 57-91%. The maximum value of 91% was obtained in the case of no. of shoots/bush but with 16.8% genetic advance. Amongst the plant attributes, the no.of shoots/bush showed heritability of 91% followed by 73% in diameter of shoots. Amongst the preferential parameters of lac insect, the length

Table 12. Lac host plants (seeds / saplings) and lac insect collected from Rajasthan.

Sl.No.	Date	Place	District	Name of plant / insect	Collection	Remarks
A. Lac host Plants						
1.	17.10.03	CAZRI Campus	Jodhpur	*Ber (Zizyphus mauritiana)*	Seeds	
2.	21.10.03	Jhalod	Udaipur	*Palas (Butea monosperma)*	Sapling	Large patches of *palas* but none was infected with lac insect
B. Lac Insect						
3.	17.10.03	CAZRI Campus	Jodhpur	*Ber (Zizyphus mauritiana)*	Mature lac insect	Yellow
4.	18.10.03	Beawar	Beawar	*Ber (Zizyphus mauritiana) and Pipal (Ficus religiosa)*	Mature lac insect	Yellow
5.	19.10.03	Pushkar & Ajmer	Ajmer	*Pipal (Ficus religiosa)*	Mature lac insect	Yellow
6.	20.10.03	Udaipur	Udaipur	*Ber (Zizyphus mauritiana), Pipal (Ficus religiosa), Pakur (F. infectoria) and Bargad (F. bengalensis)*	Mature lac insect	Yellow
7.	21.10.03	Jhalod	Udaipur	*Pipal (Ficus religiosa*	Mature lac insect	Crimson

Table 13. List of lac insect stocks maintained at the Institute.

Sr. No.	Lac Insect Stock / Collected from	Sr. No.	Lac Insect Stock / Collected from
1	*Kusmi* early crimson	2	*Kusmi* late crimson
3	*Kusmi* trivoltine crimson	4	*Kusmi* yellow, Orissa
5	*Rangeeni* crimson	6	*Rangeeni* inbred crimson
7	*Rangeeni* trivoltine crimson	8	Cross (trivoltine yellow)
9	*Rangeeni* yellow	10	Meghalaya
11	Bangalore* (Karnataka)	12	Thrissur (Kerala)
13	Jhalod crimson (Udaipur, Rajasthan)	14	Udaipur yellow (Rajasthan)
15	Echoda (Adilabad, Andhra Pradesh)	16	Patiala crimson (Punjab)
17	Ludhiana crimson (Punjab)	18	Akhnoor (Jammu & Kashmir)

* Only few female lac insects in the population due to preponderance of males during summer season

Table 14. Evaluation of biological parameters of different lac insect stocks when reared on *Flemingia macrophylla* during rainy season.

Lac insect stock	Density at initial Settlement / cm^2	Survival (%) at 21 days of inoculation	Male proportion (% of surviving insects)	Survival at crop maturity (% of initial settlement)
Rangeeni Trivoltine Crimson	82	43.9	33.7	18.3
Kusmi Trivoltine Crimson	57	66.6	32.6	7.9
Cross (Trivoltine Yellow)	98	65.3	52.2	29.4
Rangeeni Crimson	83	54.2	30.6	16.3
Rangeeni Yellow	89	46.7	64.2	12.0
Rangeeni Inbred Crimson	52	37.8	32.7	22.5
Kusmi Early Crimson	80	48.8	24.6	9.7
Kusmi Late Crimson	88	61.3	16.0	NA
Kusmi Yellow	90	80.0	25.9	32.6
Meghalaya Crimson	117	65.8	35.6	36.1
Ludhiana Crimson	77	87.7	71.3	25.9

Table 15. Performance of different lac insect breeds on *F.semialata*.

Lac insect breeds	Brood lac productivity (kg/m shoot length)
LR - 5314	0.322
LR - 5312	0.269
LR - 5313	0.214
LR - 5318	0.274
CD 1%	0.111
CD 5%	0.080

Table 16. Data showing average value of different growth parameters in *Flemingia spp.* during December 2003.

Treatments/ cultivars/ ICPW ACC No	Plant height (cm)	No of primary branches / bush	Length of primary branch (cm)	Length of internodes (cm)	Diameter of internodes (cm)	No of inoculable branches / bush
T2 (*F. macrophylla* /193)	60.9	14.3	47.3	3.2	0.9	7.0
T3 (*F. macrophylla*/194)	61.1	11.4	49.6	3.0	0.8	6.7
T4 (*F. macrophylla* /196)	70.1	8.0	44.6	3.4	1.0	5.4
T5 (*F. macrophylla* /198)	45.9	7.4	21.3	2.8	0.6	3.7
T6 (*F. paniculata* / 200)	53.1	9.7	31.7	3.0	0.7	5.2
T7 (*F. semialata* / 201)	66.7	4.8	32.4	6.1	1.0	2.0
CV%	10.65	27.0	13.9	11.0	11.4	23.7
CD at 5%	9.5	3.77	7.9	0.59	0.15	1.79
CD at 1%	13.2	5.21	10.9	0.8	0.2	2.48
PCV	17.5	42.7	31.7	35.9	21.2	42.7
GCV	13.9	33.0	28.5	34.2	17.6	35.4
H2%	63.0	60.0	81.0	91.0	70.0	69.0
G.A	5.44	8.07	9.36	11.19	6.65	9.2

of lac coverage has shown 58% heritability. Out of five yield parameters *i.e.* cell weight, brood, scraped lac/m along with brood and lac stick/bush tested, the scrap lac yield has shown 79% heritability followed by brood lac/m and broodlac/ bush (Table16).

Mechanization of lac cultivation operations

Development of modified power operated lac scraper

A modified power operated lac scraper has been designed and developed (Fig. 2). The developed machine scrapes lac under action of shear and compressive force and crushes sticklac under compressive force. The constructional details of modified power operated lac scraper are described below.

Constructional detail

In this machine motor speed of 1450 rpm at its shaft is reduced to 30-40 rpm at scraping roller shaft using V-belt and V-pulley type speed reduction mechanism in two steps. In this type of speed reduction mechanism, bigger size pulleys are fitted which make machine voluminous. In order to make a compact machine it was modified introducing gear box type speed reduction mechanism. Detail of the machine is described in the following sections.

Scraping roller

Scraping cum crushing rollers are the main component of the machine and comprise of two corrugated mild steel rollers each having a diameter of 125 mm and are 200 mm long. One of the rollers is fixed and other one is spring loaded, and thus

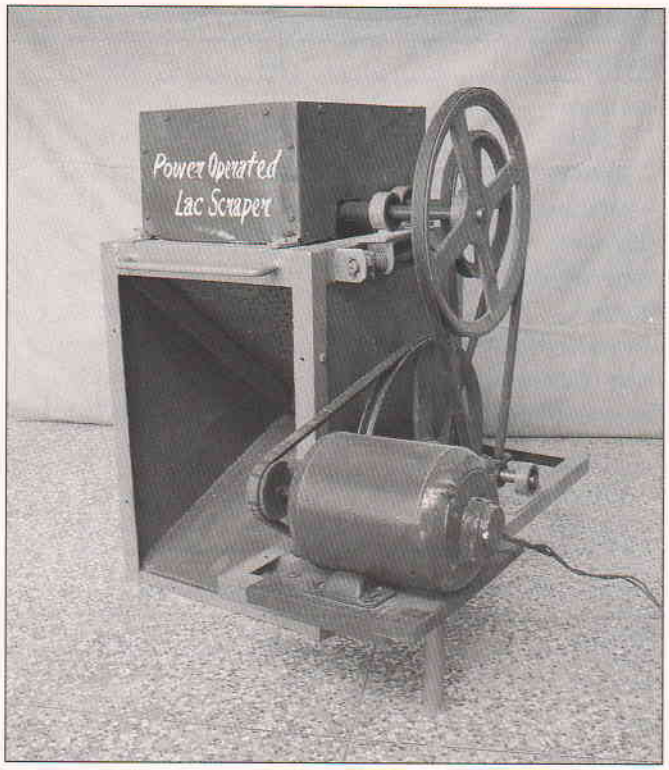


Fig. 2. Power-operated lac scraper

adjustable. The rollers rotate in opposite direction at a speed differential 1:1.66 between them. In idle condition, the gap between fixed and adjustable rollers remains 2mm. During operation gap is adjusted automatically according to the diameter of lac sticks and permit entry of lac sticks between rollers. In this way, the sticks are caught in between the rollers and lac is scraped by means of compression and searing actions. Similarly on feeding sticklac, it is crushed by compressive force applied between two rollers.

Separating screen

A sieve is fitted at an inclination of 45^0 under the two scraping rollers to receive the scraped lac and stick in case of scraping and crushed lac in crushing. Most of the lac encrustation, which pass through the sieve, fall on inclined pan which guides the received material towards the outlet of the machine. The scraped lac encrustation/crushed lac which does not pass through the sieve along with sticks slide down the sieve and come out of the machine.

Feed hopper

Feed hopper is fitted at the upper portion of the machine and is used to feed and guide the lac sticks/sticklac between scraping rollers safely.

Drive mechanism

The drive mechanism comprises of a gearbox, V-groove pulleys and V-belt to transmit power from motor to fixed and spring-loaded rollers. The drive mechanism reduces the 1450 rpm speed at motor shaft to 30-40 rpm at scraping roller shafts. The gearbox gets drive from motor shaft through a coupling. From gearbox power is transmitted to scraping rollers through V-belt and V-groove pulley. The machine is driven by 0.5 H.P. single phase A.C. electric motor and for its operation needs only one person.

Machine frame

The basic structure of machine, i.e. angle frame on which various components are fixed is made from mild steel angle iron (35x35x5 mm). The feed hopper frame is made up of mild steel flat (25x5 mm).

Testing and Evaluation

The machine scrapes lac under the action of shear and compressive forces. The compressive force acts due to compression of spring where as shear force acts due to differential speed of rollers. Machine was tested using *rangeeni* lac stick (used up broodlac or *phunki*). A basket filled with lac stick was kept on a platform raised to the level of feeding hopper for the convenience of the operator. The capacity of the machine as scraper was measured by calculating weight of lac stick scraped/unit time. The scraping loss was measured in terms of percentage of lac encrustation remained unscraped and were carried along with lac stick.

Observations were recorded for determination of scraping capacity of the machine & scraping loss.

The data obtained from the experiments were analysed. The scraping capacity of the machine was found to be 10.6 kg lac stick per hour. It means that if the machine is operated by a person for 8 hours in a day, from 85 kg of lac sticks lac can be scraped. However in traditional method one farmer scraps only about 10-15 kg of lac sticks in a day of 8 working hours. It means with the use of machine scraping can be done about 6 times faster as compared to traditional method. Further, in machine scraping chances of soil, sand and unwanted material being included in the scraped lac is reduced. The scraping loss was 8 % after two passes. The machine requires single-phase electrical power for operation and it is suitable for villages having electricity.

Economics of lac cultivation in Jharkhand

Schedule / questionnaire was developed after test survey and primary data collected from 180 lac growers to assess the farm resources, economic condition of lac growers, cost and return analysis in lac cultivation, difference in the economic efficiency of traditional and modern method of lac cultivation (Table 17).

Table 17. Survey of lac growers

District	Block	No. of villages	No. of growers
Ranchi	Bundu	4	40
	Ormanjhi	5	50
	Silli	3	20
	Murhu	4	40
W. Singhbhum	Bundgaon	3	30
	Total	**19**	**180**

30 trained lac growers were also surveyed during above period who had got one week training form ILRI, Ranchi

Preliminary findings of the project based on first year survey data are presented below and in Tables 18-21:

- 37.5 per cent lac growers have <1 ha., 48 per cent have 1-2 ha. and 14.5 per cent have more than 2 ha. of land holding.
- 31.3 per cent *palas*, 58.5 per cent *ber*, 18 per cent *kusum* and 8 per cent other lac host trees are utilised for lac cultivation at growers level.
- The major source of income of lac growers are foodgrain production (36.7 %), lac cultivation (29.5 %), vegetable production (11.5 %), as labour (16.3 %), forest produce and wood collection (3.2 %) and other activity (2.8 %).

Table 18. Analysis of cost of cultivation of lac on *palas* and *ber* (Rs. per 25 trees)

Particulars	*Ber*	*Palas*
Hired human labour	140 (5.35)*	140 (8.37)
Broodlac cost	761.25 (29.10)	560.0 (33.48)
Other input	25.5 (0.97)	15.5 (0.93)
Depreciation on implement	10.0 (0.38)	10.0 (0.60)
Interest on working capital	54.60 (2.09)	42.90 (2.57)
Cost A	**991.35**	**768.4**
Interest on fixed capital	12.0 (0.46)	12.0 (0.72)
Rental value of tree	852.75 (32.60)	512.0 (30.61)
Cost B	**1856.10**	**1292.40**
Value of family labour	760.0 (29.05)	380.0 (22.72)
Cost C	**2616.1 (100.0)**	**1672.4 (100.0)**

* Figures in the parenthens represent % value

Table 19. Returns from lac cultivation on *palas* and *ber* (Rs. per 25 trees)

Particulars	*Ber*	*Palas*
Total output		
Sticklac	4839.75	667.0
Broodlac	76.0	2283.75
Bio-mass	200.0	125.0
Gross return	5115.75	3075.75
Cost of cultivation	2616.10	1672.40
Net return	2499.65	1403.35
Input-output ratio (BC ratio)	1:1.96	1:1.84
Family labour income	3259.65	1783.35
Farm business income	4124.40	2307.35
Cost of production / Kg.		
Sticklac	33.36	31.99
Broodlac	-	24.39

Table 20. Physical input and output in lac cultivation (per 25 trees)

Particulars	*Ber*	*Palas*
Input		
Human labour		
Hired labour	3.5 Days	3.5 Days
Family labour	19.0 Days	9.5 Days
Broodlac	21.7 Kg.	14.0 Kg.
Output		
Sticklac	74.5 Kg.	11.5 Kg.
Broodlac	1.75 kg.	50.75 Kg.
Wood-stick	200 Kg.	125 Kg.

Constraints in lac cultivation at growers level

- Financial problem in purchasing broodlac
- Lack of knowledge on scientific method of lac cultivation
- Insect mortality after settlement
- Scraping problem in case of *ber*
- High price of *kusmi* broodlac
- Problem of theft specially when host trees are at distant place from home
- Management of *kusum* tree is very difficult due to its height

Collection of ITK relevant to lac cultivation

Following three useful ITK has been collected. (a) Wrapping of polythene sheet around main trunk of tree for protecting lac crop from squirrel damage (b) Putting ash / neem oil all over the body to protect biting of ants while pruning or harvesting the lac crop specially from *kusum* tree. (c) Wrapping *kusmi* broodlac with paddy straw before inoculation in the month of Jan/Feb to ensure complete emergence of lac larvae from broodlac.

Table 21. Number of farmers and contribution in lac production by different group of farmers.

Palas

No. of host	< 25	25-50	51-100	101-500	>500	0
% Farmers	23.5	25.5	23.5	15.7	5.9	5.9
Contribution in production	3.8	15.0	23.8	34.8	22.6	

Ber

No. of host	< 10	10-25	26-50	51-100	> 100	0
% Farmers	12.0	22.4	28.3	5.4	6.0	25.9
Contribution in production	11.9	23.7	24.7	23.3	16.4	

Kusum

No. of host	< 5	5-10	11-15	16-20	> 20	0
% Farmers	16.0	8.2	12.3	6.6	6.9	50.0
Contribution in production	24.3	22.9	28.7	12.0	12.1	

Study of lac marketing in India

Survey of Lac Growers

In Orissa 8 districts namely, Sambalpur, Jharsuguda, Mayurbhanj, Balasore, Koraput, Nabarangpur, Kalahandi and Rayagara were surveyed. Lac is considered as a forest produce in Orissa as it is mainly the collection of naturally growing lac in the forest areas. Two types of crops, bivoltine (two crops in a year) and trivoltine (three crops in a year) are prevailing in Orissa. In some places, organized lac cultivation is practiced. Data on raw lac collection in Sambalpur, Balasore and Nabarangpur region were recorded.

At Nilagiri block, Balasore, few persons were involved in lac culture using scientific method. Under Nilagiri block there are 5 Gram Panchayat (G.P) out of which the villagers of only 3 G.P.s namely Kishorechandrapur, Telipadh, Goradrihi are involved in lac production. They got training on lac cultivation about 3 years back from ILRI, Ranchi organized by ITDA (Integrated tribal Development Agency). They use *Kusum* (locally know as *pagra*) for lac cultivation. Presently they have inoculated trivoltine lac insect whereas they had inoculated the bivoltine lac insect during last year. They had purchased broodlac for boivoltine crop from Ranchi and for trivoltine crop from Sarat @ Rs. 120 per kg. and @ Rs. 100 per kg. respectively. Generally, the cultivators inoculate one kg. of brood lac per host plant and harvest an average of ten kg. of yield per tree. The major problem faced by the farmers is mortality of the lac larvae due to fog. They spray insecticide and fungicide against parasite, predators and fungal attack respectively. The Lakho Shilp Samanvay Samitte, Nottapara, collect the raw material and dispatch it to lac processing units of Jharkhand @ Rs. 120 per kg of seedlac obtained (chowri basis).

During this year, the survey work was conducted in Jharkhand, West Bengal, Orissa and Tamil Nadu. Eight lac growers of Arki, thirteen of Bundu, seven of Murhu, sixteen of Ormanjhi and eight of Silli Blocks of Ranchi District, six of Bandgaon Block of W. Singhbhum (Jharkhand), seven of Jhalda Block of Purulia District (W.B.) and twelve of Chandahandi Block, Nabarangpur (Orissa) were surveyed. Fig. 3 depicts average annual production of sticklac by lac growers surveyed.

Lac Markets

The markets/ *haats* of Mayurbhanj and Balasore districts were surveyed. Badam Pahar, where *haat* held on Sunday, arrival of lac was not regular. It is collected from forest area of Simlipal and also came through Jashipur. The scraped lac is dispatched to the wholesaler at Manjhgaon (Jharkhand). There is a market named Badra Bazar between Rairangpur and Badampahar, held on Wednesday. Here, lac arrival is only on demand basis. The Primary purchasers of Jashipur informed that the collected lac (@ Rs. 50 per kg.) at Jashipur

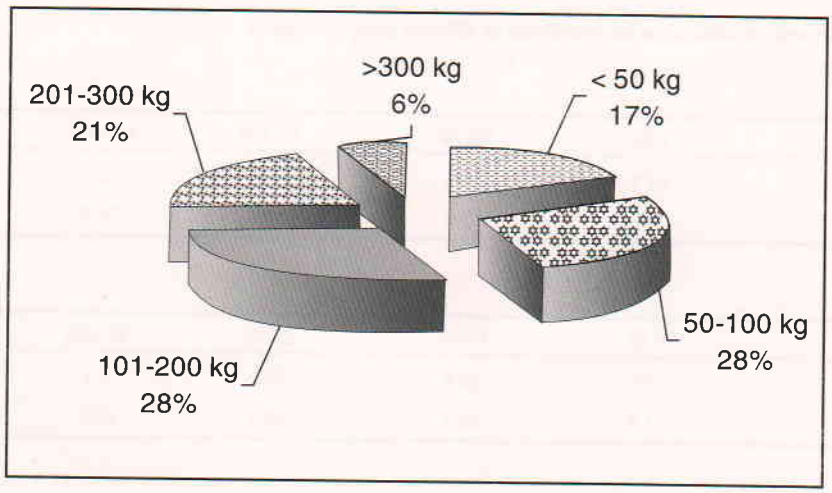


Fig. 3. Average annual lac production at growers' level

market have been dispatched to different areas of Jharkhand like Chaibasa, Chakradharpur, Jagannathpur from where it goes to Processing unit of Balarampur.

The primary purchasers of Sarat *haat*, purchase the lac @ Rs. 30 per kg. from the villagers of Similipal forest and sold to the wholesaler in the same *haat* and same day @ Rs. 40 per kg. Lac arrival is good in this *haat* and is throughout the year. The total number of lac wholesalers and primary purchasers in this *haat* was 2 & 8 respectively. Lac arrival in this *haat* ranges between 50 kg to 4 quintal depending on season. At Kotri *haat* arrival of lac was throughout the year. There were two primary purchasers dealing lac who were interviewed. The purchasing and selling rates of lac was Rs. 30 & 40 per kg respectively. The lac arrival on that day was 90 kg. According to them arrival of lac ranges between 10 to 80 kg. each day per primary purchaser.

The lac wholesaler of Barkhaladi has informed us that he collects lac from 8-10 primary purchasers of Sarat market and 8 primary purchaser of Salchua market @ Rs. 40 per kg. The arrival of lac ranges between 10-60 kg and 10-25 kg in Sarat and Salchua *haats* respectively. The crop was trivoltine and arrived at its peak during Dec-Jan., April and July-Aug. During the current year (Nov.02-Feb03) he had collected about 30q. of lac. He dispatches the lac at Balarampur Mandi through another wholesaler at Jorda.

Periodical Survey of lac markets

Important lac markets / *haats* held weekly were selected from Ranchi (Jharkhand) and Purulia district (west Bengal) for collection of data like, price of raw material, amount of lac arrival and number of paikars/ primary purchaser and wholesalers involved in lac trading. These information have been collected weekly i.e. on the major market day. The markets surveyed are Jonha, Bandgaon and Soeko in Ranchi, and Kalimati in Purulia (Figs. 4 & 5).

Survey of Processing Units

Thirty-two small scale as well as five large scale Processing Units of Balarampur, three of Tulin and two of Jhalda District Purulia, West Bengal were surveyed. There is an organization 'Lakha Khudra Kutir Silpa Samitti, Balarampur' which has about 100 and only small scale P.Us as members. Survey of 32 small-scale processing units showed that each unit is owned by 2 family members, who were involved in supervision and management. The number of *bhatta* per unit ranges between 2-6, majority of them use hand-crushing machine and few use power operated crushing machine. Their main produce is button lac, however they also produce shellac and process seed lac on demand. Bore well is the principal source of water. About 50% of them have washing barrel and only one has press machine.

The problems faced by the P.Us :

- Confusion in whether lac has to be treated as industrial produce or natural forest product during transit of material.

- New technologies would be accepted to them for adoption if they could be offered on turn-key basis.
- There is no incoming of new skilled labourers in the processing works.
- High electric charges (Rs.3.40/unit).
- There is no subsidy in the price/ cost of the machineries utilized in lac processing.
- There are very few awareness programmes.
- The processing units have to pay 3% commission to the private *arhats* for the purchase of raw materials and an interest (@ 6 to 18% per annum) if the raw material is procured as loan.

In Tulin (Dist. Purulia, W.B.) there are about 30 small-scale processing units, out of which only 21 are functioning. The processing units produce mostly button lac and very few shellac (as per demand) for domestic consumption, using traditional *bhatta* for manufacture of produce. The processing is supervised / managed by the owners. For operation of *bhatta* they involve three persons per *bhatta* on contract basis. Out of 21 operational *bhatta* owners, only 4-5 owners act as retailer and sell their produce to different areas for domestic use and the rest of the owners sell their produce through these retailers. The produce is sold to the retailers of Balrampur, Kolkata (West Bengal) market, Handicraft industries of Jaipur (Rajasthan), Sitamari, (Muzaffarpur, Bihar).

