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annual report 2001-02

वार्षिक प्रतिवेदन 2001-02

Indian Lac Research Institute

Ranchi, India

वार्षिक प्रतिवेदन 2001-2002

Annual Report 2001-2002

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भारतीय लाख अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
राँची - 834 010, झारखण्ड, भारत
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(Indian Council of Agricultural Research)
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Contents

PREFACE

The main focus during the year lay on taking stock of the grounds covered during the IX Plan period. While the achievements made during the period gives us a sense of satisfaction, it also inspires us to set higher goals for the years ahead. Such moments also provide us opportunity to identify the grey areas in the progress of the institute, in research, management and administration and explore means of overcoming the bottlenecks in achieving the desired results.

The X Plan document is being prepared in the light of the lessons learnt from the past. Suitable shifts have to be made in the research strategies in the light of the changing needs of the lac industry to make the research more useful. More emphasis would be given on integrated farming system on lac for developing more eco-friendly technologies. The lac production technologies would be refined for introducing components that would provide multiple benefits to the system and also ensure sustained productivity.

The economics of lac refining needs to be improved by adopting measures for better efficiency, modernisation of equipment and exploitation for by-products. Industrial participation in lac production, especially, in brood lac production would be more fruitful in achieving desired levels of production.

The liaison between the Institute and the industry grew significantly during the last plan period. We hope it would be reinforced further during the forthcoming years. Joining of hands or people involved in different spheres of lac industry alone can only take the industry to a better future.

Dr KK Kumar
Director

EXECUTIVE SUMMARY

Lac crop and host management for better yield

- Spraying of water at one/two-day interval on *ber* during the months of April and May was found to protect male lac insects from desiccation, ensuring timely fertilisation and production of brood lac on maturity of crop in summer season.
- Suitable range of girth of plants (lower and upper) for lac larvae settlement and producing significant lac encrustation in winter lac crop was found to be 4.5-3.4 cm in *Flemingia semialata*, 4.6-3.4 cm in *F. macrophylla* and 4.4-2.9 cm in *Albizzia lucida*.
- At crop maturity in summer lac crop (*jethwi* 2001), only 33.4 and 37.4% of initial coverage of primary and secondary shoots respectively of *akashmani* resulted in thick lac encrustation, which account for broodlac yield.
- The contribution of different plant components such as main stem, branches, twigs, leaves and roots in six and a half year old *akashmani* plants were 22.8, 20.6, 21, 15 and 20.8 percent respectively, on dry wt. basis.
- Highest yield of bio-mass was recorded in the treatment N_{20} + 1/2 urea + 1/2 FYM which was significantly higher than the control. The yield of sticklac (lac bio-mass) was highest in the treatment N_{20} (inorganic) only.

Lac insect pest suppression

- Release of egg parasitoid *Trichogramma brasiliense* @ 300 insects / tree was found to be most suitable for pest suppression in *jethwi* crop on *kusum*.
- The insecticides *Nukil* (ethofenprox) and *Caldan* (cartap hydrochloride) were found to be effective in the management of lac insect predators.

Lac insect-host plant interaction

- Out of total inoculable shoot length available for lac larval settlement, only 0.82, 0.64 and 5.9m shoot lengths were covered with thick lac encrustation in winter season lac crop (*aghani* 2000-01) in *F. semialata*, *F. macrophylla*, and *A. lucida*, respectively.
- Eight genotypes of *Flemingia* spp. were inoculated with *kusmi* lac strain for raising *aghani* lac crop. Out of these, *F. semialata* (ICPW 201) showed superior lac productivity, producing on an average 187.5g broodlac/bush. The best survival of bushes after inoculation was 87% in two species i.e., *F. paniculata* and *F.semialata*. The former was better for brood production whereas the latter showed cracking during maturity period of *aghani* lac crop. The latter was found suitable for increased productivity as well as quality as compared to the former.
- *F. semialata* (ICPW 201) was found better with regard to larval settlement (33.8%) on primary branches during *aghani* lac crop.
- The maximum mortality of inoculated plants due to stress caused by lac insects and water was recorded as 25% in *F. semialata* and 12.5% in *F. paniculata* (ICPW 200).

Mecahanization of post-harvest operation

- The pedal operated roller type lac scraper developed was tested for its performance using *kusmi* lac sticks. The scraping losses at different roller speed ratios and spring constants were determined and analysed.