The major problems faced by the processing units in Tulin:

1. The rate of produce is fluctuating
2. The marketing is not systematic and with excess bargaining
3. The produce has restricted use
4. Bank loan is not easily available to the traders or manufacturers of lac produce.

Arhat at Balarampur

There are about 15 private *Arhats* in Balarampur. They charge @ 3 per cent in marketing of lac i.e. it sell raw material @ Rs. 103 when the purchase was made @ Rs. 100. *Arhatias* made payment to wholesaler in cash and deduct 1 per cent in cash amount. *Arhatias* supply the raw material (Scraped Lac) to processing units on cash payment at delivery or as loan with an interest rate of 6 to 18 per cent per annum.

Survey of domestic lac consumption centers

Balarampur, West Bengal : There are 4 handicrafts and bangle makers at Main bazaar, Balarampur involving 27 members at works (13 men and 14 women workers). They were involved in making several items along with bangles like pen, pen stand, candle stand, paperweight, jewellery box, lac decorated glass plates and many other items (as an accessory) as per demand. Generally they dispatch their products to Kolkata market. The main problem faced by them is the delay in payment from the buyers.

Nabrangpur, Orissa : There are about 50 families of *Shankhari* Tribe at Nabarangpur District of Orissa, among them 8 families were engaged in lac handicrafts manufacture. Only female members are involved in this art. They use lac for coating and decoration over bamboo baskets, jewelry boxes of ply wood, earthen toys, dried coconuts, bangles, invitation cards etc. They have established a society named 'Ma Mangla Mahila Lakh Karigar Samanvay Samittee, Nabrangpur'. The society collects the handicraft items and dispatch them to different shopkeepers/ retailers of tourist places in Orissa viz. Bhubhneswar, Katak and Puri. Presently very few handicraft manufacturers dispatch their produce through this society. They get raw lac from Chandahandi, Nabrangpur either directly from the lac cultivators or through the agents @ Rs. 90/- to Rs. 130/- per kg. They purchase the colour from Behrampur, Orissa @ Rs 400-500 / kg. They collect bamboo baskets, earthen toys and other raw materials locally.

Sivakasi, Tamil Nadu : There are 45 Colour Match Manufacturing Units (CMMU) at Sivakasi, Virudhunagar District, Tamil Nadu registered under Sivakasi Colour Match Manufacturer's Association and about 10 CMMUs present in the surrounding area of Sivakasi viz. Sattur, Kovilpatti. The CMMU use Shellac in form of an adhesive material "Shellac glue" – 20% - 25% of shellac solution, for manufacture of colour matches. One manufacturing unit use shellac coating over its product 'Bicat' (used in Defence) to prevent moisture absorption.

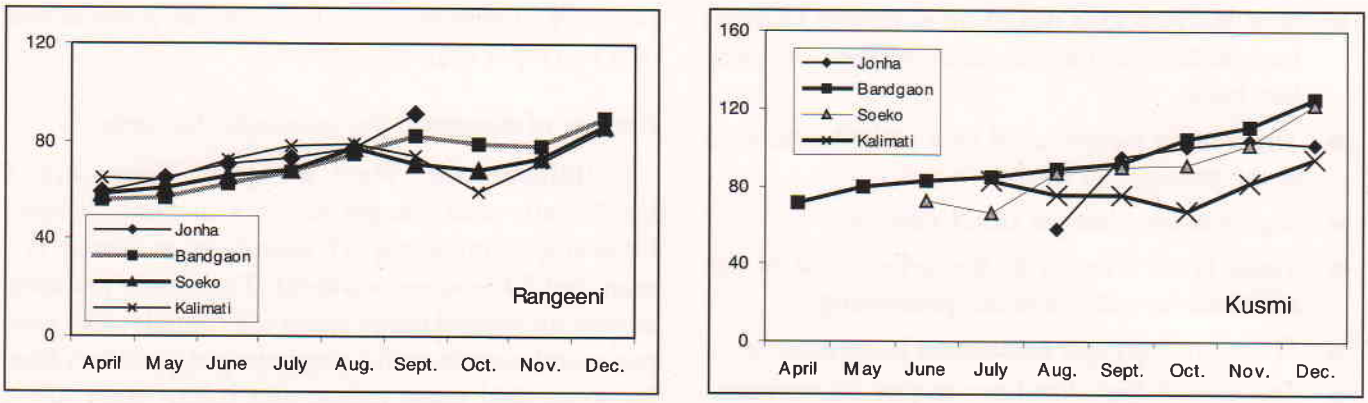


Fig. 4. Average purchase price (Rs.) of rangeeni *and* kusmi *lacs at village market*

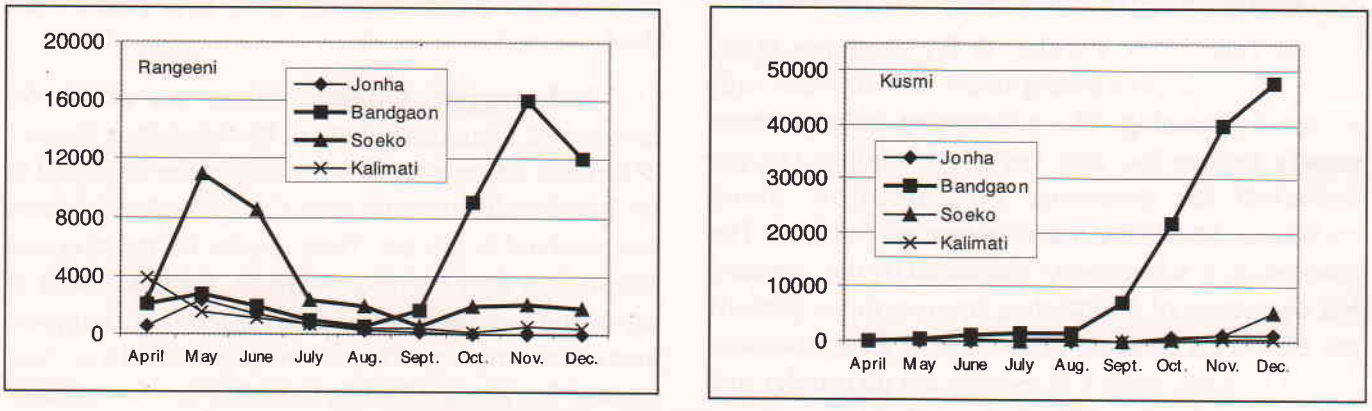


Fig. 5. Average weekly arrival of raw lac (Kg.) in village markets

The CMMU manufacture colour matches using two methods, 1 Solvent process (Shellac based) and 2. Water process (Dextrin based). About 40% of CMMUs at Sivakasi follow the solvent process. Some of the CMMUs purchase shellac flakes and prepare shellac glue using thinner in 1kg of shellac: 3 liters of thinner ratio whereas other CMMUs purchase shellac glue directly. They purchase shellac flakes from Shellac Manufacturing Units of Gondia @ Rs.140 to Rs.190 per Kg and 'shellac glue' either from a local supplier or Sah Suppliers of Chennai or TANSI (Tamil Nadu Small Industries Corporation), Chennai. The cost incurred is Rs. 52/liter of shellac glue including transportation charges. Shellac consumption in 17 Colour Match Manufacturing Units of Sivakasi, Tamil Nadu during 2003 was 20.3 T.

LAC PROCESSING AND PRODUCT DEVELOPMENT

RESEARCHES COMPLETED

Synthesis of some bio-active compounds from aleuritic acid

Aleurityl hydrazide (m.p. 135-136°C) was synthesised from methyl aleuritate (prepared by refluxing aleuritic acid with methanol containing boron trifluoride etherate for 15 minutes) by refluxing with 30% hydrazine hydrate in methanol for 1 hr. on water-bath. The compound showed antifungal activity, as tested at C.D.R.I., Lucknow .

New cyclic ureides (mps 135-137°C and 180-181°C, yield 60% and 50% respectively) were synthesised from (*E*)-2- undecen-1,11-dioic and (*E*)-2,9-undecadiene-1,11-dioic acids, obtained from azelaic acid aldehyde and 7-hydroxy heptanal (periodate oxidation products of aleuritic acid) respectively by treatment of the aforesaid dioic acids with two moles of N, N^1 – dicyclohexylcarbodimide (DCC) in tetrahydrofuran, for possible anticonvulsant and tranquilising effects. IR(KBr); 1680, 1675 (- CONH) , 968 (CH=CH)cm^{-1}

New cyclic thioureide, (*E*) - 2-undecenylthiourea), yield ~ 25% was also synthesised from (*E*)-2-undecen-1,11-dioic acid by refluxing its dimethyl ester with dry methanol containing sodium methoxide. The compound is expected to show drug like activity. IR(KBr):1180-1175 (C=S) and 970 cm^{-1}. The presence of sulphur was also detected.

Hydrazide (mp 164-165°C; yield ~ 30%) was synthesised for the first time from (*E*)-2-undecen-1,11 – dioic acid by adopting the above mentioned procedure. Thiosemicarbazide was obtained as a liquid (yield 25%) by the condensation of methanolic solution of the acid hydrazide with phenyl isothiocyanate at steam bath temperature. Both the compounds may exhibit antifungal, antibacterial, anticonvulsant and tranquilising effects. IR(neat) ; 3200-3190 (-NH), 1680, 1675 (secondary – CONH), 1180 – 1176 (- C=S) and 1965 (-CH = CH) cm^{-1}.

(*Z*)-9- Hexadecenal in quantity (500 mg), a sex pheromone component of *Helicoverpa armigera* (cotton bollworm) and rice-stemborer was synthesised from *erythro*-aleuritic acid adopting the procedure reported earlier. The compound was compared with the authentic sample brought from Aldrich Company. Presence of – CHO was detected . IR (neat); 1730 and 725 (CH= CH)cm^{-1}.

This compound along with 9,11-dodecadien-1-yl acetate (IR(neat); 2924, 2860 and 1736 cm^{-1} and 16-acetoxy - (*E*)-9- hexadecenoic acid. IR(neat); 1730, 1700 and 970 (CH=CH) cm^{-1} synthesised from *threo*-aleuritic acid were evaluated for attracting/repelling activities on the adults of major lac predators *Eublemma* amabilis and *P.pulverea* in an olfactometer. Former two compounds showed strong attractant while last one showed strong repellent properties.

10- Carboxymethyl (*E*)-2- decenoic acid (yield ~ 40%), a plant growth regulator analogue synthesised from azelaic acid aldehyde (one of the periodate oxidation products of aleuritic acid) by its condensation with malonic acid in the presence of dry pyridine. The compound resulted in root initiation in pointed gourd tested at H.A.R.P., Plandu. IR(neat): 1725, 970 (CH=CH)cm^{-1}.

Amides are well known for their therapeutic values. Keeping this in view, hitherto unreported amides(yield~55% and 60% respectively were synthesised from aleuritic acid by its treatment with methyl and butylamines respectively) in the presence of dicyclohexyl carbodiimide (DCC) at room temperature. IR(neat); 3320 and 1660 (- $CONH_2$) cm^{-1}. The presence of - $CONH_2$ group was further confirmed by heating these compounds with aq. NaOH, there was evolution of NH_3.

Aziridine was synthesised for the first time by stirring an equimolar mixture of methyl 16-hydroxy - (*E*)-9- hexadecenoate (Prepared from *threo* - aleuritic acid) and 3- amino-2-methyl-4-oxaquinazoline (prepared from anthranilic acid) in dry dichloromethane for 15-20 minutes and lead tetracetate added to it in several portions during 3 hr. The reaction mixture was further stirred for 30 minutes, filtered and washed with dry dichloromethane. The combined filtrate and

washings on evaporation of solvent to dryness gave an oily crude product which was purified by column chromatography. IR(neat); 825 (azirdine ring), 970 (CH=CH) 775 (aromatic), 1730 (ester CO), 1675 (C=O), 1210 (N-N), 1120 (C-N) cm^{-1}, yield ~ 25%.

The compound is expected to exhibit antitumor, insect chemosterilant or immunostimulant activity.

The structures of all the compounds were also confirmed by elemental and spectral analyses.

Development of lac wax-based formulations

Lac wax, a by-product of the lac industry is obtained commercially during the production of dewaxed lac or dewaxed bleached lac. Lac wax possesses characteristics comparable with those of carnauba and similar commercial waxes. The present study was taken up for development of lac wax based formulations, for their utilisation in coating of fruits and vegetables and as a polishing material for leather & automobile surfaces.

Initially, a set of experiments were carried out to prepare aqueous emulsion based on lac wax and other ingredients. Different compositions, varying the proportion of lac wax and other ingredients (solid content 15%) were taken in a pre-heated stainless steel beaker immersed in oil bath and maintained at constant temp. 90-95°C. Hot water was added to the melted compositions and the heating was continued for a period of 4 hrs. Altogether eleven formulations were prepared and tested for stability at room conditions. It was observed that the stability of these formulations was not satisfactory except the compositions No. 5 & 6. Keeping in view of stability, five fresh emulsion formulations were developed by increasing the solid content from 15 to 25%. These emulsions were found to be quite stable for more than a month. These compositions were tested on mango, *litchi*, apple, *kinnow* & citrus fruits as well as on capsicums to see their effectiveness in enhancing the shelf-life. Fully mature, unripe mangoes were coated with different emulsion formulations (T-1 - T-5). Properties like physiological loss in weight (PIW) and changes in firmness, titrable acidity, total soluble solid content and the organoleptie characteristics of the coated as well as uncoated control samples were determined periodically throughout the storage period. Wax treatment was found to be effective in preventing the weight loss and maintaining the firmness of the fruits. Coated fruits also showed less variation in acidity, total sugar and total soluble solid content. Based on sensory evaluation and weight loss, an extended shelf life of 8-10 days was found in case of mango samples coated with emulsion T - 1.

Freshly harvested *litchi* (c.v. *shahi* & China) were coated with lac wax emulsion. Coated as well as uncoated samples were kept in open (22 – 36 °C, 40 – 75% RH), inside ventilated polythene pouches as well as in domestic refrigerator. It was concluded that the shelf life of litchi may be extended upto 4-5 days (in case of shahi variety) and 8-9 days (in China variety) by coating with the developed formulation and then keeping inside ventilated polythene pouches at ambient conditions.

Apples (c.v. red delicious) were also coated with lac wax based emulsion formulations. It was observed that although the coated samples in comparison to control suffered minimum loss of weight but appearance becomes dull and taste also deteriorated after 15 days of storage.

Capsicums were coated with these emulsions by dipping method and then stored at ambient conditions. Shelf-life of the coated samples was found to be extended by 3 days as determined by sensory evaluation and the extent of weight loss.

The Central Institue of Post Harvest Engineering and Technology (CIPHET), Abohar on our request, conducted an exploratory trial on evaluation of lac wax emulsion in combination with fungicide to see the PHL of kinnow fruits collected in the year 2002 & 2003 season.

The emulsion compositions L-7W & L-5 W were provided to them in bulk quantity (approx 10 lit) to conduct the evaluation trial. Mature fruits were collected after harvesting and washed with clean water and the moisture removed from the surface. The fruits were treated with L – 7 W, L – 7W+ Bavistin – 1000 ppm. L-5 W, L-5 W + *Bavistin* – 1000 ppm, stay fresh wax and *Bavistin* – 1000 ppm by dipping method and excess wax emulsion was removed from the fruit surface. One set was maintained as control. Treated fruits were packed in CFB boxes (30 fruits in each) and stored at ambient (Temperature 22 – 42 °C, RH – 20-65%)

and cold store (Temperature 4-5°C, R.H. 85-90%) conditions. Fruit rot, weight loss, shelf life, physiochemical and organoleptic characteristics were recorded at initial 7 & 15 days interval. The quality of treated fruits were determined in terms of total soluble solids (%) by using hand refractometer, acidity (in terms of citric acid), & vitamin C present alongwith organoleptic evaluation. The data are presented in Table 22 to 28. On the basis of results obtained, the following conclusions were drawn :

- Minimum incidence of *P. italicom* was observed in sample L-5 W in combination with *Bavistin* (1000 ppm) followed by sample L-7 W.
- Minimum fruit rot was found in L-5 W + *Bavistin* (1000 ppm) at ambient conditions as well as cold store after 15 and 60 days storage respectively.
- The average shelf life of fruit was also increased by 6 & 20 days in ambient and cold store conditions respectively.
- Lac wax compositions in combination with fungicide (*Bavistin* – 1000 ppm) gave better result as compared to lac wax alone.

After applying lac wax compositions, whitish patches of wax appear on fruit surface but it may be removed by cloth or washing with water and the fruits look like untreated fruits.

Two polish compositions based on lac wax were developed for use on leather, automobile & metal surfaces. The compositions have shown satisfactory performance as regard gloss and smoothness of the surfaces.

Table 22. Effect of lac wax emulsion in combination with fungicide on incidence of *Penicillium italicum* on kinnow fruit

Sl. No.	Treatment	Incidence (%) of *P. italicum*
1.	Control	75.0 (60.67)*
2.	Stayfresh wax	17.9 (24.79)
3.	L7W	31.2 (33.28)
4.	L7W + (*Bavistin* - 1000 ppm)	16.7 (24.04)
5.	L5W	26.2 (30.58)
6.	L5W + (*Bavistin* - 1000 ppm)	16.4 (23.77)
7.	*Bavistin* (100 1000 ppm)	18.6 (25.52)
	CD (0.05)	7.35

* Arc sine transformed value is given within parentheses.

RESEARCHES IN PROGRESS

Development of technologies for processing and diversification of value added products from lac

Studies on qualitative changes in lac with storage

Study on changes in the different physico-chemical properties of winter crop (*aghani*) and summer crop (*jethwi*) seedlac and shellac during storage, were continued. A decrease in flow and rise in cold alcohol insolubles, melt-viscosity were observed for both *aghani* and *jethwi* seedlac and shellac, indicating deterioration in the resin qualities. For *aghani* crop, decrease in flow was more rapid for shellac (76%) compared to that for seedlac (43%) after 18 months of storage, this indicated better keeping properties of seedlac compared to shellac. The degradation in the quality of the *jethwi* of lac was comparatively faster than the *aghani*. Application of an antioxidant on both *jethwi* seedlac and shellac was found to check degradation of resin qualities. Flow values of *jethwi* seedlac and shellac showed a decrease of 60% and 37%; the respective values antioxidant treated samples were 38% and 29%, after 10 months of storage at ordinary condition.

From a plot of flow vs. storage period (up to 10 months), the following relationship between flow and age were obtained.

Jethwi seedlac without antioxidant :
Flow (mm) = 54.24 – 3.41 X age (month) ..... (1)

Jethwi seedlac with antioxidant :
Flow (mm) = 53.98 – 2.04 X age (month) ..... (2)

Jethwi shellac without antioxidant :
Flow (mm) = 65.51 – 2.26 X age (month) ..... (3)

Jethwi shellac with antioxidant :
Flow (mm) = 69.24 – 1.91 X age (month) ..... (4)

The above relationships indicate lower rates of deterioration of antioxidant treated seedlac and shellac, compared to untreated samples.

A steep rise in cold alcohol insolubles was observed after 10 months of storage in *aghani* shellac, indicating polymerization of resin. Seedlac, however, did not show marked change in cold alcohol insolubles with age.

The increase in melt-viscosity (at 105°C) noticed for both *aghani* and *jethwi* seedlac and shellac on storage indicated polymerization of the resin. Melt-viscosity measurement at 105°C was found to be difficult by the (cone and plate) rheometer after 18 months for *aghani* and 8 months

Table 23. Effect of lac wax emulsion in combination with fungicide on fruit weight loss of kinnow under ambient condition

Sl. No.	Treatment	Physiological loss in weight (%)					
		2002	2003				
		15 days	5 days	15 days	20 days	20 days	25 days
1.	Control	22.9	1.74	5.0	8.6	10.8	14.6
2.	Stayfresh wax	11.7	1.15	2.9	4.6	6.7	8.9
3.	L7W	18.3	1.40	3.5	5.4	7.2	10.2
4.	L7W+(*Bavistin* - 1000 ppm)	18.8	1.68	2.9	4.8	6.7	9.4
5.	L5W	13.5	1.18	2.5	3.9	5.9	7.8
6.	L5W+(*Bavistin* -1000 ppm)	12.1	1.21	2.9	4.6	6.3	8.6
7.	*Bavistin* (1000 ppm)	18.4	1.75	4.6	8.5	9.5	12.0
	CD - (0.05)	1.7	0.32	1.13	1.17	1.40	1.41

Table 24. Effect of lac wax emulsion in combination with fungicide on fruit weight loss of kinnow under cold store condition in 2002

Sl. No.	Treatment	Physiological loss in weight (%)			
		Duration of storage			
		15 days	30 days	45 days	60 days
1.	Control	3.37	6.92	10.11	16.85
2.	Stayfresh wax	2.24	6.18	7.86	11.35
3.	L7W	2.04	6.74	7.14	12.35
4.	L7W+(*Bavistin* - 1000 ppm)	2.29	6.12	6.89	11.22
5.	L5W	2.67	5.74	6.25	11.49
6.	L5W+(*Bavistin* - 1000 ppm)	2.06	5.35	6.21	8.92
7.	*Bavistin* (1000 ppm)	2.95	6.76	8.16	13.12
	CD - (0.05)			0.39	

Table 25. Effect of lac wax emulsion in combination with fungicide on physico chemical characteristics of fruit under ambient condition

Sl. No.	Treatment	Physico-chemical characteristics							
		After 15 days (2002)					After 30 days (2002)		
		Peel (%)	Juice (%)	TSS (%)	Acidity (%)	Vitamin C (mg/100ml juice)	Peel (%)	Juice (%)	TSS (%)
1	Control	28.8	42.0	13.4	0.93	18.6	27.6	43.7	13.3
2	Stayfresh wax	23.5	45.6	12.6	0.63	19.9	25.0	46.1	12.3
3	L7W	25.4	42.4	13.4	0.87	25.6	26.1	45.9	12.2
4	L7W+(*Bavistin*-1000 ppm)	26.3	42.1	12.2	0.73	21.2	25.6	46.2	12.0
5	L5W	22.9	45.9	13.2	0.70	21.2	25.7	46.4	12.0
6	L5W+(*Bavistin* - 1000 ppm)	27.6	43.1	12.4	0.72	21.2	24.7	46.6	11.9
7	*Bavstin* (1000 ppm)	26.7	44.2	12.8	0.73	24.80	26.1	45.1	12.8
	CD (0.05)	1.5	1.4	0.7	0.5	2.76	NS	NS	0.6

Initial value : (2002); Peel (%) 25.4; Juice(%) 45.9; TSS(%) 11.9; Acidity (%) 0.82; Vitamin C (mg/100 ml juice) 26.2

(2003); Peel (%) 24.6; Juice(%) 48.6; TSS(%) 10.6; Acidity (%) 0.88; Vitamin C (mg/100 ml juice) 26.2

Table 26. Effect of lac wax emulsion in combination with fungicide on physico chemical characteristics of fruit after 60 days of storage under cold store conditions

Sl. No.	Treatment	Physico-chemical characteristics				
		Peel (%)	Juice (%)	TSS (%)	Acidity (%)	Vitamin C (mg/100 ml juice
1	Control	29.3	42.3	11.6	0.67	20.51
2	Stayfresh wax	30.5	43.0	13.2	0.79	19.87
3	L7W	29.8	41.7	13.4	0.93	19.87
4	L7W+(*Bavistin* - 1000 ppm)	25.3	41.4	13.2	0.88	21.15
5	L5W	25.6	42.5	12.2	0.71	19.87
6	L5W+(*Bavistin* - 1000 ppm)	27.8	43.8	13.8	0.78	22.43
7	*Bavistin* (1000 ppm)	26.1	43.3	11.4	0.79	19.23
	CD (0.05)	1.9	NS	0.7	0.31	1.41

Initial value : Peel (%) 25.4; Juice(%) 45.97; TSS(%) 11.9; Acidity (%) 0.82; Vitamin C (mg/100 ml juice) 20.5

Table 27. Effect of lac wax emulsion in combination with fungicide on shelf life of kinnow fruit

Sl. No.	Treatment	Shelf life (days)		
		Ambient condition		Cold store condition
		2002	2003	2002
1.	Control	6	22	40
2.	Stayfresh wax	12	36	55
3.	L7W	10	30	50
4.	L7W + (*Bavistin* 1000 ppm)	10	32	55
5.	L5W	10	35	55
6.	L5W+ (*Bavistin* 1000 ppm)	12	35	60
7.	*Bavistin* (1000 ppm)	10	28	45

Table 28. Effect of lac wax emulsion in combination with fungicide on organoleptic characteristics of 30 days stored fruits under ambient condition

Sl. No.	Treatment	Organolepetic characteristics (1.9 Hedonic scale)		
		Colour	Taste	Aroma
1.	Control	6.0	6.8	6.0
2.	Stayfresh wax	6.0	7.7	5.8
3.	L7W	6.3	7.1	6.7
4.	L7W + (*Bavistin* 1000 ppm)	6.8	6.2	6.8
5.	L5W	5.5	6.5	6.7
6.	L5W+ (*Bavistin* 1000 ppm)	6.5	6.2	6.5
7.	*Bavistin* (1000 ppm)	6.1	6.0	6.0
	CD (0.05)	NS	NS	NS

for *jethwi* seedlac and shellac stored under similar condition, revealing considerable polymerization of the resin. The temperature was to be raised up to 130°C for melt-viscosity measurements. An attempt was made to find out a correlation between melt-viscosity (at 105°C) and flow :

Aghani seedlac Flow = 74.75 - 0.04 X Melt-viscosity (at 105°C) .....(5)

Aghani shellac Flow = 86.03 - 0.085 X Melt-viscosity (at 105°C) .....(6)

Jethwi seedlac Flow = 85.3 - 0.115 X Melt-viscosity (at 105°C) .....(7)

Jethwi Shellac Flow = 102.37 - 0.251 X Melt-viscosity (at 105°C) .....(8)

A rise in yield point (minimum force required for flow) was also observed during storage of *aghani* seedlac, indicating cross-linking in the resin molecules. An appreciable increase in the thixotropy revealed that the resin molecules would take more time for realignment when stress is withdrawn. This observation also suggests polymerisation in the resin molecules.

No appreciable change was observed in acid values of both *aghani* and *jethwi* seedlac and shellac samples. An appreciable decrease was observed in hydroxyl value of *aghani* seedlac. (14 units) and shellac (18 units) due to storage for about 18 months. Similar reduction in hydroxyl value was reported by previous researchers.

A rise in melting temperature (about 3°C) of both seedlac and shellac was recorded from the study of the melting profiles by DSC with storage, revealing polymerization of the resin molecules. Application of antioxidant checked the polymerization to some extent. Rangaswami and De

(1942) also reported similar rise in the melting range of seedlac and shellac. A decrease in dielectric strength was observed, revealing degradation of the insulating property.

Similar studies have been initiated for *rangeeni* seedlac and shellac.

Water thinned shellac – synthetic resin/polymer blends for cementitious surfaces

In continuation to the work reported earlier, twelve more formulations of lac based water thinnable coating compositions for cementitious surfaces were developed with different synthetic resins. They showed better performance in comparison to the previous formulations. Adhesion and finish were found to be better as the films were more smooth and no visible damage or detachment of the film was observed. Alkali resistance was also found better as two of the developed compositions SPF-03 and SPF-04 remained unattached upto 18 hrs when dipped in 0.5% KOH solution.Water resistance test was carried out as per the recommendation made by the RAC and no effect was observed, even after four months of dipping the coated cement panels in water. Resistance towards wet abrasion was also found to be better in comparison to previous formulations. The properties of the developed products were also compared with those of the two commercially available products namely Asian paints and ICI Dulux paints.

Some comparative film performance of water-thinned lac-based coating compositions are shown in the Table 29.

Development of Spiritless Gasket Shellac Compound

In response to the request made by a private firm, attempts were made to develop formulations of Spiritless Gasket Shellac Compound. Two samples were supplied to the firm, for evaluation. The performance of the samples as reported to be satisfactory by the firm, but however, they desired for further improvement in consistency of one composition and drying time of another composition. Keeping in view of their suggestions, two more samples were formulated, tested as per IS specification and compared the performance especially, consistency and drying time, with that of four commercially available products namely *Kangarool, Victor, M-seal* and *Waxpol* brands. Performance of the samples were found to be satisfactory. The samples were sent to the firm for further evaluation.

Development of lac-based coating formulations for extending shelf life of fruits and perishable food stuffs

The project commenced from 1st April. After extensive literature survey, work on development of lac-based formulations was started. Application studies were carried out on farm-fresh, locally available fruits and vegetables *viz. litchi,* capsicum (bell peppers), pointed gourd (*parval*), tomatoes and garden peas (whole and shelled) at ambient conditions. Samples of formulations were also dispatched to CISH, Lucknow, for preliminary evaluation on mangoes. Lac, in alcoholic solution, or dissolved in basic media, formed satisfactory coatings on the produce, in all cases. Gloss improved by 200%, adhesion was adequate, but the coatings led to rapid ripening and subsequent rotting. Although the coatings increased the mechanical strength of the fruits / vegetables, flexibility was lost. Hence, the formulations were further improved upon, to include plasticisers, anti-oxidants and additives, to improve upon the 'breathability' of the coatings. Machine made shellac resulted in chocolate coloured coatings and also poor performance due to presence of excess wax. Hence, the use of dewaxed, decolourised lac was adopted. pH of the formulations were maintained at 6.7 - 7.0.

Periodic observations on various quality parameters included: physiological loss in weight (PLW), cumulative % rotting, TSS (^{0} brix), vitamin C content, sugars, titrable acidity and chlorophyll content. The application studies revealed that *litchis* were indifferent to such coating treatments, and further work was required. Although in peak summer, the coated litchi fruits underwent less dehydration, as compared to control, the colour loss of the pericarp could not be prevented.

In contrast, capsicum, pointed gourd and whole garden peas responded very favourably to the coating treatments. Several varieties of *parval* (HAP-5, HAP-6, HAPEL-1, Swarna Aloukik, Swarnrekha, and HAP – 40) were obtained from HARP, Ranchi, and although the varieties differed in response, on

Table 29. Film performance of lac based water thinned coating compositions

Sl. No.	Characte-ristics	Specifi-cation	SPF-02	SPF-03	SPF-04	SPF-05	SPF-06	SPF-07	SPF-08	SPF-09	SPF-10	SVF-5407	SVF-5007	SVF-5507E
1	Consist-ency	Smooth and uniform and suitable for application by appropri-ate method.	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform	Smooth and uniform
2	Drying time													
	a) surface dry	15 min.	Pass	10 min	10 min	Pass	Pass	Pass	Pass	Pass	9 min	12 min	10 min	10 min
	b) Hard dry	4 hrs	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3	Finish	Smooth and matt or egg shell finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish	Smooth and matt finish
4	Flexibility and adhesion	Shall not show any visible damage or detachment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film	no visible damage or detach ment of film
5	Resistance to water spotting		Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
6	Resistance to water (continuous immersion)			> 4 months	> 4 months						> 4 months	> 4 months		

the whole, the shelf-life of *parval* could be increased upto 10 days (Fig. 6). Similarly, the shelf life of capsicum could be enhanced by 14 days (Fig. 7). Coated garden peas could be stored upto 7 days. No significant changes were observed in the values of TSS, pH, acidity and sugars on storage behaviour of capsicum, pointed gourd and peas, at room temperature (Table 30). But the treatments failed on shelled peas, where fungal growth, as well as fermentation were observed. Even the incorporation of anti-fungal agents, in the formulations, did not improve upon the response of the shelled peas, towards the coating formulations.

Various varieties of tomatoes (CHOT-1, HATH-2, HATH-3, Swarn Naveen and HAP 40) were obtained, garden fresh, from HARP, Ranchi and treated with different formulations. In all cases, the storage performance of control was better than treated fruits. Hence, it was concluded that the coating technique could not be applied on tomatoes, for improving their post harvest shelf life.

Preliminary studies were also carried out, on the formulation of solventless coatings, in powder form etc., including their spectroscopic behavior, using conventional transmittance, specular reflectance and diffuse reflectance studies.

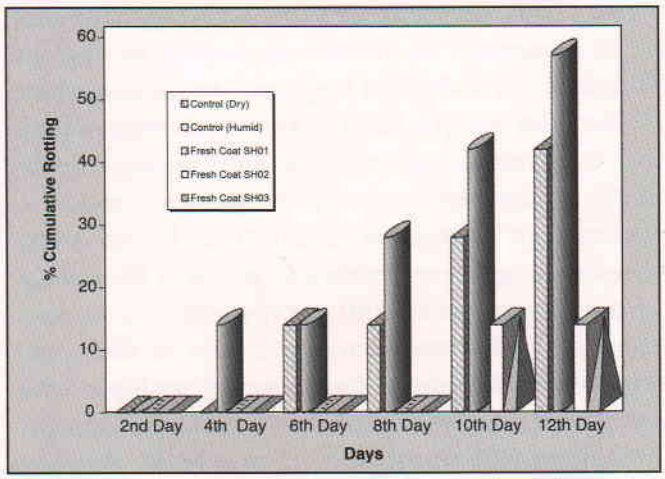


Fig. 6. Cumulative percentage of rotting in uncoated and coated pointed gourd

Table 30. Percentage acidity of uncoated and coated whole garden peas

Sl. No.		Initial	After 10 Days
1.	Control	0.33	0.58
2.	Fresh Coat SH 01	-do-	0.38
3.	Fresh Coat SH 02	-do-	0.38
4.	Fresh Coat SH 03	-do-	0.44
5.	Fresh Coat SH 04	-do-	0.40

Mechanisation of *bhatta* process for production of button lac/shellac.

In the earlier testing of machine, problem was encountered with squeezing of seedlac bag so this year a separate squeezing mechanism has been developed which has four spring loaded jaws for holding and giving manual rotation to seedlac bag along with linear motion of bag. The *kiri* chamber of the machine was insulated on all surfaces using glass wool for keeping it warm (above softening temperature of lac) which was necessary for motion of feeding roller in *kiri* chamber.

During testing of machine using 5 cm diameter small seedlac bag, squeezing was found possible and machine was able to produce four buttons in a row but cooling of button lac on G.I. sheet was not proper, so length of conveyer belt was extended upto 150 cm for proper cooling of button lac. The machine was tested using continuous seed lac bags of 5 cm dia. The problem of multiple knot of seedlac bag in main chamber was noticed which was not required because squeezing was allowed only near hooper end of machine. During operation, rate of filteration was slow as compared with traditional *bhatta* process even at the temperature of oven above 120°C. This indicates that scraping of filtered lac is necessary for further squeezing of bag, as filtered lac on surface of bag tends to decrease rate of filteration which results in slow squeezing of bag, and in formation of multiple knot during entire length of bag inside oven. Attempts were made to remove the formation of multiple knots using scraping ring for continuous scraping of filtered lac during the process and temperature was also adjusted. There was increase in rate of filteration alongwith reduction in formation of multiple knot which indicates requirement of continuous scraper for successful operation of machine. Further modification and testing is required for successful operation of machine.

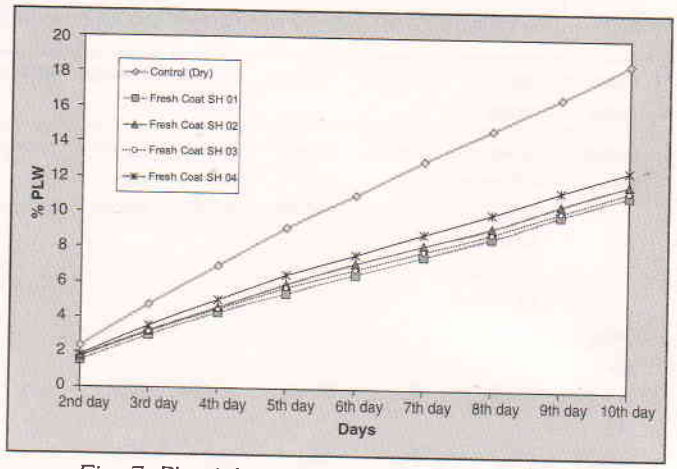


Fig. 7. Physiological loss in weight in uncoated and coated capsicum

Use of sticklac in development of composite board from *arhar* stick for panel/furniture

Sticklac (scraped lac) is the cheapest form of lac which farmers bring to the market. Generally, alcoholic medium is used as a solvent for lac. The recovery of solvent poses problem and increases the cost. In view of the above, experiments were carried out to prepare composite board using sticklac in aqueous medium. Composite boards of size 12 cm x 12 cm x 1.2 cm from pulverized *arhar* stick were made using sticklac in different alkaline aqueous solutions such as containing sodium carbonate, sodium hydroxide, sodium silicate, ammonia and a mixture of borax and sodium carbonate respectively. These composite boards, in general were found to have a lower tensile strength perpendicular to surface (~0.6 N/mm^2) and higher water absorption on 24 hrs immersion (~ 84%) compared to the values around 0.8 N/mm^2 and 50% respectively of the composite board made using sticklac in alcoholic (methanol) medium . Further, the water content of the mat to be hot pressed was observed to be a major factor which controls bonding and hence the strength properties of composite board. Composite boards were made at varying water contents such as 10%, 20%, 30%, 40% and 50% respectively of the mat to be hot pressed and their modulus of rupture were studied. For this purpose a test assembly for span length up to 10 cm was fabricated and used with KMI tensile tester. The results are given in Table 31. It is seen from the table that the optimum value of modulus of rupture is around 30% of water content.

The press- cycle for making composite board was studied. The maximum contact pressure applied was 22 kg / cm^2 . It was found that a press-cycle of 35 minutes gave composite board of optimum modulus of rupture (Table 32) free from patch mark on both the surfaces. Composite boards were also prepared using different particle type from pulverized *arhar* stick. As shown in Table 33, the composite board made from particles passing through 30 mesh size sieve mixed in the ratio ~ 2:1 with the coarser particles (splinters) containing fibres had adequate physical properties . The coarser particles consisted of both smaller particles (average length ~ 0.5 cm and width ~ 0.1 cm) and bigger particles (average length ~ 1.2 cm and width ~ 0.3 cm). Further work is in progress.

Technology Mission on Cotton (TMC)

Integrated pest management (IPM) at village level for cost effective, Quality production.

As per technical programme, the synthesis of the following sex pheromones was continued during the reported period

(i) *Z*-9 Hexadecenal

(ii) *Z*-11 Hexadecenal

(ii) *Z*-11 Octadecenal

(iii) *E, E*, - 10-12 Hexadecadienal

The authentic samples of compounds (I) to (iii) in qualities 2.5 g, 11g, & 3 g respectively were provided to the PI, MM 3.1, NCIPM, New Delhi.

Samples prepared at ILRI were also compared with the samples provided by BARC, Trombay, by Co-FTIR. Samples prepared at ILRI were found to be spectroscopically purer. The synthesis of the pheromones synthesised at ILRI are expected to be formulated in traps for evaluation in the proportions subject to variation.

Product Demonstration Unit

Demonstration of Processing/Product Preparation

Technical preparation of dewaxed bleached to M/s Gupta Brothers (Shellac), Bundu, Ranchi at the firms site and to M/s Vijaya Shellac, Gondia (Maharashtra) at the Institute.

Table 31. Effect of water content of mat on modulus of rupture of composite board

Sl. No.	Water content of mat (%)	Modulus of rupture (N/mm^2)	moisture content of board * (%)
1.	0	7.8	9.7
2.	10	10.0	9.6
3.	20	11.7	9.3
4.	30	11.8	9.4
5.	40	11.3	9.2
6.	50	6.5	9.3

* Atmospheric R.H ~ 90%

Table 32. Effect of press-cycle on modulus of rupture of composite board

Sl. No.	Press-cycle (Minutes)	Modulus of rupture (N/mm^2)
1.	25	6.6
2.	30	11.2
3.	35	13.8
4.	40	11.8
5.	50	10.2

Table 33. Physical properties of composite board of different particle type

Sl. No.	Particle type	Mean density of board (g/cc)	Tensile strenth perpendicular to surface (N/mm^2)	Modulus of rupture (N/mm^2)	Water absorption 24 hrs. (%)
1	Particles passing through 30 mesh size sieve (A)	0.70	0.45	12.5	70.8
2.	Coarser particles (splinters) and fibrous material (B)	0.70	0.23	9.6	125.9
3.	A and B in ratio ~ 2:1	0.73	0.53	13.9	73.6

Product Preparation

Lac dye (Tech. Grade) (Dye content 82%)	105 g
Lac dye pure (Dye content up to 97%)	50 g

As per existing report, the solubility of water soluble lac prepared by ammonia method, lasts 4-5 months. So, to increase the life of water soluble lac, experiments were carried out to prepare water soluble lac in presence of borax. It has been concluded that addition of 15% borax on the weight shellac in presence of boiling water, results in water soluble lac which has got solubility in water up to 15 months. The comparative studies of film properties of both the water soluble lacs (borax bond & ammonia based), as regard water resistance, impact resistance, flexibility & scratch hardness, revealed it satisfactory for utilization for interior decorations.

During the period under report 27 litres of melfolac (heat and water resistance varnish) and 2 kg dewaxed bleached lac were prepared for exhibition cum-sale counter.

A simple process has been developed for purification of technical grade of lac dye (commercial) to pure grade or edible grade. The yield has been found to be 60-65% on the wt of dye content in the sample.

Testing Lab

During the period 205 samples of shellac/ seedlac/bleachedlac/lac dye/ aleuritic acid/by product of lac were received from Govt. organisations/ private industries / various divisions of ILRI and in all 518 test were carried out and a sum of Rs. 48, 150 has been earned.

Current Status, technology assessment, product promotion and problems of the industry

Surveys were conducted at Gondia (Maharashtra), Katghora, Dhamtari, Sakti (Chattisgarh), Bundu, Murhu, Khunti (Jharkhand) & Balrampur, Jhalda and Tulin (W.B), where lac processors/manufacturers were contaced to collect data on the arrival of stick lac and problems associated with processing/manufacturing.

At Gondia there were six manufacturers out of which four were surveyed and data are presented below:

Name of the Industry	Name of Item	Total production capacity per year (tons)	Actual production per year (tons)
1 Surya Shellac Industry	Seedlac	72	72
	Shellac	48	48
2. Hari Shellac Industry	Seedlac	150	150
	Shellac	300	300
3. Vijaya Shellac & Chem	Shellac	210	140
	Seedlac	75	60
4. Siva Shellac & Chem.	Seedlac	10,000	100
	Shellac	120	20
	Varnish	10,000 BL	2000 BL

At Katghora there were five lac manufacturers, which were surveyed and data presented below :

Name of the Industry	Name of Item	Total production capacity per year (tons)	Actual production per year (tons)
1. Satyanarayan Agarwal Lac Factory	1. Shellac	500	400
2. Paleram Agarwal Lac Factory	1. Seedlac	450	400
3. Mohan Lal Agarwal Lac Factory	1. Seedlac	450	400
4. Ramesh Kr. Agarwal Lac Factory	1. Seedlac	450	400
5. Singhania Lakh Industry	1. Seedlac	450	400
	Total	2300	2000

At Dhamtari there are thirteen lac manufacturers out of which six were surveyed and data presented below:

Name of the Industry	Name of Item	Total production capacity per year (tons)	Actual production per year (tons)
1. Aishwarya Bleached Shellac Corporation	1. Bleached lac	35	35
	2. Seedlac	120	120
2. Arbind Shellac Product	1. Bleached lac	35	27
	2. Seedlac	50	45
3. Bastar Lac Udyog	1. Seedlac	400	100
4. Rokadia Shellac Industry	1. Seedlac	260	250
5. Indian Shellac Industry	1. Seedlac	300	100
6. Ganpati Traders	1. Seedlac	30	15
	2. Bleached lac	6	6
	3. Button lac	4	4
	Total	1210	702

At Sakti there are three manufacturers and all have been surveyed and data are given below:

Name of the Industry	Name of Item	Total production capacity per year (tons)	Actual production per year (tons)
1. D. Manoharlal (Shellac) Pvt. Ltd.	1. Shellac	200	120
	2. Dewaxed decolourised shellac	100	80
2. Vishnu Shellac	1. Shellac	250	200
	2. Bleached lac	100	50
3. Jai Durga Traders	1. Seedlac	250	150
	Total	**900**	**600**

At Bundu there are 20 lac manufacturers, we have surveyed 10 of them. The total production at present is 500 tons finished product. Lac production of finished product was 1200 tons a year ago. The manufacturers did not disclose their actual figures.

At Khunti we have surveyed three manufacturers out of six and the data collected are given below :

Name of the Industry	Name of Item	Total production capacity per year (tons)	Actual production per year (tons)
1. Tajna River Industries Pvt.Ltd.,	1. Bleached lac	720	144
2. Parvati Lakh Udyog	1. Shellac	1000	800
	2. Seedlac	200	100
3. Tajna Shellac Pvt.Ltd.,	1. Shellac	1000	650
	2. Seedlac	200	150
Total		**3120**	**1844**

At Balrampur about 7000 tons of sticklac is processed according to the manufacturers. According to the statistics provided by the manufacturers the total finished product comes to about 13,000 tons and accordingly sticklac 32,500 tons. According to the manufacturers 72% lac is exported and 28% remains for internal consumption *i.e.* 9360 tons is exported and 3,640 tons is used for internal consumption.

The estimated sticklac processed at different centres, finished products, exports and internal consumption are as follows:

Place	Sticklac produce MT	Finish product	Export	Internal consumption
Gondia	2,225	890	100	790
Dhamtari	1,755	702	300	402
Katghora	5,000	2,000	1,800	200
Sakti	1,500	600	100	500
Khunti	4,610	1,844	1,844	NIL
Bundu	1,250	500	100	400
Balrampur	17,500	7,000	5,000	200
Total	33,840	13,536	9,144 (73%)	2,492 (27%)

According to our survey the domestic production is at least 35000 tons. The export is 70% and internal consumption is 27%.

At Jhalda &Tulin, there are 30 manufacturers. They are producing about 650 tons of button lac/ shellac per annum, that means they are purchasing about 1400 tons stick lac per annum.

During our survey, we have also gathered the following problems of the industries which require our attention.

1. The use of shellac in pharmaceutical industries is facing threat from a recently developed substitute.
2. BHEL is also going to replace shellac by alkyd resin of foreign company. In this regard lac industry has also requested to convince BHEL to use shellac instead of alkyd resin.
3. Manufacturers have bought suitable treatment of lac effluents in view of pollution control restrictions.
4. Manufacturers of Dhamtari want improvement of mechanised washing of seedlac, as the present method is very old. They are also interested in technology for dust separation from crushed sticklac.

REVOLVING FUND SCHEME

Balance Sheet

(April 2003 - March 2004)

Production of quality broodlac on *kusum* and *palas*

Opening Balance : 7,29,942
ICAR Due amount : 1,02,000

EXPENDITURE		INCOME	
Items	**Amount**	**Items**	**Amount**
Labour	48,977	Sale of broodlac (*kusmi*)	1,57,540
Watch & ward	22,200	Sale of broodlac (*rangeeni*)	-
Other Items	8,702	Sale of sticklac	37,775
T. A.	1,360		
Total	81,239		
		Total :	1,93,315
Gross profit			**Rs. 1,12,076**
Less Workers share and establishment charges 2003-04			(-) 11,200
Net Profit			**1,00,876**

Description of Reserve Growth during 2003-04

Items	Withdrawals		
Refunded to ICAR (Second Installment)	34,000.00	Opening Balance for 2002-03	**Rs. 7,29,942**
		Deposited Net Profit for 2003-04	**1,00,860**
		Other income	1,19,780
Total	34,000.00		**9,50,598**
Closing Balance for 2003-2004			**9,16,598**

TRANSFER OF TECHNOLOGY

Lac as a source of livelihood: Technology intervention for sustained production in Khunti Sub-Division

The project was initiated with the following objectives: i) To provide improved implements for lac cultivation to farmers, ii) To provide training to progressive lac growers in scientific methods of lac cultivation so that they can act as Master trainers, iii) To organize On-farm training for the beneficiaries and iv) Technology intervention in lac cultivation at the following stages: Pruning of lac host tree, Use of optimum amount of broodlac, Broodlac inoculation using synthetic netting, Pesticide spray to manage pests and diseases, Harvesting of crop at proper stage.

750 (500 in phase - I and 250 in phase II) beneficiary families from 70 SHGs in 65 Hamlets of 2 Blocks (Khunti and Torpa) have been adopted under the Project.

During Phase - I of the project each group of five farmers was provided with a Farming Kit containing: One rocking sprayer, five secateurs, five scraping knives, five pruning knives, two tree pruners, 7500 nylon netting sleeves and 10 % subsidy on the broodlac purchased. 25 farmers were given one week training to act as master trainers. On-Farm training was organised in 14 villages and Field visits were undertaken at critical stages of lac cultivation.

While during Phase - II of the project Farm implements (as in Phase - I) are to be provided to the beneficiaries. 15 farmers have been given one week training to act as master trainers. On-Farm training has been organised in target villages (Table 34). More than 11000 trees have been pruned, 179.5 quintals of broodlac procured and inoculated and more than 1.8 lakh net bags used.

During this period the Honorable Minister for Co-operation Sri Devi Dayal Kushwaha visited the field and distributed the assets available on grant by the Government of Jharkhand. At present the package of practices is being followed. The lac crop was satisfactory. The harvest is expected in Apr-May 04.

In Phase - II a new concept of risk cover has been introduced for the lac growers. An MoU has been signed between PRADAN and Indian Grameen Services Company to provide input credit and production insurance services to the farmers. The risk cover will be operational only when the farmer has followed the "Package of Practices" developed by ILRI.

Risk cover:

1. The extent of labour cost incurred by lac grower will be coverd in proportion to the crop loss.
2. After estimation of labour costs provided by the farmer, they are guaranteed raw lac production of at least 60% of the broodlac provided to the farmer.
3. In case the actual production is less than the "Guaranteed production", the gap between the "actual" and "Guaranteed" will be provided to the farmer *e.g.* a farmer taking 15 Kg broodlac gets an actual production of only 5 Kgs, he will be provided additional 4 Kgs and the farmer does not have to pay any amount in either cash or kind.
4. The risk cover will be operational only when the farmer has followed the "Package of practices" developed by ILRI.

Production sharing beyond "Guaranteed Production":

In lieu of the inputs provided the farmer will share his/her produce in the following manner:

Table 34. On-farm training camps in Khunti Sub-division, under state-sponsored project

Date	Village, Block
22.9.03	Gopla and Ronhe Munga Toli, Torpa
23.9.03	Sandasom, Torpa and Remta, Khunti
24.9.03	Unkada, Khunti and Gitilpiri, Torpa
25.9.03	Gutwa, Torpa and Barbanda, Khunti
26. 9.03	Kamra Simar Toil, Torpa
27.9.03	Kaneyar, Torpa and Torankel, Khunti
7.10.03	Karra Toil, Khunti
8.10.03	Bagichatoli, Khunti
9.10.03	Upka and Kerabora, Torpa
10.10.03	Ghagari, Torpa

1. 1st Slab: *When production is above the "Guaranteed production" and below twice of the broodlac provided* : Farmer will share equally the additional raw lac production over and above the "Guaranteed production" upto twice the broodlac provided.
2. 2nd Slab: *When the production is above twice the broodlac supplied* : The farmer will get 70% of additional raw lac production over and above twice the broodlac provided.

LINKAGES

On the initiative of Livelihood Solutions, a Delhi-based NGO, a team comprising of Dr Andy Hall, South Asia Regional Co-ordinator, CPHP, Innovation Policy, ICRISAT, Patancheru; Shri Guru Naik, Director, Livelihood Solutions, New Delhi; Dr Shambu Prasad, Visiting Scientist (Innovation Policy), ICRISAT; Shri Rajeshwar S. Raina, NISTADS, New Delhi and Shri Rasheed Sulaiman, Scientist, NCAP, New Delhi visited the Institute on October 6 , 2003. An interactive meeting was held to discuss about scope and modalities of using lac culture and related activities for enhancing the livelihood of farmers of Jabalpur, Shahdol and Seoni regions of Madhya Pradesh. Dr KK Kumar, Acting Director, Dr P. Kumar, Head, Lac Production Division, Dr N Prasad, Head, Lac Processing and Product Development Division, Shri R. Ramani, Head, Transfer of Technology Division, Dr KK Sharma, Senior Scientist participated in the meeting. The scope of lac cultivation and lac-based cottage industries was analysed during the course of discussion. The team was assured of all possible co-operation from the Institute in their efforts.

TRAINING PROGRAMMES

Farmer and Housewife Training Programme

The institute conducted one-week and One-day training programmes with special emphasis on lac culture. One week programmes mainly covered lac cultivation, processing at farm level and utilization of lac at village level. A total of 476 farmers from different states participated in this programme. A summary of different programmes is given in Table 35.

Human Resource Development

Forest Range Officers, SDOs from State Forest Department (Chhattisgarh and Maharashtra), Students of Allahabad Agriculture Institute (Deemed University), College of Agriculture BHU *Varanasi* and Govt polytechnic, Latehar have undergone One-Week training in lac cultivation, processing and its uses (Table 35).

One-day Education Programme on Lac

One-day programme on lac cultivation was organized for 3 batches of post-graduate /Graduate students (68) from various colleges and universities (Table 36).

Field Education Programme

This programme was organized in three blocks of Ranchi district (Jharkhand), 3 blocks of *Mahasamund* district in Chhattisgarh, *Amravati* district of Maharashtra, *Devas* district of M. P. and Adilabad district of A P. A total of 1424 persons were benefited under this programme (Table 37).

On- Farm Training

This programme was organized in collaboration with other organizations in Jharkhand, WB, Chhattisgarh, M.P., and A.P. covering 13 villages as detailed in Table 38.

One-day Orientation Programme

This programme aimed to educate the existing lac farmers and suggest remedial measures of their problems. A total of 501 farmers in 15 batches received training under this programme. A summary of this programme is given in Table 36.

Process/ Product Demonstration

Process know how for the preparation of dewaxed bleached lac was transferred to M/s Gupta Bros. (Shellac), Bundu, Ranchi at the firm's site and to M/s Vijaya Shellac, Gondia, (Maharashtra) at the Institute.

Introduction and lac crop monitoring in Allahabad dist.

Under the collaborative work with Bioved Research Society, lac production has been initiated in *Koraon* area of Allahabad district wherein *katki* crop was raised from ILRI broodlac. The harvested crop was re-inoculated on many *palas* trees. Expert from this institute has monitored the crop twice and guided the farmers further in the village itself. This is the new area where there was no production of lac and people were not knowing lac cultivation but large number of host trees existed.

Survey

A survey has been carried out to explore the possibility of introduction of lac cultivation in Mehboobnagar district (AP). The report has been submitted to concerned agency.

Table 35. One-week Training Programme on lac culture and other aspect

Sl. No	Sponsoring Organization	Nominating Organization	Period	No. of participants
Farmers Training				
1	Empowering Tribal Project, Sinjusoren, Ranchi	Self	13th Jan-18th Jan	23
2	PRADAN, Ranchi	Self	27th Jan to 01st Feb	14
3	PRADAN, Ranchi SAGEN, Orissa	Self	3rd Feb to 08th Feb	13 9
4	Jharkhand Women's Development Society, Ranchi	Self	3rd March to 8th March	24
5	Jharkhand Women's Development Society, Ranchi	Self	10th March to 15th March	9
6	• Abhiyan Samitee, Dhanbad • SIRDI, Betul • Bhartiya Kisan Mazdoor Sangathan, Gondia	Self	24th March to 29th March	2 11 10
7	Farmers, Lacharagarh, Simdega	Self	1st April to 5th April	19
8	Jharkhand Women's Development Society, Ranchi	Self	21st April to 26th April	16
9	Nav Bharat Jagriti Kendra, Murhu	Self	12th May to 17th May	24
10	Alternative for India Development, Lesliganj, Medninagar (Palamau)	Self	19th May to 24th June	9
11	ATMA, Jamtara	Sidhu Kanhu Alpsankhyak Vikas Samiti and Self	26th May to 31st May	29
12	PRADAN, Khunti	Self	9th June to 14th June	14
13	SIP (Social Integration Programme), DVC Panchat, Purullia	Self	28th July -2nd Aug	8
14	Empowering Tribal Project	Self ILRI	25TH Aug to 30th Aug	20 10
15	DPIP, Velugu, Mehboobnagar	SERP	1st Sept to 6th Sept	28
16	DPIP, Velugu, Mehboobnagar	SERP	8th Sept to 13th Sept	26
17	DPIP, Velugu, Mehboobnagar	SERP	22nd Sept to 27th Sept	25
18	DPIP, Velugu, Mehboobnagar DFO Kathgorha	SERP Self	13th Oct. 18th Oct	24 6
19	ATMA, Chaibasa, (W Sighbhum)	Kolhan Mahila Sangathan, Goelkera	20th Oct to 24th Oct	21
20	DPIP, Velugu, Mehboobnagar	SERP	27th Oct to 1st Nov	26
21	DFO (Territorial), Kanker, Chhattisgarh Holy Cross, Hazaribag	Self	11th Nov to 15th Nov	19 1
22	ATMA Chaibasa, (W Sighbhum)	Kolhan Mahila Sangathan, Goelkera	17th Nov to 22nd Nov	21
23	State Forest Department, Dist -Korba (Chhattisgarh)	Self	8th Dec to 13th Dec	15
			Total	**476**
Human Resource Development				
25	Allahabad Ag. Inst. (B.Sc. Ag. Student)	Self	3rd March to 8th March	9
26	Allahabad Ag. Inst. (B.Sc. Ag. Student)	Self	10th March to 15th March	1
27	College of Ag, BHU, Varanasi (B.Sc. Ag. Student)	Self	2nd June to 7th June	18
28	Govt. Polytechnic, Latehar	Self	2nd June to 7th June	1
24	D.F.O., Katghora	Self	13th Oct. to 18th Oct.	5
29	Maharashtra State Forest Dept.,Yawatmal	Self	29th Oct. to 1st Nov.	4
30	D.F.O. (Territorial), Kanker,Chhattisgarh	Self	11st Nov. to 15th Nov.	6
			Total	**44**
			Grand Total	**520**
Tailor made Course				
1	Adim Jati Seva Madal	Self	24th Feb to 26th Feb	15

Table 36. One-day Training Programme on lac culture and other aspect

Farmers	R.K.Mission , Ranchi	5	244
	Nav Bharat Jagriti Kendra, Khunti	1	28
	ICAR Research Complex, Patna	1	30
	PRADAN, Khunti & Torpa	1+1	46
	SRI, Ranchi	1	40
	St. Veeynaj School, Lachragarh, Simdega	2	69
	Centre for Entrepreneurship Development, Ranchi	1	20
	NABARD, Ranchi	1	29
	SUPPORT, Hazaribag	1	5
	Total	**15**	**501**
Students	Nirmala College, Ranchi	1	25
	Chhattisgarh Tribal Development Society	1	25
	Ranchi University	1	18
	Total	**3**	**68**
(b) Exposure Programme			
Entrepreneurs	Centre for Entrepreneurship Development, Ranchi	1	30
	Grand Total	**19**	**599**

Table 37. Field Education programme on lac Cultivation

State	District /Block	Venue/Village	Collaborating Agency	No. of participants
Jharkhand	Ranchi / Kanke	Borya	Khalkho Consultant + Forest Dept.	30 35
	Ranchi/Khunti	Rajasthan Bhawan, Khunti	N.B.J.K., Khunti	30
	Ranchi/Silli	Rameshanand Higher Secondary School, Hakedag, Silli	Parvatiya Durgam Shiksha Vikas, Gangaghat, Angara	40
Chhattisgarh	Mahasamund	Amarkoni	Mili Watershed Project,Zila Parishad, Mahasamund	20
	-do-	Sirpur	-do-	87
	-do-	Jalki	-do-	36
	Mahasamund/ Pithora	Pithora	-do-	21
	-do-	Bagarpali	-do-	100
	Mahasamund/ Baghbehara	Amakoni	-do-	45
	-do-	Kashekera	-do-	40
Maharashtra	Amravati	Bahiram	Satpura Integrated Rural Development (SIRDI)	50
Madhya Pradesh	Devas	Devas	Zila Panchayat,Devas	172
		Bagli	-do-	438
		Kannod	-do-	250
Andhra Pradesh	Adilabad	Adilabad	ITDA Training Centre	30
			Total	**1424**

Table 38. On-farm training Programme

State	District /Block	Venue/Village	Collaborating Agency	No. of Participants
Jharkhand	Ranchi	Angarha/ Sarjamdih	RK Mission	85
		Angarha- Hundrajara	R K Mission	110
		Murhu- Gutiguda	R K Mission	100
		Angarha- Gundletola	R K Mission	100
	Saraikela- Kharsawan	Gangpur	Krishi Gramin Vikas Kendra, Jamshedpur	20
W B	Purullia	Putidih	Farmers	10
Madhya Pradesh	Hoshangabad	Bankhedi	MP Forest dept	137
Chhattisgarh	Mahasamund	Amakoni	Collector, Mahasamund	50
		Chindola, Khamaria, Khallari		25
		Khallari	Mili water shed Project Zila Parishad	70
Andhra Pradesh	Adilabad	Tejapur, Kothaguda	Dist Poverty Initiative, Project (DPIP)	30
			Total	**737**

PUBLICITY THROUGH EXHIBITIONS, ETC.

Participation in exhibitions and *kisan melas*

The institute participated in a number of exhibitions/kisan melas organized by other organizations. It also organized a number of small exhibitions on its own, to support certain extension activities/programmes. A large number of visitiors were benefited from the exhibits of the stall. Literature on lac technologies was also distributed among the interested persons.

Date/Period	Event and Venue	Organized by
11-13.2.2003	Central Kisan Mela, Getalsud Farm Ranchi	R.K. Mission,
13.02.2003	Adra Utsava, Kisan Mela, High School Ground, Silli, Jharkhand	INDAL, Muri
19-22.2.2003	SERSA stadium, Adra, W.B.	Adra Utsav Authority, Purulia
5-9.04.2003	Mahila Udyog Mela (MUM), Zila School, Ranchi	Prabhat Khabar, Ranchi
22-31.08.2003	Agrotech India and Graminshilpa Mela 03, Jay Prakash Narayan Zila Parishad Maidan, Dhanbad	Janmotsov Committee, Kotagang Nadia, W.B.
23.8.2003	Field exhibition, Guttigada, Murhu	R.K. Mission Ranchi
14-27.11.2003	India International Trade Fair, Pragati Maidan, New Delhi	IITFAI, New Delhi
17.11-12.2003	Hari Har Kshetra Mela, Sonepur, Bihar	Govt. of Bihar

Exhibitions put up for lac growers at field training camps:

Date	Village, Block	Supported by
22.9.03	Gopla, Torpa	PRADAN, Khunti
22.9.03	Ronhe Munga Toli, Torpa	-do-
23.9.03	Sandasom, Torpa	-do-
23.9.03	Remta, Khunti	-do-
24.9.03	Unkada, Khunti	-do-
24.9.03	Gitilpiri, Torpa	-do-
25.9.03	Gutwa, Torpa	-do-
25.9.03	Barbanda, Khunti	-do-
26. 9.03	Kamra Simar Toil, Torpa	-do-
27.9.03	Kaneyar, Torpa	-do-
27.9.03	Torankel, Khunti	-do-
7.10.03	Karra Toil, Khunti	-do-
8.10.03	Bagichatoli, Khunti	-do-
9.10.03	Upka, Torpa	-do-
9.10.03	Kerabora, Torpa	-do-
10.10.03	Ghagari, Torpa	-do-

Publicity through mass media

Promotional stories on lac comprising of benefits of lac cultivation and utilization and the activities of the Institute were covered by DDK, Ranchi and E-TV and Sahara TV which were subsequently telecast by these channels.

Telecasts on the following topics were also made through mass media in which Dr KK Sharma, Sr. Scientist participated as a subject matter specialist:

- Lac production on *ber* , Doordarshan Kendra, Ranchi on Jan. 27, 2003
- Pruning of lac host trees, Doordarshan Kendra, Ranchi on Apri. 29, 2003
- *Kaise Karen kusum vriksh par lakh ke kheti?*, Doordarshan Kendra, Ranchi on May 14, 2003
- *Lakh utpadan ke poshak vriksh avum unki dekh rekh*, AIR, Ranchi on 23.08.03

The information on ILRI and lac technologies are also available at website www:icar.org.in/ilri/default.htm

Publications brought out

- Commercially viable products from the waste of aleuritic acid, a folder, 4pp
- Plant Growth Regulator Analogues from Aleuritic Acid, a folder, 4pp
- *Lakh ki Kheti Ke Liye Unnat Yantra* (Hindi), a folder, 8pp
- Scientific Cultivation and Use of lac, Training Manual, 87pp
- *Paier Chaalit Lakh Chhilane ki Machin* (Hindi), a folder, 4 pp
- *Vidhut Motor Chaalit Lakh Chhilane ki Machin* (Hindi), a folder, 4 pp
- Canlac, Technology Profile, 6 pp
- ILRI Lac Newsletter Vol. 6 (3, 4) 7(1, 2, 3,4), 4 pp

Reprinting extension publications for distribution

- *Palas tatha ber par lakh ki Sammilit Kheti ki unnat vidhi*, 4 pp, 4000 copies
- *Aaiye Sikhen Unnat Vidhi se Lakh ki Kheti*, 4 pp, 500 copies
- *Kaise Karen Kusum Vriksh par Lakh ki Kheti*, 4 pp, 1500 copies
- Lac Culture Operation-Why? When?, How? 18 pp, 400 copies
- *Lakh ki Kheti - Sawal Kisanon ke Jawab Visheshagyon ke*, 44 pp, 1500 copies
- *Lakh Utpadan ke Unnat vidhiyan Evam Upyog*, 60 pp, 700 copies
- *Lakh ki Kheti ke Liye Unnat Yantra*, 8 pp, 1000 copies

Besides, 195 performae were also printed for official purposes.

PUBLICATIONS

Publications

- Bhattacharya A, Jaiswal, AK and Kumar KK. 2003. Ovicidal action of insecticides against lac insect predator *Eublemma amabilis*. *Proceedings of National Symposium on Frontier area of Entomological Research*, 5-7 Nov., 2003, New Delhi, 237-38.
- Bhattacharya A, Jaiswal A K, Sharma K Krishan and Mishra Y D. 2003. Efficacy of *Trichogramma chilonis* in the management of *lepidopteran* predators of lac insect. *Proceedings of National Symposium on Frontier area of Entomological Research*, 5-7 Nov., 2003, New Delhi. 239-240.
- Bhattacharya A, Mishra YD, Sushil SN, Jaiswal AK and Kumar KK. 2003. Relative efficacy of some *Trichogramma* spp. for management of *lepidopteran* predators of lac insect, *Kerria lacca (Kerr)* under field conditions. *Proceedings of the Symposium of Biological Control of Lepidopteran Pests*, 301-303.
- Chakrabarty P K, Mishra Y D and Bhattacharya A. 2003. Biology of *pseudo* lac insect on *Flemingia* sp. *Proceedings of National Symposium on Frontier area of Entomological Research*, 5-7 Nov., 2003, New Delhi. 241.
- Saha D, Srivastava S, Majee RN, Kumar P and Kumar K K 2003. Effect of plant growth regulator analogue from lac on shoot tip culture of *Flemingia macrophylla* (Willd) O.Ktze, a promising lac host plant. *Science and Culture*, **69** (7-8) : 287-288.
- Sharma K Krishan, Kumar KK, Bhattacharya A. and Ghosal S. 2003. Super parasitism in Indian lac insect *Kerria lacca* and its implication on fecundity and resin production. *Proceedings of National Symposium on Frontier area of Entomological Research*, 5-7 Nov., 2003, New Delhi . 235-236.
- Saha D; Srivastava, S.; Majee; R.N., Kumar P. & Kumar K. K. 2003. Effect of plant growth regulator from lac on shoot tip culture of *Flemingia macrophylla* (Willd) O. Ktze, a promising lac host plant. *Sci. & Cult.* 69(7-8), 287-288.
- Goswami, D.N., Jha, P.C. and Mahto, K. (2003) Rheological studies of shellac, *Pigm. Resin Technol.* (U.K.), 32, (#2), 107-112.
- Goswami, D.N., Jha, P.C., Mahato, K. and Kumar, K.K. 2003. Jute reinforced sheets based on shellac filled SMC. *Pop. Plast. Pack.*, **48** (#3), 68-71
- Goswami, D.N., Saha, S.K. and Agarwal, S.C. 2003 Solubility parameter of shellac from three dimensional approach, *J. Polym. Mater*, **20**, 249-255
- Sarkar, P.C. and Kumar K.K. 2003. CANLAC – Can Coatings for the New Millennium, *Packaging India*, **35** 15.
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- Giri, S.K., Prasad, N & Kumar, K.K. 2003. Lac wax based emulsion coating to extend post harvest life of mango. *Indian Food Packer*, May-June-2003.
- Goswami, D.N., Prasad, N., Jha, P.C. & Mahto, K. 2003. Utilisation of gummy mass – a by-product of lac industry. *Indian J. of Chem. Tech.* Vol. 11, Jan. 2004, 121-126.

Papers presented in Seminar /Symposia

- Bhattacharya A, Jaiswal A K, Mishra Y D and Chakrabarty P K. 2003. Efficacy of *Trichogramma brasiliense* Ashmed in the management of lepidopteran predators of lac insect *Kerria lacca (Kerr)*. National Conference on Zoology: Opportunities and challenges, 21-23 December, 2003, Kanyakumari. pp. 83-84.
- Chakrabarty PK, Mishra YD, Kumar KK and Bhattacharya A. 2003. Biology of lac insect *Kerria chinensis* (Mahdihassan) (*Homoptera : Tachardiidae*) on *Flemingia* spp. National Conference on Zoology : Opportunities and challenge, 21-23 December, 2003, Kanyakumari. pp 84-85.

- Jaiswal A K, Bhattacharya A, Kumar K K and Kumar S. 2003. Evaluation of ethofenprox (Nukil 10 E.C.) on lac insect culture for management of *Eublemma amabilis* Moore-a *lepidopteran* predator. National Conference on Zoology: Opportunities and challenges, 21-23 December, 2003, Kanyakumari. pp. 82-83.
- Mishra, Y D, Kumar, P and Yadav, S.K. 2003. Lac ecosystem : challenges and solutions. National seminar on Environmentally friendly industries- Today and Tomorrow (EFTT-2003) 8-9 November, 2003 Ranchi. pp 125.
- Sharma K Krishan and Ramani R. 2003. Variations in productivity linked parameters of lac insects of *Kerria* spp. (*Homoptera : Tachardiidae).* National Conference on Zoology: Opportunities and challenges. 21-23 December, 2003, Kanyakumari pp 85-86.
- Yadav, S.K. and Kumar, P. 2003 Sustainable agriculture through lac culture. International Conference on Eco-restoration, 14-21 October, 2003 New Delhi and Dehradun, pp 160.
- Majee, R.N., Yadav, S.K.S., Srivastava, S. and Kumar, K.K. 2003. Nematicidal activity of lac based chemicals against root knot nematode, *Meloidogyna incognita. 5th* National Symposium on Bio-Control Agents for Sustainable Management of Pests, 18-20 Dec., 2003, GBPUAT, Pantnagar, Uttranchal, Souvenir & Abstracts p. 194.
- Srivastava, S, Saha, D., Majee, R.N. and Kumar, K.K. 2003. Lac resin as a potential source of plant growth regulators. 2nd International Congress of Plant Physiology on sustainable plant productivity under changing environment held 8-12 Jan. 2003, New Delhi, India, Book of Abstract of 2nd ICCP p. 502.
- Goswami, D.N., Sarkar, P.C. and Kumar, K.K. 2003 Lac based technologies for entrepreneurship development. In Proceedings of 4th All India People's Technology Congress, 22- 23 Feb. 2003, at Kolkata, organised by Forum of Scientists, Engineers & Technologists.
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- Sao, K.P., Pandey, S.K. and Kumar K.K. 2003. Lac as a binding material for particle boards. International Conference on Development & Growth of Non-wood Agro. Boards and Allied Industry. 14 Feb. 2003, Max Mueller Bhavan, New Delhi.
- Giri, S. K., Prasad, N. and Kumar , K.K. 2003. Effect of lac wax coating and packaging on the storage behaviour of Litchi presented in the International Seminar on " Demonizing Technology for Rural Development at R.R.L. (Bhubneshwar) on October 7-9, 2003.
- Sarkar, P.C., "Applications of FT-Transmithance & Reflectance in Agriculture and Food Sciences", presented at National Symposium on Instrucmentation, at GBPUAT, Pantnagar, on 3rd-5th November 2003.

Book Chapter

Sharma K Krishan and Kumar KK. 2003 . Lac insects and their host plants. pp. 75-104. In G. Tripathi and A. Kumar (eds) *Potential of Living Resources.* Discovery Publishers, New Delhi.

LIST OF APPROVED ON-GOING PROJECTS

1. Evaluation, improvement and introduction of lac-based farming systems

- Bio-rational approaches for management of pests of lac insects and host plants
- Nutrient management in soil for maximixing lac yield
- Management of *Flemingia semialata* for sustainable lac production under different crop geometry and irrigation
- Integration of *Flemingia semialata* with horticultural crops for sustainable lac production under irrigated conditions.

2. Insect and host plant improvement for increased productivity and stability

- Collection, maintenance, conservation and evaluation of lac insects and host plants and their genetic improvement

3. Development of technologies for processing and diversified value-added products from lac resin

- Synthesis of some bio-active compounds from aleuritic acid
- Studies on qualitative changes in lac with storage
- Water thinned shellac - synthetic resin/polymer blends for cementitious surfaces
- Development of lac-based coating formulations for extending shelf life of fruits and perishable food products.

4. Processing and utilisation of by-products

- Mechanisation of *bhatta* process
- Use of stcklac in development of composite boards from lignocellulosic waste material, *arhar* sticks and jute / caddus for panel / furniture

5. Industrial liaison and dissemination of lac production, processing and utilisation technologies

- Mechanisation of lac cultivation operations
- Publication and publicity activities
- Current status, technology assessment, product promotion and problems of lac industries
- Training, demonstration, extension education and information service on lac culture, processing and product development

Approved Ad hoc Research Schemes

- Study of lac marketing in India.

Revolving Fund Scheme

- Production of quality broodlac on *kusum* and *palas* at different agro-climatic regions

NATP Projects

- Technology Mission on Cotton : Evaluation of location specific IPM modules for eco-friendly and sustainable cotton production
- National Agricultural Technology Project on plant biodiversity

Sponsored Projects

- Adoption of Lac Growers of Jharkhand for Model Upliftment throuh Scientific Lac Cultivation.

DBT Projects

- Lac as a source of livelihood: Technology intervention for sustained production in Khunti Sub-Division
- Evaluation of Bio-contro agents and bio-rational approaches for management of lac insect predators
- Biological, chemical and molecular characterization of lac insect-host plants relationship
- Application of molecular fingerprinting for genetic characterization of races and species of lac insect.

PARTICIPATION OF SCIENTISTS IN SEMINAR, SYMPOSIUM, WORKSHOP, TRAINING, ETC.

Participation in Seminar /Symposia

- Dr. S.K. Yadav attended International Conference on Eco-restoration held at New-Delhi and Dehradun, organized by National Institute of Ecology, 14-21 October, 2003.
- Dr. K.K. Kumar, Dr. A. Bhattacharya and Dr. K.K. Sharma attended National Symposium on Frontier Areas of Entomological Research, 5-7 Nov., 2003, IARI, New Delhi.
- Dr. S.K. Yadav attended National Seminar on Environmentally friendly industries- Today and Tomorrow (EFTT-2003) organized by Indian Institute of Plant Engineers- Ranchi Chapter, 8-9 November, 2003.
- Dr. K.K. Sharma attended, Seminar on Plant Biodiversity and Importance of Natural Resource Management, general awareness programme at Asanwari on 17.11.03 organised by NBPGR Regional Station Plandu.
- Dr. A. Bhattacharya, Dr. A. K. Jaiswal and Dr. K. K. Sharma attended National Conference on Zoology, 21-23 December, 2003, Kanyakumari.
- Dr. S. Srivastava, Scientist participated in 2nd international congress of plant physiology held at I.A.R.I., New Delhi during 18-20 January 2003
- Dr. D.N. Goswami attended 'Two-day International Conference on Development and Growth of Non-wood Agro-boards and Allied Industry held on 14-15 February 2003 at New Delhi.
- Dr. K.P. Sao, International conference on Development & Growth of Non-wood. Agro-Board& Allied Industry, 14th Feb. 2003, Max Mueller Bhavan, New Delhi.
- Dr. P.C. Sarkar, "*Annual Review Workshop of Technology Mission on Cotton*", at CICR, Nagpur, 26-27th March 2003.
- Dr. P.C. Sarkar, ' *Multiservice IP Networking*", organised by M/s D-Link, Mumbai, at Hotel Yuvraj Palace, Ranchi, on 7th June 2003
- Dr. P.C. Sarkar, "*Annual Workshop of Technology Mission on Cotton*", at NCIPM, New Delhi, 28th - 29th August 2003.
- Dr. P.C. Sarkar, "*National Symposium on Instrumentation*", organised by Instrumentation Society of India, at GBPUAT, Pantnagar, on 3-5th November 2003
- Sri S.K. S. Yadav, Scientist participated in 5th National Symposium on Bio-control agents sustainable management of Pests held at GBPUAT, Pantnagar during 18-20 December, 2003.

MEETINGS OF IMPORTANT COMMITTEES

Research Advisory Committee (RAC)

The Ninth Meeting of the Research Advisory Committee of the Institute was held on 27th February 2003. The following members were present :

1. Prof. S. Maiti — Chairman
   Retd. Prof. & Head
   Materials Science Centre
   IIT, Kharagpur
2. Dr. S. Lingappa — Member
   Director (Research)
   University of Agricultural Sciences
   Dharwad
3. Dr. S. Ray, — Member
   Retd. Dy. Director & Head,
   Chemical Technology Division
   Central Drug Research Institute
   (CSIR), Lucknow
4. Dr. G. D. Shetye, — Member
   Retd. Reader UDCT
   Bombay University, Mumbai
5. Shri Binay Kr. Gupta — Member
   M/s Gupta Bros (Shellac)
   P.O. Bundu, Ranchi - 835 204
6. Dr. K. K. Kumar — Member
   Director, ILRI, Ranchi
7. Dr. P. Kumar — Member Secretary
   PS & Head, LP Division
   ILRI, Ranchi

Dr. K. K. Kumar, Director of the Institute welcomed the Chairman and other participating members of the RAC and sought guidance and suggestions for the X Plan document.

The Director presented the salient achievements of the Institute and future course of action as per the core programmes R&D on lac cultivation, processing utilization and transfer of technologies.

The chairman welcomed all the members present in the meeting and thanked the Director for apprising the members present about overall activities of the Institute.

He was of the opinion that lac activities must be extended to some other parts of the country. Prof. Maiti further remarked that :

- Agenda should be sent to the members of RAC at least 15 days in advance of the scheduled RAC Meeting.
- The format of the Research Progress Report should be uniform.
- The difficulties/problems faced by the scientists in execution of the project should also be put in the progress report presented to RAC for their consideration and remedial measures.

Action taken report was placed before RAC and was accepted.

The progress made under various projects of the Institute were presented by concerned PIs. Five new projects were also presented and approved with minor modifications. Extension proposed for eight projects was approved.

The suggestions given and observations made are summarized below :

General

- Domestic consumption of lac should be increased by R&D efforts to use lac in non-conventional fields.
- Dr. Lingappa appreciated the progress made by the scientists and observed though it is good beginning to start lac production in A.P. but other side of lac industry, marketing aspects, diversification of lac products and creation of

RAC meeting in progress

market demand for lac need to be intensified.

- Chairman suggested that a Committee consisting of Director & two other scientists may be constituted to solve the problem of broodlac supply.

Lac Production

- Dr. Lingappa suggested that multiplication of parasitoids in large scale must be tried and effective technology should be demonstrated in lac producing area. Efforts should be made to get financial support from the ministry.
- Since export demand is increasing day-by-day cost effective lac production technologies should be developed.

Lac Processing & Product Development

- Most of the members were of the opinion that besides lac and lac products, more emphasis should be laid on the development of lac compounds, polymer-based products, emulsion compounds, and use of lac derivatives in biological control for pest management.
- The Chairman suggested that fundamental research has to be carried out so that shellac molecule may be intelligently applied. Similarly for all materials, new advanced technology must be found for survival of lac.
- He advised to hold Brain storming sessions to have new ideas for novel use of shellac.

Transfer of Technology

- Dr. Ray was of the opinion that charges for the transfer of technology should be higher than the existing one. Since the Institute is trying to convince more industries for transfer of technology, from April 2003. onwards, rates should be revised. Dr. Shetye suggested that an advisory Committee should be constituted consisting of Director and two outside Members from the field of technology transfer for price fixation for transfer of technology.

Staff Research Council (SRC)

Meeting held on February 25, 2003

In this opening remarks, Dr. Kumar, Director, ILRI and Chairman, SRC, welcomed all the scientists present and congratulated them about the recent Institute's activities, including *Kisan Divas*, ICAR Sports Meets etc.

After briefly reviewing the ongoing research projects, the following new research project proposals, to be taken up form 1st April 2003, were discussed in detail :

"Development of lac-based coating formulations for extending shelf life of fruits and other perishable food products"

Dr. P. C. Sarkar, Scientist, LP & PD Division proposed the project. Director desired that a scientist (horticulturist) from HARP, Ranchi be associated with the project, to which the PI agreed. After deliberations, it was decided that the following fruits / vegetables would be evaluated after coating : apples, mangoes, *litchi*, citrus varieties, capsicum and brinjals (fruit of eggplant). The House approved the project in principle; it would be put up before the RAC for consideration.

"Use of sticklac in development of composite boards from lignocellulosic waste material, *arhar* sticks and jute / caddus for panel / furniture.

Dr. K. P. Sao, Pr. Scientist, LP & PD division proposed the project. The project would be in collaboration with NIRJAFT, Kolkata, for which necessary modalities would have to be worked out. Director desired that the duration of the project be reduced to 3 years. The House approved the project in principle; it would be put up before the RAC for consideration.

"Integration of *Flemingia semialata* with horticultural crops for sustainable lac production under irrigated conditions"

Dr. B. P. Singh, Pr. Scientist, LP Division proposed the project. Shri G. Singh, Sr. Scientist and Dr. S.K. Yadav would be associated with the project.

"Improvement in lac host plant propagation techniques"

Shri S.C. Srivastava, Sr. Scientist, LP Division proposed the project. After much deliberation, it was decided to associate Dr. B. P. Singh, Pr. Scientist, LP Division, with the project and also provide full time technician to Shri S. Srivastava. The House approved the project in principle; it would be put up before the RAC for consideration.

"Economics of lac cultivation in Jharkhand"

Dr. G. Pal, Scientist, TOT Division proposed the project. After due deliberations, it was decided to take up 2 districts (of two blocks each) viz. Ranchi and Simdega, for the proposed study, so that sample size could be increased to 40 villages and 400 families.

The Meeting concluded at 5.15 pm, with a Vote of Thanks to the Chair by Dr. P.C. Sarkar, Member Secretary.

Meeting held on June 17-18, 2003

In this opening address, Dr. K.K. Kumar, Chairman, SRC, ILRI, informed the House that a Plan Budget of Rs. 540 lakhs for ILRI under SFC had been approved.

As informed by DG, ICAR, a 24 hr TV channel on agriculture was soon to be launched and the ILRI had to provide suitable material for the same. Director requested Dr. P. Kumar, Head, LP Division and Dr. N. Prasad, Head, LP & PD Division, for taking necessary action in this regard.

He also emphasized on the settlement of outstanding advances, as this, also will be monitored by the DG, ICAR, directly on monthly basis.

Proceedings of last SRC was approved unanimously.

The progress made under various projects of the Institute was reviewed and suitable suggestions made for improvement.

Five new projects proposed earlier and subsequently recommended by RAC, were approved. Members expressed their difficulties in operating scientific instruments, maintaining cultures, etc. due to erratic power supply and wide voltage fluctuations.

The meeting concluded with a vote of thanks to the Chair by the Member-secretary.

EVENTS ORGANISED

Farmers' Meet at Dahu village, Ormanjhi

Village Mukhya addressing the farmers

The Institute is promoting adoption of scientific methods of lac cultivation among the lac growers under a State-sponsored programme. Some of the lac growers in Ormanjhi block, under this scheme had supplied the Institute, the surplus brood lac produced by them. The success of these adopted farmers has inspired other farmers in area for taking up lac cultivation. A small function was organized at Panchayat Bhavan, Dahu village, Ormanjhi on 30th September, 2003 to distribute the cost of the brood lac supplied by these farmers in which more than 125 farmers including women participated. Besides the officials from ILRI, this function was attended by Dr GK Choudhary, State Marketing Manager, IFFCO; Dr PN Singh, LDM, Bank of India; Shri Anand Kothari, KVIC, Ranchi and Shri Yogeshwar Thakur, Mukhiya, Dahu Village.

Dr Choudhary promised to support lac-based integrated approaches through the special schemes available with IFFCO. He urged formation of co-operatives of farmers. He said successful growers will be encouraged through rewards. Dr Singh assured all possible financial support, through appropriate bank, for lac cultivation. He emphasised on more participation of women in such activities. Shri Kothari urged the farmers to come forward to setup lac-based enterprises and described the subsidies being provided by KVIC through the local banks for such schemes.

Farmer-NGO-Institute Interface

A "Farmer-NGO-Institute Interface" was organized at the Institute on 20th September, 2003 to mark the 79th Foundation Day of the Institute. The main focus of the Interface was to project the much higher demand for lac than the current production in the country and means achieving the desired lac production level through active and collective involvement of farmers, NGOs and the Institute. Fifty-seven participants including lac growers; representatives from GOs, NGOs, lac industry, financial institutions and autonomous bodies as well as scientists from the institute took active part in the Interface.

The Inaugural Ceremony

The Inaugural Session started at 11.30 a.m. at the Lecture Hall. Hon. Food, Civil supplies and Co-operatives Minisiter of Jharkhand Govt., Shri Devdayal Khushwaha was the Chief Guest. Shri Sawna Lakra, local MLA chaired the session. Shri Anand Kothari, Member, Khadi Village Industries Commission was the Special Guest. Dr KK Kumar, Director of the Institute welcomed the guests and the participants. He outlined about the advantages of lac cultivation compared to other agricultural crops and its importance in the economic upliftment of the growers, particularly the tribals.

Dr Pranay Kumar, Head, Lac Production Division presented research and extension activities as well as the recent achievements made by the institute. Mr B. Abraham from PRADAN, an NGO shared the experiences of his organization in development of rural opportunities. He outlined various reasons which make lac cultivation an attractive activity in the livelihood enhancement of

Shri Kushwaha, State minister addressing the delegates

the farmers of Jharkhand.

Shri Anand Kothari saw a tremendous scope for lac consumption in various areas. He urged all those concerned with lac for setting a very high production targets. He gave specific suggestions for promotion of lac production and consumption. He also pointed out the role KVIC can play in setting up of lac-based village industries.

The Chief Guest, Shri Khushwaha urged the Institute to formulate a blueprint for the development of lac in the State. He promised to extend all possible support from the Jharkhand Govt. He felt that LAMPS and PACS, the units in the co-operative network of the State have now been revitalised and should be fully exploited for procurement of lac directly from the farmers at remunerative price. He also said that suitable action would be initiated for providing insurance to the growers for lac crop.

Shri Sawna Lakra praised the contribution made by this institute with long and rich history. He cited success stories of huge economic benefits derived by some lac growers. He emphasised on the need for overcoming the exploitation of lac growers by the middlemen. He desired that regular meets should be organized to promote awareness about the benefits of lac among people.The inaugural session concluded with a vote of thanks by Dr KK Sharma, Senior Scientist of the Institute.

The function was attended by representatives from all the leading local newspapers, AIR, and DD Kendra, which subsequently gave a wide coverage of the event.

The Deliberations

Participants representing different sectors/ interests actively participated in the brainstorming sessions held after the inaugural function of the meet. Mr R. Ramani, Principal Scientist conducted the proceedings. The pre-lunch session of the deliberations were held under the auspices of Shri D. Khushwaha, Food, Civil supplies and Co-operatives Minisiter of Jharkhand Govt. He elaborated on the possible role of Co-operatives for the development of lac in the State. He also promised that any initiative from any quarter for lac promotion would be supported fully by his ministry.

The following observations/recommendations emerged out the discussion held during pre- and post-lunch sessions of the interface.

Income and employment generation through lac cultivation

- When the contour of Chotanagpur, irrigation facilities, nature of land and soil are considered, lac cultivation emerges as an attractive choice for economic improvement and providing local employment opportunities.
- It has been found returns from lac forms a substantial proportion in the total income of lac growing households; in certain areas, it is more than that from agriculture.
- The major lac cultivation activities are concentrated during the lean period of agriculture activities in the region.
- The raw lac is fetching a good price at present and marketing is not a problem.

General

- India is the leading lac producing country in the world. There is definite demand in the world for harmless and natural products like lac. Therefore, very high targets for lac production in country should be set and lac production should be promoted through awareness campaigns, demonstrations with the active guidance and support of ILRI.
- A "Lac Cell" should be constituted under the Industries Dept. in Jharkhand to promote and support lac-based industrial development in the State.
- All the "Broodlac Farms" of the Forest Dept should be revitalised to meet the local brood lac demand .
- Promotional and developmental activities should be undertaken for utilization of lac in Indian handicrafts. To support this, a "Lac Handicraft Development and Training Centre" should be created at ILRI.
- Microprocessing Centres of Lac should be setup in villages and they should be networked.
- A "Lac Marketing Research and Development Centre" should be setup.

The deliberations came to a conclusion at 6:15 pm with a vote of thanks by Dr KK Sharma, Sr. Scientist.

DISTINGUISHED VISITORS

Dr Andy Hall, ICRISAT and personnel from Livelihood Solutions (NGO) at the Institute Museum

The Lac Museum was visited by 1978 persons comprising of 1171 farmers, 673 students and 134 others from all walks of life.

- Hon. Sri Kariya Munda, Union Minister, Agro based Rural Industries, New Delhi.
- Hon. Sri Hukum Deo Narayan Yadav, Agriculture Minister(State), Govt. of India, New Delhi
- Dr Raghubansha Singh, M.P., New Delhi
- Sri Manjay Lal, M.P., New Delhi
- Mrs Sushma Singh, Development Commissioner, Jharkhand
- Mr Handoko Lukito, JL.A.Yani No-1 Palembadg, Indonesia
- Dr Pitam Chandra, ADG(PE) ICAR, New Delhi
- Dr A.K. Sinha, Director, ICAR-RCER, Patna
- Mr J.B. Chowdhury, Former V.C., GBPU A&T, Pantnagar, UP
- Dr B.L. Jalali, Ex-Director Research, HAU, Hisar, Haryana
- Dr S.K. Tandon, ICAR, HQ, New Delhi
- Rev. Thomas Mathew, Principal, St. Thomas School, Ranchi.
- Prof M.D. Teli, UICT, Matunga, Mumbai.
- Dr R.C. Srivastava, Adviser, Ministry of Science & Technology, New Delhi
- Andy Hall, South Asia Regional Co-ordinator, Crop Post-harvest Programme, ICRISAT, Hydrabad, A.P.
- Mr Stuart Lloyd & Jane Lloyd, Northan Ireland
- Mr C.B. Singh, OSD to Union Agriculture Minister
- Shri Guru Naik, Director, Livelihood Solutions, New Delhi
- Mr Akhlesh Argal, IFS, Dy CF, Head Agro forest Division, TFRI, Mandla-Road, Jabalpur-482021

SUPPORT SERVICES

Institute Research Farm

The following activities were under taken up during the period under report :

Harvesting of *jethwi* 2003 crop, *phunki* removal and scraping of lac from *katki* turmeric, ginger, arhar, maize, Gora paddy, sweet potato etc. were raised in between the rows and plants of *kusum* and *palas* plots and mixed plantation of *bhalia* and *galwang*. Seedlings of various host plants *viz, kusum, ber, galwang, palas, akashmani, khair, Flemingia semialata* were raised in polythene bags as well as in nursery beds for filling up the vacant spaces in respective plots for research and experimental use, distribution among the farmers and for sale.

Management and maintenance of Farm including roads, paths, channels, hedges and edges were carried out. Hoeing, weeding and mulching of various plots, removal of termites from lac host tree plots and roads and spraying of insecticides to control the termites wherever and whenever necessary were carried out. Unwanted and obnoxious weeds were eradicated from *ber, khair, kusum, putri, sisam, galwang, akashmani* plots manually as well as by ploughing.

Seasonal flowers, shrubs and ornamental foliage plants were planted on various spots in the office premises including dispensary, Guest-House, different Divisions and Sections for beautification and landscaping of the area.

Approximately 2500 Trainees / Farmers / Students visited Institute plantation under short and long term training programmes organized by TOT Division. Proper arrangements were made to acquaint them with the lac insect, host plants, improved methods of lac cultivation and management of host plants etc.

An amount of Rs. 60190/- was earned as revenue through the sale of different farm produce, broodlac, etc.

Library & Documentation Centre

The Library of the Institute is a repository of scientific & technological information on lac. Besides catering to the needs of Institute scientists and technologists, the library also renders services to other researchers, academicians and students as well as Lac Industrialists from all parts of country.

The Library maintains adequate linkage with leading reference libraries like National Library, Kolkata; INSDOC, New Delhi, INSA for strengthening the information resources. The library also supplies photocopies of rare research articles to National Science Library, New Delhi from time to time against payment.

Library holdings (as on 31st January 2003)

Documents	Additions during the year under report	Total Holdings
Books	204	7409
Bound Journals	396	18701
Annual Reports	142	4332
Reprints/Research papers	-	307
Bulletins/Research notes	-	522
CD-ROMS	11	64
ISI-Specifications	7	102
Maps	—	37
Patents		
Patents Foreign	—	327
Patents Indian	—	15
Journal Subscriptions & Periodical Receipts		
Foreign Periodicals (Subscribed)	—	23
Foreign Periodicals (Gratis/Exchange)	—	9
Indian Periodicals (Subscribed)	—	60
Indian Periodicals (Gratis/Exchange)	—	27

The Library also maintains the mailing lists as detailed below for regular mailing of the Annual Report/Newsletters and other publications of the Institute :

Description	No. of organisations
Indian	
a) Exchange (for Libraries) -	58
b) Complimentary/on gratis -	77
Foreign Countries	
a) Exchange -	6
b) Complimentary/on gratis -	9
c) Embassies & others -	8

Services rendered

- Photocopy : 1812 pages photocopies have been done and supplied to the readers on payment and 2530 pages photocopies have also been provided for the Institute Scientists as per their needs.
- Circulation : 872 books and bound volumes were issued to the borrowers.
- Sale of publications : Sale of priced and distribution of unpriced publications of Institute is also being looked after by the Library Section. A revenue of Rs. 5380/- has been earned.

Mechanical Section

Electric Maintenance/Repair Work

- Maintenance work done at Residencial Quarters, admin. buildings, labs. and street lights including pump houses etc. 1300 jobs excuted including cabling/A.C. Installations.
- Repair/Servicing work as regard to Labs./ Electrict measuring instruments including meter, Balances, Emergency units etc. have done (Nos. of Jobs 423) including Relays and P. filters.

Mechanical works for Repair/Maintenance related to workshop

- Repairing/overhauling and changing of spares in motors/Lift pumps (water), control starters including servicing of Genset Engines etc. were done. Jobs done - 272.
- Machine shop (related to Lathe, Drilling, Grinding and Fabrication work) for valve spindles machine spares, Lac scraper/bhatta M/c etc. done. Jobs done - 357.
- Execued jobs related to electric welding, M.S. cutting and fabrication/repair of farm Implements, structure fittings and assisted in other maintenance work. Jobs done - 129.
- Operational maintenance of three pump houses to ensure regular water supply.

Civil Work

- Carpentary and wooden repair for labs/office furniture including doors, windows of residential quarters and wood surfacing work done. Nos. of jobs - 275.
- Laying of waterpipe lines/reparing and replacement of sanitary fittings inside Labs, Offices, Residential quarters including over head tanks. No. of jobs - 375.
- Water storage and supply after treatment to res./ non-residential bldgs. regularly including water for farm section.

Other Activities/Work

- Monitoring of C.P.W.D. and other civil work.
- Maintenance of Genset/Solar units of the Institute.

Appendix I

METEOROLOGICAL DATA

Recorded at Namkum, Ranchi during Jan.-Dec. 2003

Month	Mean Maximum Temp. (℃)	Mean Minimum Temp. (℃)	Mean Dry bulb Temp. (℃)	Mean Wet bulb Temp. (℃)	Mean Humidity (%)	Total rainfall (mm)	Highest Maximum Temp. (℃)	Lowest Minimum Temp. (℃)
January	24.64	6.26	13.83	11.31	73.45	1.1	28.0	1.9
February	27.57	12.52	18.27	15.76	76.71	20.9	31.0	10.0
March	31.32	14.64	23.03	20.09	75.87	66.7	34.8	7.2
April	37.24	20.49	29.18	25.28	72.93	38.5	40.5	16.6
May	38.99	22.45	30.90	26.56	71.70	8.7	42.8	19.4
June	36.35	23.53	28.84	26.64	84.30	97.9	43.5	17.2
July	30.81	23.21	26.12	25.23	93.38	279.4	35.7	21.0
August	30.07	22.84	25.70	25.08	95.19	353.0	33.0	21.6
September	29.88	21.88	25.42	24.58	93.06	177.0	32.0	20.6
October	28.17	19.40	23.37	22.11	90.00	298.7	32.2	17.3
November	27.14	10.09	18.77	16.54	79.30	3.5	30.0	7.3
December	24.65	8.46	16.24	14.03	78.67	10.4	19.0	4.7

The highest temperature - 43°C on 1.6.2003

The lowest temperature - 1.9°C on 16.1.2003

The total rainfall - 1355.8 mm

Monsoon rainfall - 907.3 mm

Hailstorm - 19.2.03, 5.6.03

PERSONNEL

Present sanctioned strength (As on 31.12.2003)

Scientific

RMP	..	1
Head of the Division	..	3
Principal Scientist	..	1
Senior Scientist	..	12
Scientist	..	39
Total	..	**56**

Adminstrative

Admin. Officer	..	1
Finance & Acc. Officer	..	1
Asstt. Director (OL)	..	1
Asstt. Admin. Officer	..	2
Security Officer	..	1
Sr. P.A.	..	1
P.A.	..	2
Jr. Accounts Officer	..	1
Assistant	..	12
Sr. Clerk	..	13
Steno Gr. - III	..	1
Jr. Clerk	..	5
Total	..	**41**

Technical

Category - III	..	3
Category - II	..	21
Category - I	..	46
Total	..	**70**

Supporting

Grade - IV	..	10
Grade - III	..	20
Grade - II	..	34
Grade - I	..	37
Total	..	**101**

	Sanctioned	*Filled*	*Vacant*
Scientistfic . including R.M.P	56	31	25
Technical	70	63	7
Adminstrative	41	34	7
Supporting	101	90	11
Total	268	218	50

Dr. K. K. Kumar - Director

Division of Lac Production

Dr. P. Kumar	- P. S. & Head
Dr. B. P. Singh	- P.S. (Agron.)
Dr. A. Bhattacharya	- P.S. Agric. Entomol.)
Sri Ganauri Singh	- Sr. Scientist (Soil Sc. Agric. Chem.)
Sri S. C. Srivastava	- Sr. Scientist (Plant Breeding)
Dr. K. K. Sharma	- Sr. Sc. (Agric. Entomol.)
Sri Y. D. Mishra	- Scientist (SG) (Agric. Entomol.)
Sri S. K. Yadav	- Scientist Sr. Scale (Agron.)
Sri D. Saha	- Scientist (Biotech.)
Sri R. K. Singh	- Scientist (Soil & Water Conservation)
Smt. S. Prasad	- P.A.
Sri Mauris Ekka	- Tech. Officer (Lab.) (T-6)
Sri M. L. Rabidas	- F/F Tech. (T-4)
Sri S. S. Prasad	- F/F Tech. (T-4)
Sri D D. Prasad	- F/F Tech. (T-4)
Sri K. P. Gupta	- F/F Tech. (T-4)
Sri D. K. Singh	- F/F Tech. (T-4)
Sri R. K. Swansi	- Lab. Tech. (T-I-3)
Sri D. W. Runda	- F/F Tech. (T-2)
Sri R. Gulam Singh	- F/F Tech. (T-2)
Sri S. K. Tripathi	- F/F Tech. (T-2)

Division of Lac Processing and Product Development

Dr. N. Prasad	- P.S. & Head (Org. Chem.)
Dr. D. N. Goswami	- P.S. (Physics)
Dr. R. N. Majee	- P.S. (Org. Chem.)
Dr. K. P. Sao	- P.S. (Physics)
Dr. P. C. Sarkar	- Scientist (SS) (Org. Chem.)
Sri S. K. Pandey	- Scientist (Mech. Engg.)
Dr. S. K. Srivastava	- Scientist (Org. Chem.)
Sri S. K. Giri	- Scientist (AS & PE)
Sri S. K. S. Yadav	- Scientist (Org. Chem.)
Sri M. Fahim Ansari	- Scientist (Org. Chem.)
Sri D. D. Singh	- Tech. Officer (Lab.) (T-6)
Sri T. K. Saha	- Tech. Officer (Lab.) (T-6)
Sri Bhola Ram	- Lab. Tech. (T-4)
Sri B. P. Ghosh	- Lab. Tech. (T-4)
Sri B. P. Keshri	- Lab. Tech. (T-4)
Smt. P. Devi	- Lab. Tech. (T-3)
Sri Hironmoy Das	- Lab. Tech. (T-2)

Sri Binod Kumar - Lab. Tech. (T-2)
Sri S. K. Tirkey - Lab. Tech. (T-2)
Sri Ajay Kumar - Lab. Tech. (T-2)
Sri A. Pandey - Sr. Clerk

PD Unit
Sri K. K. Prasad - Tech. Officer (Lab.) (T-6)
Sri Jagdish Singh - Tech. Officer (Lab.) (T-6)
Sri Anup - Lab. Tech. (T-2)

Transfer of Technology Division

Dr. K. K. Kumar - PS, Head, & Acting Director
Sri R. Ramani - PS (Agric. Entomol.)
Dr. K. M. Prasad - PS (Org. Chem.)
Dr. A. K. Jaiswal - Sr. Scientist, (Agric. Entomol.)
Sri Radha Singh - Sr. Scientist, (Phys. Chem.)
Sri P. M. Patil - Scientist, Sr. Scale (Phys. Chem.)
Sri M. L. Bhagat - Scientist, Sr. Scale (Agric. Entomol.)
Dr. N. Prasad - Scientist Sr. Scale (Farm Mach. & Power)
Dr. G. Pal - Scientist (Agric. Economics)
Sri L.C.C.N. Shahdeo - Tech. Officer (F/F Tech.) (T-6)
Sri R. N.Vaidya - Tech. Officer (F/F Tech.) (T-6)
Sri A. K. Sinha - P.A.
Sri R. P. Srivastava - Jr. Asst-cum-photographer (T-4)
Smt. Ratna Sen - Museum Assistant (T-4)
Sri Anil Kr. Sinha - (F/F Tech.) (T-4)
Sri P. A. Ansari - (F/F Tech.) (T-4)
Sri Binod Kumar - (F/F Tech.) (T-4)
Sri S. B. Azad - (F/F Tech.) (T-4)
Sri Madan Mohan - (F/F Tech.) (T-2)
Sri Raj Kumar Rai - (Lab. Tech (T-2)

RFRS for Lac, Balarampur, W.B.

Dr. A. Bhattacharya - PS (Agric. Entomol.) I/c
Dr. S. Ghosal - Scientist Sr. Scale (Agronomy)
Sri K. A. Nagruar - F/F Tech. (T-1-3)

Administrative Staff

Sri Ashok Mallick - Administrative Officer
Sri Devesh Nigam - Fin. & Accounts Officer
Sri A. K. Yadav - Security Officer
Sri K. D. Pandey - Asstt. Administrative Officer
Sri R. Rabidas - Sr. P.A.
Sri S. Prasad - P.A.
Sri A. K. Sinha - P.A.
Sri S. K. Yadav - Jr. Stenographer
Sri K. N. Sinha - Assistant Admin. Officer
Sri Budhan Ram - Assistant
Sri Ravi Shanker - Assistant
Sri D. Ram - Assistant
Sri Sudharshan Ram - Assistant
Sri K. L. Choudhury - Assistant
Sri R. K. Upadhaya - Assistant
Sri N. Topno - Assistant
Sri Md. Mobarak - Assistant
Sri B. K. Rajak - Assistant
Sri P. Singh - Assistant
Sri Vijay Ram - Sr. Clerk
Sri Emil Gari - Sr. Clerk
Sri Thibu Minz - Sr. Clerk
Sri Baijnath Gope - Sr. Clerk
Sri Anant Pandey - Sr. Clerk
Sri S. C. Lal - Sr. Clerk
Sri Raghunath Mahto - Sr. Clerk
Sri Bihari Sahu - Sr. Clerk
Sri Wilson Guria - Sr. Clerk
Sri K. Oraon - Sr. Clerk
Sri Pranay Kumar - Sr. Clerk
Sri N. Gope - Sr. Clerk
Sri A. K. Tripathy - Sr. Clerk
Sri R. K. Toppo - Jr. Clerk
Sri K. K. Deonath - Jr. Clerk
Sri Samal Kumar - Jr. Clerk
Shri Arjun Gope - Jr. Clerk

Hindi Cell

Sri Lakshmikant - Asstt. Director (O.L.)
Dr. Anjesh Kumar - Hindi Translator (T-4)

Director/ARIS Cell

Sri A. K. Sahay - Tech. Officer (T-6), F/F
Sri D. Ganguly - Tech. Officer (T-6), Lab.

Testing Laboratory

Sri D. Ghosh - Tech. Officer (Lab.) (T-6)
Sri K. M. Sinha - Tech. Officer (Lab.) (T-6)
Sri B. K. Singh - Lab. Tech. (T-2)

Farm Unit

Dr. K. K. Sharma - Sr. Scientist, I/c
Sri R. L. Ram - (F/F Tech.) (T-4)
Sri M. Surin - T-I-3 (Tractor Driver)
Sri Satish Kumar - (F/F Tech.) (T-2)
Sri S. K. Mukherjee - T-2 (F/F Tech.)

Mechanical Section

Dr. N. Prasad - Sr. Scientist, I/c
Sri S. K. Srivastava - Tech. Officer, T-5
Sri S. K. Bhaduri - Tech. Officer, T-5
Sri H. L. Bhakta - Instru. Mech., T-4
Sri B. L. Dey - Boiler Asstt. T-4
Sri I. D. Das - Asstt. Mech., T-2
Sri A. Sharma - Carpenter, T-2
Sri R. K. Ravi - Wireman, T-2
Sri Kunwar Tirkey - Turner, T-2
Sri V.R.S.R. Choudhary - Glass Blower, T-2

Library

Sri R. P. Tewari - Tech. Officer (T-6)
Sri V. K. Singh - Tech. Officer (T-6)
Sri K.K. Debnath - Jr. Clerk

Dispensary

Dr. P. K. Pandey - AMA on deputation
Sri C. Pandey - Stockman-cum-compounder (T-4)

Central Stores

Dr. K. M. Prasad - Principal Scientist, I/c
Sri Md. Mobarak - Assistant

Transport

Sri Bandhan Runda - T-I-3
Sri Jaswant Tiwari - T-2
Sri Narayan Lakra - T-2
Sri Arvind Kumar - T-2
Sri Rajesh Kr. Yadav - T-1
Sri Mandeswar Singh - T-2

Promotions, Transfers, etc.

Appointment

Dr. Bangali Baboo, Director - w.e.f. 10.11.03

Promotion

Dr. P.C. Sarkar, Sc. (Sr. Sccale) - w.e.f. 10.6.94
Dr. S. Ghosal, Sc. (Sr. Scale) - w.e.f. 27.7.98
Shri R. Singh, Sr. Sc. - w.e.f. 27.7.99
Dr. N. Prasad, Sc. (Sr. Scale) - w.e.f. 30.8.2001
Dr. S. K. Yadav, Sc. (Sr. Scale) - w.e.f. 14.9.2002
Shri A. K. Tripathi, Sr. Clerk - w.e.f. 3.5.2003
Shri K. N. Sinha, Asst. Admin. Off.- w.e.f. 29.11.2003

Promotion from S.S.G III to IV (2750-65-3300-70-44000)

Shri Sukra Ekka
Shri Jagannath Naik
Smt. B. Deogharia
Shri V. K. Ram
Smt. Kamla Devi

Promotion from S.S.G II to III (2650-65-70-4000)

Shri Mahadeo Oraon
Shri B.P. Kujur
Shri Mangra Oraon
Shri Deepak Kr. Kachhap
Shri Chaitu Kachhap
Shri Ganesh Ram
Shri Mani Mahto
Shri Raj Kumar Naik
Shri Dhiraj Prasad Singh
Shri Baneshwar
Shri R. K. Singh
Shri R. B. Sah
Shr J. Hans
Shri Mahavir Mahto
Shri Md. Nayeem Ansari

Promotion from S.S.G I to II (2610-60-3150-65-3540)

Shri Birsa Oraon (Lodma)
Shri Dukha Toppo
Smt. B.A. Baraik
Shri Bandhan Oraon
Shri K.P. Kashi
Shri N. Mishra
Shri I. K. Singh
Shri Balram Ram
Shri Suresh Ram
Shri Sadho Oraon
Shri Dukma Oraon
Shri Suresh Pandit
Shri I. Lakra
Shri R. C. Mandap
Shri Baiju Oraon
Shri Louis Ekka
Shri Isaiya Ekka
Shri Suraj Nath Toppo

Retirement

Shri K.D. Pandey - w.e.f. 31.1.2003
Shri Sudarshan Ram - w.e.f. 31.1.2003
Shri Y Pathak - w.e.f. 31.1.2003
Shri Budhu Ram - w.e.f. 28.2.2003
Shri Markus Lakra - w.e.f. 31.3.2003
Dr. S. K. Jaipuriar - w.e.f. 30.6.2003
Shri K. L. Choudhury - w.e.f. 31.10.2003

REPORT IN HINDI

परिचय

भारतीय लाख अनुसंधान संस्थान की स्थापना 1925 में हुई। भारत में लाख उद्योग की स्थिति की जाँच एवं इसके सर्वांगीण विकास के लिए सुझाव देने हेतु 1920 के आरम्भ में तत्कालीन भारत सरकार द्वारा गठित श्री एच. ए. एफ. लिंडसे एवं श्री सी. एम. हार्लो की दो सदस्यीय समिति की अनुशंसा के फलस्वरूप इस संस्थान का प्रादूर्भाव हुआ। समिति की रिपोर्ट 1921 में प्रकाशित हुई। अन्य पहलुओं के अलावे उन्होंने लाख के लगातार उत्पादन के लिए वैज्ञानिक रूप से जाँची-परखी विधि से सघन खेती की अनुशंसा की। उन सुझावों के आलोक में उस समय के लाख व्यापारी ''भारतीय लाख अनुसंधान संगठन'' नामक एक निजी पंजीकृत संस्था के अन्तर्गत संगठित हुए। इस संगठन को राज्य सरकार से भूमि प्राप्त हुई तथा संस्थापक निदेशक श्रीमती डोरोथी नॉरीस के अधीन संस्थान ने कार्य करना आरम्भ किया।

आरम्भ में कीट विज्ञान अनुभाग संस्थान की प्रमुख ईकाई थी तथा जैव रसायन अनुभाग उसका सहयोगी था। तत्पश्चात् 1920 के दशक में अनुप्रयुक्त अनुसंधान के लिए भौतिक रसायन अनुभाग बना। तदुपरांत इन दोनो अनुभागों को मिलाकर एक रसायन विभाग बना। इस तरह इस संस्थान का कार्यक्षेत्र कीट विज्ञान एवं रासायनिक दोनों पहलुओं तक विस्तारित हो गया।

1930 में राजकीय कृषि आयोग की अनुशंसा के आधार पर केन्द्रीय विधायिका द्वारा भारतीय लाख कर अधिनियम के अधीन भारत सरकार ने भारतीय लाख कर समिति का गठन किया, जिसने 1931 में संस्थान को ''लाख संगठन'' से अपने नियंत्रण में ले लिया। द्वितीय विश्वयुद्ध के बाद 1951 एवं 1956 में गठित प्रथम एवं द्वितीय समीक्षा समितियों ने मूल एवं अनुप्रयुक्त अनुसंधान पर समान रूप से बल देते हुए विस्तृत अनुसंधान कार्यक्रम बनाये। उस अवधि में क्षेत्रीय समस्याओं को दूर करने के लिए झालदा (प. बंगाल), दमोह, उमरिया (म.प्र.) एवं मिर्जापुर (उ. प्र.) में चार क्षेत्रीय अनुसंधान केन्द्र स्थापित किये गए। बाद में विभिन्न प्रकार के निर्मित लाख की गुणवत्ता नियंत्रण हेतु लाख निर्माताओं की सहायता के लिए क्षेत्रीय जाँच प्रयोगशाला भी स्थापित की गई। ये प्रयोगशालाएँ 1959 में झालदा (प. बंगाल) एवं गोन्दिया (महाराष्ट्र), 1961 में बलरामपुर (प. बंगाल) एवं डालटनगंज (बिहार वर्त्तमान झारखण्ड) तथा 1962 में नामकुम (बिहार वर्त्तमान झारखण्ड) में स्थापित की गई।

लाख कर समिति की समाप्ति के बाद 01 अप्रैल 1966 में भारतीय कृषि अनुसंधान परिषद् (भा.कृ.अनु.प.) ने संस्थान को अपने प्रशासकीय नियंत्रण में लिया। शेशाद्री समिति की अनुशंसा के आधार पर दिसम्बर 1971 में संस्थान को रसायन विज्ञान, कीट विज्ञान, शस्य विज्ञान एवं पौध आनुवंशिकी, प्रौद्योगिकी तथा प्रसार पाँच विभागों में पुनर्गठित कर सुदृढ़ किया गया।

संस्थान

यह संस्थान राँची टाटानगर राष्ट्रीय राज पथ पर राँची शहर से 9 किलोमीटर पूर्व में शान्तिपूर्ण उपनगरीय क्षेत्र में स्थित है। यह स्थान समुद्र तल से लगभग 650 मी. ऊँचा तथा अक्षांश 23°23' उ. एवं देशान्तर 85°23' पूरब के बीच अवस्थित है। संस्थान की मिट्टी ग्रेनाइट जेनेसीस पर विकसित हुई है तथा बागान क्षेत्र की मिट्टी लैटेरिटीक तरह की है। नामकुम में प्रायोगिक बागान (लगभग 36.5 हे.) सहित संस्थान की कुल जमीन 49 हे. है। पारिस्थितिकी की दृष्टि से इस क्षेत्र में मध्यम स्वास्थ्य वर्द्धक जलवायु है तथा जनवरी से जून के बीच औसत न्यूनतम मासिक तापक्रम 6.7° सें. से 23.5° सें. के बीच तथा औसत अधिकतम मासिक तापक्रम जनवरी से मई के बीच 24.6° सें. से 39.0° सें. के बीच रहा। इस अवधि में कुल वर्षा 1355.8 मी.मी. हुई जिसमें मानसून की वर्षा 907.3 मि.मी. थी।

वर्त्तमान स्थिति

सम्प्रति देश की खुली आर्थिक नीति, उद्योगों एवं कृषि उद्यमों की विश्वव्यापकता एवं भा.कृ.अनु.प. के संरचनात्मक एवं कार्यात्मक पुनर्गठन के मद्दे नजर संस्थान में भी संरचनात्मक परिवर्त्तन हुआ है एवं प्राथमिकताओं की पुनर्समीक्षा की गई है। पुराने विभागों/अनुभागों को समाप्त कर वैज्ञानिक क्षमताओं को लाख उत्पादन, लाख संसाधन एवं उत्पाद विकास तथा प्रौद्योगिकी हस्तांतरण नामक तीन विभागों में बांटा गया है। संस्थान द्वारा म.प्र. एवं प. बंगाल में दो क्षेत्रीय अनुसंधान केन्द्र चलाए जा रहे हैं। संस्थान से बाहर के प्रयोगों के लिए क्षेत्र एवं वृक्षों को दीर्घावधि लीज पर लिया गया है। भौतिक एवं मानवीय क्षमताओं की आधारभूत संरचना के व्यापक विकास की शुरूआत की गई है। संचार एवं सूचना की पुनः प्राप्ति हेतु सूचना भंडार तक वैज्ञानिकों की पहुँच बनाने के लिए कृषि अनुसंधान आसूचना तंत्र प्रकोष्ठ (एरीस सेल) गठित किया गया है।

अपने स्थापना काल से ही संस्थान ने लाख की खेती के वैज्ञानिक तरीकों से होने वाले लाभ के संबंध में आदिवासियों को जागरूक बनाने में महत्वपूर्ण भूमिका अदा की है। संस्थान समुचित प्रौद्योगिकी को बढ़ावा देने, विकसित करने तथा प्रसार करने के लिए लगातार प्रयासरत है। संस्थान के पास लाख की खेती के वैज्ञानिक

तरीकें के लिए प्रौद्योगिकी उपलब्ध है और अनुरोध करने पर सभी प्रमुख लाख परिपालकों के लिए पैकेज एवं तरीकों की जानकारी दी जाती है। बिहार, प. बंगाल, उ.प्र., म.प्र. एवं उड़ीसा के लगभग 80,000 वर्ग कि.मी. क्षेत्र में कमजोर वर्गों के लाख के प्रमुख उत्पादकों के लिए संस्थान प्रौद्योगिकी का विस्तार करता है।

औद्योगिक पहलू की भी उपेक्षा नहीं की गई है। संस्थान ने सतत् अपनी वैज्ञानिक क्षमताओं को उपभोक्ता उद्योग की बदलती हुई मांगों के अनुरूप केन्द्रित किया है। कई उत्पाद एवं प्रक्रियाएं विकसित की गई हैं। पूर्व में इच्छुक लोगों के अनुरोध पर नि:शुल्क प्रौद्योगिकी हस्तांतरित की जाती थी। संप्रति परिषद् द्वारा संसाधन की प्राप्ति हेतु निश्चित किये गए लक्ष्य प्राप्त करने के उद्धेश्य से प्रौद्योगिकी हस्तांतरण के लिए मामूली शुल्क लिया जाता है। लाख की खेती एवं उपयोग के क्षेत्र में योगदान के लिए संस्थान को अन्तर्राष्ट्रीय मान्यता मिली है।

संस्थान के अधिदेश

मुख्य संस्थान के लिए :

- उपलब्ध या आनुवंशिक रूप से विकसित लाख कीट एवं लाख परिपालकों को अपना कर लाख की खेती की प्रौद्योगिकी विकसित करना।
- उद्योगों के लिए लाख संसाधन की तकनीक का विकास।
- पायलट संयत्र प्रदर्शन हेतु लाख के उपयोग में विविधता लाने के लिए अनुसंधान।
- कृषकों एवं उद्यमियों के लिए प्रौद्योगिकी हस्तांतरण।
- लाख के उत्पादन, संसाधन एवं उपयोग पर सूचना संग्राहक के रूप में कार्य करना।

क्षेत्रीय अनुसंधान केन्द्रों के लिए

- भिन्न-भिन्न कृषि-जलवायु की परिस्थितियों के अन्तर्गत लाख की खेती की विकसित प्रौद्योगिकी की जाँच।
- बीहन लाख का उत्पादन एवं क्षेत्रीय परिपालकों की खोज।
- कृषि वानिकी पद्धत्ति में लाख के उत्पादन को बढ़ाने हेतु कृषकों का प्रशिक्षण।
- क्षेत्रीय आधार पर उद्यमियों को जागरूक बनाने का कार्यक्रम।

संगठित ढांचा

संस्थान के प्रधान निदेशक हैं। वैज्ञानिक निम्नलिखित तीन विभागों में कार्यरत हैं: (1) लाख उत्पादन, (2) लाख संसाधन एवं उत्पाद विकास एवं (3) प्रौद्योगिकी हस्तांतरण। प्रशासनिक स्कंध में निदेशक कार्यालय, प्रशासकीय अनुभाग, क्रय अनुभाग, वित्त एवं लेखा अनुभाग एवं केन्द्रीय भंडार शामिल हैं। पुस्तकालय, निदेशक प्रकोष्ठ, प्रक्षेत्र अनुभाग एवं अनुरक्षण तथा कर्मशाला अनुभागों के द्वारा तकनीकी सहायता प्रदान की जाती है। राजभाषा प्रकोष्ठ, सुरक्षा, चिकित्सा एवं सम्पदा अनुरक्षण सेवाएं सहायक ईकाईयाँ हैं।

मुख्य परिसर में औषधालय एवं आवासीय क्वार्टरों के अतिरिक्त लाख उत्पादन विभाग, लाख संसाधन एवं उत्पाद विकास विभाग, प्रौद्योगिकी हस्तांतरण विभाग, प्रशासकीय अनुभाग, वित्त एवं लेखा अनुभाग, पुस्तकालय, निदेशक प्रकोष्ठ, कृषि अनुसंधान आसूचना तंत्र प्रकोष्ठ, राजभाषा प्रकोष्ठ एवं यांत्रिकी अनुभाग है। इससे सटा एक छोटा परिसर है जिसमें संसाधन प्रयोगशाला एवं स्टाफ के आवास गृह हैं। संस्थान के दोनों परिसरों में खेल का मैदान है।

स्टाफ

संस्थान में 1 आर.एम.पी., 55 वैज्ञानिक, 70 तकनीकी, 41 प्रशासकीय एवं 101 सर्पोटिंग ग्रेड के स्वीकृत पद है।

राजस्व

रिपोर्ट की अवधि में संस्थान द्वारा विभिन्न मदों में कुल आय रु. 20.95 लाख थी।

बजट

2003-2004 की अवधि में योजना एवं गैर योजना मद में खर्च का विवरण नीचे सारिणी में दिया गया है

लेखा शीर्ष	योजना		गैर-योजना	
	बजट अनुमान	वास्तविक व्यय	बजट अनुमान	वास्तविक व्यय
स्थापना शुल्क	-	-	349.45	344.26
यात्रा भत्ता	3.00	3.00	2.70	2.70
अन्य शुल्क	64.00	61.25	73.35	70.23
अन्य मद (प्रशिक्षण इत्यादि)	6.00	3.91	0.50	10.50
निर्माण	30.00	30.00	8.00	6.57
कुल	103.00	98.16	434.00	424.26

'हिन्दी दिवस एवं हिन्दी चेतना मास'

राजभाषा प्रकोष्ठ की गतिविधियाँ

- श्रीमती सुशान्ति प्रसाद, आशुलिपिक को हिन्दी आशुलिपि एवं श्री कृष्ण कन्याल देवनाथ कनीय लिपिक को क्रमश: हिन्दी आशुलिपि एवं हिन्दी टंकण प्रशिक्षण हेतु दक्षिणी छोटानागपुर प्रमंडल राँची के कार्यालय में प्रशिक्षण हेतु नामित किया गया।
- संस्थान के सहायक निदेशक (रा.भा.) श्री लक्ष्मी कान्त ने ''नेशनल इंस्टिच्यूट ऑफ पब्लिक एडमिनिस्ट्रेशन, बंगलोर द्वारा 14-15 नवम्बर 2003 को आयोजित ''संसदीय राजभाषा समिति'' से संबंधित हिन्दी कार्यशाला में भाग लिया।
- संस्थान परिसर में दिनांक 19.12.2003 से 25.11.2003 तक ''कौमी एकता'' सप्ताह का आयोजन किया गया। इस अवसर पर राष्ट्रीय एकता से जुड़े भाषायी सामंजस्य, कमजोर वर्गों का उत्थान, धर्मनिरपेक्षता, महिला कल्याण, पर्यावरण संरक्षण, आदि विषयों पर क्रमश: डॉ. निरंजन प्रसाद, अध्यक्ष लाख संसाधन एवं उत्पाद विकास विभाग, श्री रंगनादन रमणि, प्रधान वैज्ञानिक, डॉ. दीपेन्द्र नाथ गोस्वामी, प्रधान वैज्ञानिक, श्री रामप्रताप तिवारी, पुस्तकालयाध्यक्ष ने अपने-अपने विचार प्रकट किए। संस्थान के निदेशक डॉ. बंगाली बाबू ने अपने अध्यक्षीय भाषण में राष्ट्रीय एकता एवं अखंडता को अक्षुण्ण बनाये रखने के लिए प्रयासरत रहने की अपील की। सभा संचालन डॉ. अंजेश कुमार एवं धन्यवाद ज्ञापन श्री लक्ष्मी कान्त ने किया।
- राँची नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में दिनांक 16.12.2003 ''आज के सामाजिक एवं आर्थिक परिवेश में वर्तमान शिक्षा पद्धति की प्रासंगिता-विचार विमर्श एवं सुझाव'' विषयक संगोष्ठी में बैठक में संस्थान का प्रतिनिधित्व श्री लक्ष्मी कान्त सहायक निदेशक (रा.भा.) ने किया।
- डॉ. अंजेश कुमार, वरिष्ठ हिन्दी अनुवादक ने बागवानी एवं कृषि वानिकी शोध कार्यक्रम पलांडू, नामकुम, राँची द्वारा आयोजित हिन्दी कार्यशाला में भाग लिया।
- संस्थान राजभाषा कार्यान्वयन समिति के तत्वावधान में दिनांक 20.08.2003 को ''छुट्टी यात्रा रियायत, दौरा भत्ता एवं कंटिजेंट विपत्र'' विषय पर एक हिन्दी व्याख्यान का आयोजन किया गया जिसमें श्री देवेश निगम, वित्त व लेखा अधिकारी ने उपस्थित अधिकारियों/कर्मचारियों को इन विषयों से संबंधित नियमों से अवगत कराया गया।
- नगर राजभाषा कार्यान्वयन समिति, राँची के तत्वावधान में दिनांक - 22.08.03 को संस्थान द्वारा राँची स्थित केन्द्र सरकार के कार्यालयों के बीच एक अन्ताक्षरी प्रतियोगिता का आयोजन किया गया। जिसमें श्री रामप्रताप तिवारी, भारतीय लाख अनुसंधान संस्थान को प्रथम; डॉ. अश्विनी कुमार सिन्हा, केन्द्रीय तसर अनुसंधान एवं प्रशिक्षण संस्थान, नगरी को द्वितीय स्थान प्राप्त हुआ। केन्द्रीय रिजर्व पुलिस बल के श्री यू.वी. तायडे को अहिन्दी भाषी वर्ग में पुरस्कार के लिए चुना गया।

संसदीय राजभाषा समिति द्वारा संस्थान का निरीक्षण कार्यक्रम

- संसदीय राजभाषा समिति का निरीक्षण कार्यक्रम 17 जुलाई 2003 को होटल राँची अशोक के सभागार में सम्पन्न हुआ। निरीक्षण समिति में माननीय उपाध्यक्ष एवं सासंद डॉ. लक्ष्मी नारायण पाण्डेय, श्री सर्वराज सिंह, श्री तिलकधारी सिंह एवं श्री बालकवि बैरागी ने भाग लिया। इनके साथ संसदीय राजभाषा समिति के अवर सचिव (अनुसंधान) श्री दिनेश कुमार पाण्डेय भी निरीक्षण मे कार्यक्रम में भाग लिया। संस्थान में राजभाषा हिन्दी की प्रगति की समीक्षा की गई एवं हिन्दी पुस्तकों के क्रय में और अधिक राशि व्यय करने की सलाह दी गई। संस्थान द्वारा हिन्दी प्रकाशनों की प्रदर्शनी तथा संस्थान इस अवसर पर में तैयार लाख पर बनी फिल्म की प्रदर्शन भी किया गया।

  भारतीय कृषि अनुसंधान परिषद नई दिल्ली के निदेशक (हिन्दी) श्री अनिल कुमार दुबे तथा भारतीय लाख अनुसंधान संस्थान, नामकुम, राँची के अधिकारियों में डॉ. कौशल किशोर कुमार निदेशक, डॉ. प्रणय कुमार अध्यक्ष लाख उत्पादन विभाग, डॉ. निरंजन प्रसाद अध्यक्ष लाख संसाधन एवं उत्पाद विकास विभाग एवं श्री रंगनादन रमणि अध्यक्ष प्रौद्योगिकी हस्तांतरण विभाग, वित्त एवं लेखा अधिकारी श्री देवेश निगम के अलावे सहायक निदेशक (राजभाषा) श्री लक्ष्मी कान्त तथा वरीय हिन्दी अनुवादक डॉ. अंजेश कुमार ने संस्थान में हिन्दी के प्रयोग संबंधी सूचनाएं उपलब्ध करवाई।

'हिन्दी दिवस एवं हिन्दी चेतना मास'

- संस्थान में 16 सितंबर 2003 को पारंपरिक ढंग से हिन्दी दिवस एवं 'हिन्दी चेतना मास' के उद्घाटन समारोह का आयोजन किया गया। मुख्य अतिथि के रूप में झारखंड राज्य के वाणिज्य

कर एवं राष्ट्रीय बचत मंत्री माननीय प्रो. रामजी लाल सारडा ने समारोह का उद्घाटन दीप प्रज्जवलित कर किया। मुख्य अतिथि पद से बोलते हुए वाणिज्य कर एवं राष्ट्रीय बचत मंत्री श्री रामजी लाल सारडा जी ने का कि हिन्दी में भाव प्रकट करने का सर्वाधिक शक्ति अत: हिन्दी को व्यवहारिक बनाने की आवश्यकता है

समारोह की विशिष्ठ अतिथि राँची महिला महाविद्यालय की प्राचार्य डॉ. (श्रीमती) मंजू सिन्हा ने कहा कि सरकारी काम काज में सरल हिन्दी का प्रयोग किया जाना चाहिए। उन्होंने महात्मा गाँधी के विचार को दुहराया कि शिक्षा का माध्यम मातृभाषा ही होना चाहिए।

अध्यक्षीय भाषण में स्थानीय विधायक माननीय श्री सावना लकड़ा जी ने आहवान किया कि जिस तरह से हमारे देश के अंग्रेजो की गुलामी से स्वतंत्रता मिली है उसी प्रकार सरकारी काम काज में अंग्रेजी से छुटकारा मिलना ही चाहिए। अब हमारे उपर किसी का दबाव नहीं है हमें स्वेच्छा से हिन्दी में कार्य कर गौरवान्वित होना चाहिए।

संस्थान के निदेशक डॉ. कौशल किशोर कुमार ने स्वागत भाषण में कहा कि हिन्दी हमारी मातृभाषा, राष्ट्रभाषा, संपर्कभाषा एवं राजभाषा है अत: इसका प्रचार, प्रसार एवं सरकारी कार्यालय में उपयोग करना हमारा परम धर्म है। वर्तमान स्थिति में देश की अखंडता को बनाये रखने और उसे सुदृढ़ करने के लिए हिन्दी को व्यवहारिक रूप में राष्ट्रभाषा बनाना होगा। माँ एवं मातृभूमि के जैसा ही मातृभाषा का सम्मान किया जाना चाहिए। उन्होंने संस्थान के अधिकारियों एवं कर्मचारियों से अपील कि अपने अपने स्तर पर सभी लोगों को हिन्दी का सर्वाधिक प्रयोग करना चाहिए। वैसे भी अहिन्दी भाषियों के लिए अंग्रेजी की अपेक्षा हिन्दी सीखना अधिक आसान है। देश के हर भाग के लोग हिन्दी समझते है। जहाँ तक हिन्दी शब्दावली का सवाल है हमें इस मामले में व्यापक दृष्टिकोण से अन्य भारतीय भाषाओं के प्रचलित शब्दों को भी अपनाना होगा एवं हिन्दी और हिन्दीतर भाषियों को साथ लेकर चलना होगा। लोगों को कहना होगा कि यदि आप अच्छी हिन्दी नहीं जानते तो भी हिचकने की कोई बात नहीं, समझ में आने वाली टूटी-फूटी हिन्दी का ही प्रयोग करे क्योंकि प्रयोग करते करते हिन्दी का सही प्रयोग अनायास ही आ जायेगा। हिन्दी दिवस के अवसर पर हमें आत्मचिंतन और आत्मविश्लेषण करना होगा। इस प्रकार हम यदि कार्यरूप में में हिन्दी का प्रयोग करें तो वह विश्व स्तरीय मंच पर महिमा मंडित हो सकेगी। उन्होंने आगे अपील की कि अपने अपने स्तर पर सभी कोई हिन्दी के प्रयोग को प्रोत्साहित करने में सक्रिय सहयोग प्रदान करें।

संस्थान में आयोजित हिन्दी की विभिन्न प्रतियोगिताओं में प्रथम व द्वितीय स्थान के लिए सर्वश्री रंजय कुमार सिंह, कवल किशोर प्रसाद, गनौरी सिंह, श्री शरत चन्द्र लाल, श्री हीरालाल भक्त, श्री अर्जून शर्मा को तथा सांत्वना पुरस्कार में सर्व श्री सतीश चन्द्र श्रीवास्तव, विरेन्द्र कुमार सिंह, शैलेन्द्र कुमार यादव, ध्रुवदेव प्रसाद, शिवशंकर प्रसाद तथा श्रीमती सुशान्ती प्रसाद को पारितोषिक प्रदान किये गए।

हिन्दी चेतना मास के दौरान संस्थान पुस्तकालय में वैज्ञानिक आलेखों की एक प्रदर्शनी भी लगाई गई जिसमें निर्णायक मंडल के विभागाध्यक्षों ने सर्वश्री डॉ. कौशल किशोर कुमार निदेशक एवं श्री महेश्वर लाल भगत के संयुक्त आलेख को प्रथम, डॉ. केवल कृष्ण शर्मा तथा डॉ. अनिल कुमार जायसवाल को द्वितीय तथा श्री गनौरी सिंह एवं कुमारी चंचिला कुमारी के संयुक्त आलेख को तृतीय स्थान पर होने की घोषणा की।

संस्थान के सहायक निदेशक (रा.भा.) श्री लक्ष्मी कान्त ने संस्थान में हिन्दी प्रगति रिपोर्ट प्रस्तुत करते हुए सूचित किया कि हिन्दी के प्रयोग के संबंध में संस्थान का गौरवमय इतिहास है। 1930 से ही संस्थान द्वारा हिन्दी एवं प्रादेशिक भाषाओं में प्रचार पत्रक प्रकाशित होते रहे हैं। संस्थान अपने ही कार्यालय में नहीं अपितू 'नराकास' के सदस्य कार्यालयों की हिन्दी की गतिविधियों में सहभागिता निभाता है। इसी क्रम में उन्होंने सूचित किया कि राँची स्थित केन्द्र सरकार के कार्यालयों के बीच हिन्दी में उल्लेखनीय कार्य हेतु संस्थान को राँची नगर राजभाषा कार्यान्वयन समिति द्वारा वर्ष 2003 के लिए प्रथम पुरस्कार से सम्मानित किया गया। इस अवसर पर श्री राम प्रताप तिवारी, अनिकेत सिन्हा, मनोज ने कविता पाठ किया। डॉ. अंजेश कुमार ने सभा संचालन एवं डॉ. निरंजन प्रसाद प्रधान वैज्ञानिक एवं, अध्यक्ष हिन्दी दिवस आयोजन समिति ने धन्यवाद ज्ञापन किया।

संस्थान राजभाषा कार्यान्वयन समिति के अध्यक्ष एवं निदेशक डॉ. कौशल किशोर कुमार ने राँची नगर राजभाषा कार्यान्वयन समिति के सक्रिय सदस्य एवं सेन्ट्रल बैंक ऑफ इन्डिया, राँची के सहायक महाप्रबंधक श्री यू. कृष्णामूर्ति को उनके स्थानान्तरण पर स्मृति चिन्ह देकर सम्मानित किया गया। इस अवसर पर श्री हर्ष, सचिव 'नराकास', डॉ. रमापति तिवारी, वरीय राजभाषा अधिकारी मेकन एवं श्री लक्ष्मीकान्त, स.नि. (राजभाषा) उपस्थित थे।

मौसमी आँकड़े

जनवरी–दिसम्बर 2003 के दौरान नामकुम, राँची में अभिलेखित

महीना	औसत अधिकतम तापमान	औसत न्यूनतम तापमान	औसत शुष्क बल्ब तापमान	औसत आर्द्र बल्ब तापमान	औसत नमी (%)	कुल वर्षा (मि.मी.)	उच्चतम अधिकतम तापमान	लघुतम न्यूनतम तापमान
जनवरी	24.64	6.26	13.83	11.31	73.45	1.1	28.0	1.9
फरवरी	27.57	12.52	18.27	15.76	76.71	20.9	31.0	10.0
मार्च	31.32	14.64	23.03	20.09	75.87	66.7	34.8	7.2
अप्रैल	37.24	20.49	29.18	25.28	72.93	38.5	40.5	16.6
मई	38.99	22.45	30.90	26.56	71.70	8.7	42.8	19.4
जून	36.35	23.53	28.84	26.64	84.30	97.9	43.5	17.2
जुलाई	30.81	23.21	26.12	25.23	93.38	279.4	35.7	21.0
अगस्त	30.07	22.84	25.70	25.08	95.19	353.0	33.0	21.6
सितम्बर	29.88	21.88	25.42	24.58	93.06	177.0	32.0	20.6
अक्टूबर	28.17	19.40	23.37	22.11	90.00	298.7	32.2	17.3
नवम्बर	27.14	10.09	18.77	16.54	79.30	3.5	30.0	7.3
दिसम्बर	24.65	8.46	16.24	14.03	78.67	10.4	19.0	4.7

उच्चतम तापमान — 1.6.2003 को 43.°C
लघुतम तापमान — 16.1.2003 को 1.9°C
कुल वर्षा — 1355.8 मि.मी.
मानसून वर्षा — 907.3 मि.मी.
ओला वृष्टि - 19.2.2003 एवं 5.6.2003 को

संस्थान के अधिकारियों एवं कर्मचारियों की स्थिति (31.12.03)

स्वीकृत पद

वैज्ञानिक वर्ग

अनुसंधान एवं प्रबन्धन पद (आर.एम.पी.)	01
प्रधान वैज्ञानिक	04
वरीय वैज्ञानिक	12
वैज्ञानिक	39
कुल योग	**56**

प्रशासकीय पद

1.	प्रशासनिक अधिकारी	01
2.	वित्त एवं लेखा अधिकारी	01
3.	सहायक निदेशक (रा.भा.)	01
4.	सहायक प्रशासनिक अधिकारी	02
5.	सुरक्षा अधिकारी	01
6.	वरीय वैयक्तिक सहायक	01
7.	वैयक्तिक सहायक	02
8.	कनीय वित्त व लेखा अधिकारी	01
9.	सहायक	12
10.	वरीय लिपिक	13
11.	आशु लिपिक ग्रेड III	01
12.	कनीय लिपिक	05
कुल योग		**41**

तकनीकी वर्ग

तकनीकी अधिकारी (टी-6) चिकित्सा पदाधिकारी सहित	03
तकनीकी सहायक टी -II	21
तकनीकी सहायक टी -I	46
कुल योग	**70**

सर्पोटिंग ग्रेड

1.	सर्पोटिंग ग्रेड IV	10
2.	सर्पोटिंग ग्रेड III	20
3.	सर्पोटिंग ग्रेड II	34
4.	सर्पोटिंग ग्रेड I	37
कुल योग		**101**

	स्वीकृत पद	भरे गए पद	रिक्त पद
वैज्ञानिक वर्ग (अनुसंधान प्रबंधन पद सहित)	56	31	25
तकनीकी वर्ग	70	63	07
प्रशासकीय वर्ग	41	34	07
सर्पोटिंग वर्ग	101	90	11
कुलयोग	**268**	**218**	**50**

लाख उत्पादन विभाग

		डिस्पिलिन
1.	डॉ. प्रणय कुमार, प्रधान वैज्ञानिक एवं विभागाध्यक्ष	आनुवंशिकी एवं कोशिका आनुवंशिकी
2.	डॉ. भरत प्रसाद सिंह, प्रधान वैज्ञानिक	सस्य विज्ञान
3.	डॉ. अजय भट्टाचार्य, प्रधान वैज्ञानिक	कृषि कीट विज्ञान
4.	श्री गनौरी सिंह, वरीय वैज्ञानिक	मृदा विज्ञान
5.	श्री सतीश चन्द्र श्रीवास्तव, वरीय वैज्ञानिक	पौध विज्ञान
6.	डॉ. केवल कृष्ण शर्मा, वरीय वैज्ञानिक	कृषि कीट विज्ञान
7.	श्री यज्ञदत्त मिश्र, वैज्ञानिक (चयन श्रेणी)	कृषि कीट विज्ञान
8.	डॉ. सोमेन घोषाल, वैज्ञानिक (वरीय वेतनमान)	सस्य विज्ञान
9.	डॉ. शैलेन्द्र कुमार यादव, वैज्ञानिक (वरीय वेतनमान)	सस्य विज्ञान
10.	श्री दीप नारायण साहा, वैज्ञानिक	बायोटेक्नोलोजी
11.	श्री रंजय कुमार सिंह, वैज्ञानिक	मृदा एवं जल संरक्षण
12.	श्रीमती सुशांति प्रसाद	निजी सहायक
13.	श्री मौरिस एक्का, टी-6	प्रक्षेत्र फार्म तकनीशियन
14.	श्री मुन्नालाल रविदास, टी-4	प्रक्षेत्र फार्म तकनीशियन
15.	श्री शिवशंकर प्रसाद, टी-4	प्रक्षेत्र फार्म तकनीशियन
16.	श्री ध्रुवदेव प्रसाद, टी-4	प्रक्षेत्र फार्म तकनीशियन
17.	श्री कामता प्रसाद गुप्ता, टी-4	प्रक्षेत्र फार्म तकनीशियन
18.	श्री दिलिप कुमार सिंह, टी-4	प्रक्षेत्र फार्म तकनीशियन
19.	श्री रामकिशोर स्वांसी, टी-1-3	प्रयोगशाला तकनीशियन
20.	श्री डेविड विलियम रूंडा, टी-1-3	प्रयोगशाला तकनीशियन
21.	श्री रामगुलाम सिंह, टी-2	प्रक्षेत्र फार्म तकनीशियन
22.	श्री संजय कुमार त्रिपाठी, टी-2	प्रक्षेत्र फार्म तकनीशियन

लाख संसाधन एवं उत्पाद विकास विभाग

1.	डॉ. निरंजन प्रसाद, अध्यक्ष, प्रधान वैज्ञानिक	कार्बनिक रसायन
2.	डॉ. दीपेन्द्र नाथ गोस्वामी, प्रधान वैज्ञानिक	भौतिकी
3.	डॉ. रवीन्द्र नाथ मॉजी, प्रधान वैज्ञानिक	कार्बनिक रसायन
4.	डॉ. कन्हैया प्रसाद साहु, प्रधान वैज्ञानिक	भौतिकी
5.	डॉ. पूर्ण चन्द्र सरकार, वैज्ञानिक (वरीय वेतनमान)	कार्बनिक रसायन
6.	श्री संजय कुमार पाण्डेय, वैज्ञानिक	यांत्रिकी अभियंत्रण
7.	डॉ. संजय श्रीवास्तव, वैज्ञानिक	कार्बनिक रसायन
8.	श्री सरोज कुमार गिरी, वैज्ञानिक	कृषि संरचना एवं प्रक्रिया अभियांत्रिकी
9.	श्री संतोष कुमार सिंह यादव, वैज्ञानिक	कार्बनिक रसायन
10.	श्री फहिम अंसारी, वैज्ञानिक	कार्बनिक रसायन
11.	श्री देवधारी सिंह, तकनीकी अधिकारी, टी-6	प्रयोगशाला तकनीशियन
12.	श्री तरूण कुमार साहा, तकनीकी अधिकारी टी-6	प्रयोगशाला तकनीशियन
13.	श्री भोला राम, टी-4	प्रयोगशाला तकनीशियन
14.	श्री विष्णुपद घोष, टी-4	प्रयोगशाला तकनीशियन
15.	श्री बसंत प्रसाद केसरी, टी-4	प्रयोगशाला तकनीशियन
16.	श्रीमती प्रभा देवी, टी-3	प्रयोगशाला तकनीशियन
17.	श्री हिरण्ययम दास, टी-2	प्रयोगशाला तकनीशियन
18.	श्री विनोद कुमार, टी-2	प्रयोगशाला तकनीशियन
19.	श्री शिशिल कुमार तिर्की, टी-2	प्रयोगशाला तकनीशियन
20.	श्री अजय कुमार, टी-2	प्रयोगशाला तकनीशियन
21.	श्री अनन्त पाण्डेय	वरीय लिपिक

प्रौद्योगिकी हस्तांतरण विभाग

1.	डॉ. कौशल किशोर कुमार, प्रधान वैज्ञानिक	कृषि कीट विज्ञान
2.	श्री रंगनादन रमणि, प्रधान वैज्ञानिक	कृषि कीट विज्ञान
3.	डॉ. कृष्ण मोहन प्रसाद, प्रधान वैज्ञानिक	कार्बनिक रसायन
4.	डॉ. अनिल कुमार जायसवाल, वरीय वैज्ञानिक	कृषि कीट विज्ञान
5.	डॉ. राधा सिंह, वरिय वैज्ञानिक	भौतिक रसायन
6.	श्री पितांबर मोहन पाटिल, वैज्ञानिक (वरीय वेतनमान)	भौतिक रसायन
7.	श्री महेश्वर लाल भगत, वैज्ञानिक (वरीय वेतनमान)	कृषि कीट विज्ञान
8.	डॉ. निरंजन प्रसाद वैज्ञानिक (वरीय वेतनमान)	फार्म मशीनरी एवं पावर
9.	श्री गोबिन्द पाल, वैज्ञानिक	कृषि अर्थशास्त्र
10.	श्री लाल चन्द्र चूड़ामणि नाथ शाहदेव, टी-6	प्रक्षेत्र फार्म तकनीशियन
11.	श्री रामानन्द बैद्य, टी-6	प्रक्षेत्र फार्म तकनीशियन
12.	श्री अर्जुन कुमार सिन्हा,	निजी सहायक
13.	श्री रमेश प्रसाद श्रीवास्तव, टी-4	छायाकार
14.	श्रीमती रत्ना सेन, टी-4	संग्रहालय
15.	श्री अनिल कुमार सिन्हा, टी-4	प्रक्षेत्र फार्म तकनीशियन
16.	श्री परवेज आलम अंसारी, टी-4	प्रक्षेत्र फार्म तकनीशियन
17.	श्री विनोद कुमार, टी-4	प्रक्षेत्र फार्म तकनीशियन
18.	श्री शिव बचन आजाद, टी-3	प्रक्षेत्र फार्म तकनीशियन
19.	श्री मदन मोहन, टी-2	प्रक्षेत्र फार्म तकनीशियन
20.	श्री राजकुमार राय, टी-2	प्रयोगशाला तकनीशियन

यांत्रिकी अनुभाग

1.	डॉ. निरंजन प्रसाद, वैज्ञानिक (वरीय वेतनमान)	प्रभारी अधिकारी
2.	श्री संतोष कुमार श्रीवास्तव, तकनीकी अधिकारी	टी-5
3.	श्री स्वप्न कुमार भादुड़ी, तकनीकी अधिकारी	टी-5
4.	श्री हीरा लाल भक्त, इन्स्ट्रूमेंट मेकेनिक	टी-4
5.	श्री बलाई लाल डे, व्यायलर एसिस्टेंट	टी-4
6.	श्री इन्द्रदेव दास, सहायक मेकानिक	टी-2
7.	श्री अर्जुन शर्मा, बढ़ई	टी-2
8.	श्री रवीन्द्र कुमार रवि, वायरमैन	टी-2
9.	श्री कुंवर तिर्की, टर्नर	टी-2
10.	श्री भानू राम सुख राम चौधरी, ग्लास ब्लोवर	टी-2

फार्म इकाई

1.	डॉ. केवल कृष्ण शर्मा, वरीय वैज्ञानिक	प्रभारी अधिकारी
2.	राम लोचन राम, प्रक्षेत्र फार्म तकनीशियन	टी-4
3.	श्री मरकुस सुरीन, ट्रेक्टर चालक	टी-1-3
4.	श्री सतीश कुमार, प्रक्षेत्र फार्म तकनिशियन	टी-2
5.	श्री सुनिल कुमार मुखर्जी, प्रक्षेत्र फार्म तकनिशियन	टी-2

पुस्तकालय

1.	श्री राम प्रताप तिवारी, पुस्तकालयाध्यक्ष	टी-6
2.	श्री विनोद कुमार सिंह, तकनीकी अधिकारी (पुस्तकालय)	टी-6
3.	श्री कृष्ण कन्याल देवनाथ, कनीय लिपिक	

औषधालय

1.	डॉ. पी. कुमार पाण्डेय, चिकित्सा अधिकारी	(प्रतिनियुक्ति पर)
2.	श्री चन्द्रेश्वर पाण्डेय, स्टॉकमैन-कम-कम्पाउंडर	टी-4

राजभाषा प्रकोष्ठ

1.	श्री लक्ष्मी कान्त, सहायक निदेशक (रा.भा.)	प्रभारी अधिकारी
2.	डॉ. अंजेश कुमार, वरीय हिन्दी अनुवादक	टी-4

निदेशक/कृषि अनुसंधान सूचना पद्धत्ति प्रकोष्ठ

1.	श्री अमर कुमार सहाय, तकनीकी अधिकारी	टी-6 (प्रक्षेत्र फार्म तकनीशियन)
2.	श्री दीपांकर गांगुली, तकनीकी अधिकारी	टी-6 (प्रयोगशाला तकनीशियन)

वाहन

1.	श्री बंधना रूण्डा, चालक	टी-1-3
2.	श्री जसवन्त तिवारी, चालक	टी-2
3.	श्री नारायण लकड़ा, चालक	टी-2
4.	श्री अरविन्द कुमार, चालक	टी-2
5.	श्री राजेश कुमार यादव, चालक	टी-1
6.	श्री मानदेश्वर सिंह, चालक	टी-1

क्षेत्रीय लाख अनुसंधान केन्द्र बलरामपुर (पश्चिम बंगाल)

1.	डॉ. अजय भट्टाचार्य, प्रधान वैज्ञानिक	प्रभारी अधिकारी
2.	डॉ. सोमेन घोषाल, वैज्ञानिक (वरीय वेतमान)	सस्य विज्ञान
3.	श्री करमा अब्राहम नागरूवार, (प्रक्षेत्र फार्म तकनीशियन)	टी-1-3

क्षेत्रीय परीक्षण प्रयोगशाला

1.	श्री दीपक घोष, तकनीकी अधिकारी	टी-6 (प्रयोगशाला तकनीशियन)
2.	श्री कुमार महेन्द्र सिन्हा, तकनीकी अधिकारी	टी-6 (प्रयोगशाला तकनीशियन)
3.	श्री वीरेन्द्र कुमार सिंह, प्रयोगशाला तकनीशियन	टी-2

प्रशासनिक अनुभाग

1.	श्री ओशोक मल्लिक	प्रशासनिक अधिकारी

प्रशासकीय अनुभाग प्रथम

1.	श्री लक्ष्मी कान्त	सहायक निदेशक (रा.भा.) एवं प्रभारी अधिकारी
2.	श्री रवि शंकर	सहायक
3.	श्री दुधेश्वर राम	सहायक
4.	श्री रजनीकान्त उपाध्याय	सहायक
5.	श्री बैजनाथ गोप	वरीय लिपिक
6.	श्री प्रणय कुमार	वरीय लिपिक
7.	श्री राधा किशुन टोप्पो	कनीय लिपिक
8.	श्री समल कुमार	कनीय लिपिक

प्रशासकीय अनुभाग द्वितीय

1.	श्री रामेश्वर रविदास	वरिष्ठ निजी सहायक एवं प्रभारी अधिकारी
2.	श्री बुधन राम	सहायक
3.	श्री ठिबू मिंज	वरीय लिपिक
4.	श्री नारायण गोप	वरीय लिपिक
5.	श्री विलसन गुड़िया	वरीय लिपिक
6.	श्री अरूण कुमार त्रिपाठी	वरीय लिपिक
7.	श्री रघुनाथ महतो	वरीय लिपिक

वित्त एवं लेखा अनुभाग

1.	श्री देवेश निगम	वित्त एवं लेखा अधिकारी
2.	श्री नुरजन टोपनो	सहायक
3.	श्री प्रहलाद सिंह	सहायक
4.	श्री विजय राम	वरीय लिपिक
5.	श्री इमिल गाड़ी	वरीय लिपिक
6.	श्री शरत चन्द्र लाल	वरीय लिपिक
7.	श्री बिहारी साहू	वरीय लिपिक
8.	श्री अर्जुन गोप	कनीय लिपिक

सुरक्षा

1.	श्री अनिल कुमार यादव	सुरक्षा अधिकारी

केन्द्रीय भण्डार

1.	श्री कृष्णानंद सिन्हा	सहायक प्रशासनिक अधिकारी
2.	श्री मो. मोबारक	सहायक

क्रय अनुभाग

1.	श्री कृष्णानंद सिन्हा	सहायक प्रशासनिक अधिकारी
2.	श्री कामेश्वर उराँव	वरीय लिपिक
3.	श्री बसंत कुमार रजक	सहायक

निदेशक के निजी सहायक

1.	श्री सत्रुधन कुमार यादव	कनीय आशुलिपिक

नियुक्ति/पदग्रहण

1.	डॉ. बंगाली बाबू, निदेशक, निदेशक	10.11.03

प्रोन्नति (जिनके आदेश 2003 में निर्गत हुए)

क्र.म.	नाम व पदनाम	प्रोन्नत पद	प्रोन्नति की तिथि
1.	डॉ. पूर्णचन्द्र सरकार, वैज्ञानिक	वैज्ञानिक (वरीय वेतनमान)	10.06.94
2.	डॉ. सोमेन घोषाल, वैज्ञानिक	वैज्ञानिक (वरीय वेतनमान)	27.07.98
3.	श्री राधा सिंह, वैज्ञानिक, वरीय वेतनमान	वरीय वैज्ञानिक	27.07.99
4.	डॉ. निरंजन प्रसाद, वैज्ञानिक	वैज्ञानिक (वरीय वेतनमान)	30.08.01

5.	डॉ. शैलेन्द्र कुमार यादव, वैज्ञानिक	वैज्ञानिक (वरीय वेतनमान)	14.09.02
6.	श्री अरूण कुमार, त्रिपाठी, कनीय लिपिक	वरीय लिपिक	03.05.03
7.	श्री कृष्णानन्द सिन्हा, सहायक	सहायक प्रशासनिक अधिकारी	29.11.03

एस.एस.जी. III से IV

क्र.सं.	नाम	पदनाम	वेतनमान
1.	श्री सुकरा एक्का	एस.एस.जी IV	2750-70-3800-75-4400
2.	श्री जगरनाथ नायक	एस.एस.जी IV	2750-70-3800-75-4400
3.	श्रीमती बेदाना देवघरिया	एस.एस.जी IV	2750-70-3800-75-4400
4.	श्री विजय कुमार राम	एस.एस.जी IV	2750-70-3800-75-4400
5.	श्रीमती कमला देवी	एस.एस.जी IV	2750-70-3800-75-4400

एस.एस.जी II से III

1.	श्री महादेव उराँव (के.)	एस.एस.जी III	2650-65-3300-70-4000
2.	श्री वी.पी. कुजूर	एस.एस.जी III	2650-65-3300-70-4000
3.	श्री मंगरा उराँव	एस.एस.जी III	2650-65-3300-70-4000
4.	श्री दीपक कुमार कच्छप	एस.एस.जी III	2650-65-3300-70-4000
5.	श्री चैतु कच्छप	एस.एस.जी III	2650-65-3300-70-4000
6.	श्री गणेश राम	एस.एस.जी III	2650-65-3300-70-4000
7.	श्री मनी महतो	एस.एस.जी III	2650-65-3300-70-4000
8.	श्री राजकुमार नायक	एस.एस.जी III	2650-65-3300-70-4000
9.	श्री धीरज प्र. सिंह	एस.एस.जी III	2650-65-3300-70-4000
10.	श्री बानेश्वर	एस.एस.जी III	2650-65-3300-70-4000
11.	श्री रामाकान्त सिंह	एस.एस.जी III	2650-65-3300-70-4000
12.	श्री रामबालक साह	एस.एस.जी III	2650-65-3300-70-4000
13.	श्री जगरनाथ हंस	एस.एस.जी III	2650-65-3300-70-4000
14.	श्री महाबीर महतो (W)	एस.एस.जी III	2650-65-3300-70-4000
15.	श्री मो. नईम अंसारी	एस.एस.जी III	2650-65-3300-70-4000

एस.एस.जी I से II

1.	श्री बिरसा उराँव, लोधमा	एस.एस.जी II	2610-60-3150-65-3540
2.	श्री दुखा टोप्पो	एस.एस.जी II	2610-60-3150-65-3540
3.	श्रीमती बी.ए. बराईक	एस.एस.जी II	2610-60-3150-65-3540
4.	श्री बन्धन उरांव	एस.एस.जी II	2610-60-3150-65-3540
5.	श्री के.पी. काशी	एस.एस.जी II	2610-60-3150-65-3540
6.	श्री एन. मिस्त्रा	एस.एस.जी II	2610-60-3150-65-3540
7.	श्री इबनय कुमार सिंह	एस.एस.जी II	2610-60-3150-65-3540
8.	श्री बलराम राम	एस.एस.जी II	2610-60-3150-65-3540
9.	श्री सुरेश राम	एस.एस.जी II	2610-60-3150-65-3540
10.	श्री साध ओ उराँव	एस.एस.जी II	2610-60-3150-65-3540
11.	श्री दुकमा उराँव	एस.एस.जी II	2610-60-3150-65-3540
12.	श्री सुरेश पंडित	एस.एस.जी II	2610-60-3150-65-3540
13.	श्री इगनाथियूस लकड़ा	एस.एस.जी II	2610-60-3150-65-3540
14.	श्री रामचन्द्र मंडप	एस.एस.जी II	2610-60-3150-65-3540
15.	श्री बैजू उराँव	एस.एस.जी II	2610-60-3150-65-3540
16.	श्री लूईस एक्का	एस.एस.जी II	2610-60-3150-65-3540
17.	श्री इस्सैया एक्का	एस.एस.जी II	2610-60-3150-65-3540
18.	श्री सूरजनाथ टोप्पो	एस.एस.जी II	2610-60-3150-65-3540

सेवानिवृति

	नाम	पदनाम	सेवा निवृति की तिथि
1.	श्री कुलदीप पाण्डेय	सहायक प्रशासनिक अधिकारी	31.01.2003
2.	श्री सुदर्शन राम	सहायक	31.01.2003
3.	श्री योगेन्द्र पाठक	चौकीदार	31.01.2003
4.	श्री बुद्धु राम	सर्पोटिंग ग्रेड -4	28.02.2003
5.	श्री मरकुस लकड़ा	पावर टिलर ऑपरेटर (से. ग्र. 3)	31.03.2003
6.	डॉ. शंकर कुमार जयपुरियार	वरीय वैज्ञानिक	30.06.2003
7.	श्री कनाई लाल चौधरी	सहायक	31.10.2003

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