Synthesis of nematicide from aleuritic acid

- 9-Hydroxy-Δ^2-nonenoic acid was synthesised from 7-hydroxy heptanal. The unsaturated acid was converted into its methyl ester as methyl 9-hydroxy nonenoate.
- 9-Hydroxy-Δ^2 -nonenoic acid and its methyl ester were evaluated for nematicidal properties against second stage juvenile of root-knot nematode, *Meloidogyne incognita* at 1000, 500, 250, 125 or 62.5 ppm concentration after 24 hrs and 48 hrs exposure. Both the compounds were found to possess good nematicidal activity.

Shellac-based wood varnish and can lacquer

- Two compositions of shellac-based wood varnishes (MSV 001 & MSV 005) were developed in non-spirit solvent system, which compared favourably with commercially available

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Shellac-based wood varnish and can lacquer

- Two compositions of shellac-based wood varnishes (MSV 001 & MSV 005) were developed in non-spirit solvent system, which compared favourably with commercially available

varnishes. The technology of manufacture has been transferred to an entrepreneur in Kerala.

- Two can lacquer compostions were also developed, which passed the mandatory requirements for commercial applications.

Utilisation of gummy mass (a by-product)

- Evaluation of an insulating varnish based on gummy mass, a synthetic resin and commonly used solvents was done through a local consumer, who has reported satisfactory performance when applied on the coils of a 220 kW 6.6 kV electric motor.
- Gummy mass was used as an extender in polyester resin-based sheet moulding compound for preparing fibre-glass reinforced (FRP) sheets. The FRP sheets thus prepared by hand lay-up technique and curing in the cold, possessed good mechanical properties and moderate resistance towards various chemicals. Gummy mass, being cheaper compared to polyester resin, appears to possess potential for utilization in the above fields.

Lac wax-based coating formulation

- Lac wax and bleached lac were used to prepare emulsions for coating of fruits and vegetables in order to extend their shelf life at ambient conditions. Encouraging results were obtained when these emulsions were applied on mango and capsicum.
- Emulsion compsitions based on lac wax, bleached lac and dewaxed lac when coated on mangoes and capsicums extended shelf life upto 10 and 3 days respectively, compared to uncoated samples stored at ambient conditions.

Refuse lac and agro-waste based particle board

- Refuse lac *molamma*, machine-made *passewa* and *kiri* respectively were used to prepare particle boards from *arhar* (*Cajanus cajan*) stick particles. The presence of impurities in the above materials was found to adversely affect the texture and impact strength of particle board. The above materials were also used in combination with phenol-formaldehyde resin to prepare particle boards.
- Surface lamination of particle boards could be done successfully with general purpose polyester resin using chopped glass fibre mat and surface mat as reinforcing materials.

Ad hoc Research Schemes

Forecasting of broodlac yield from *palas*

A multivariate analysis of different parameters, host plant as well as lac insect on the broodlac yield on trees was made using *baisakhi* cum *katki* 2002-2001 crops raised at three locations. Out of the variables studied, broodlac yield per tree, no. of shoot per tree, and pre-incidence of insect predators were found important.

Polyblends of Shellac

Simple method for the manufacture of insulating varnish

A simple method has been developed for the manufacture of baking-type high thermal resistant insulating varnishes based on shellac, synthetic resins and commonly used solvents. The varnishes, so developed, possessed all the basic requirements of insulating varnishes as per IS: 10026-1982. The performance of the insulating varnishes was found to be satisfactory when applied on the coils of 750 kW 6.6 kV and 3.3 kV 400 H.P. electric motors.

Performance of the baking-type varnishes was found to be satisfactory, in preliminary trial, for outside coating of cook-wares by M/s TTK Prestige Ltd., Bangalore. One of the varnishes was found to be satisfactory for the manufacture of laminated sheets based on mica paper by M/s MMTC, Koderma.

Shellac as filler/extender in the manufacture of FRP

Fibre-glass reinforced (FRP) sheets were also prepared by hand lay-up technique using shellac-based baking type insulating varnishes and also by cold curing using shellac as a filler for the synthetic resin based sheet moulding compound. The FRP sheets possessed good mechanical properties and resistance towards various chemicals. Transferred the technology of preparation of FRP sheets by hand lay-up technique by baking as well as by cold curing to a local entrepreneur.

Shellac filled SMC was used for coating on plywood yielding attractive finish similar to 'sunmica'.

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 5.62 °C in January and 23.1 °C in May and mean maximum temperature varied between 25 °C in December and 38.7 °C in May. The total rainfall during the period was 1258.5 mm of which the monsoon rainfall was 1107 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 at 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 :

- 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 55 scientific, 96 technical, 45 administrative and 112 supporting grade posts.

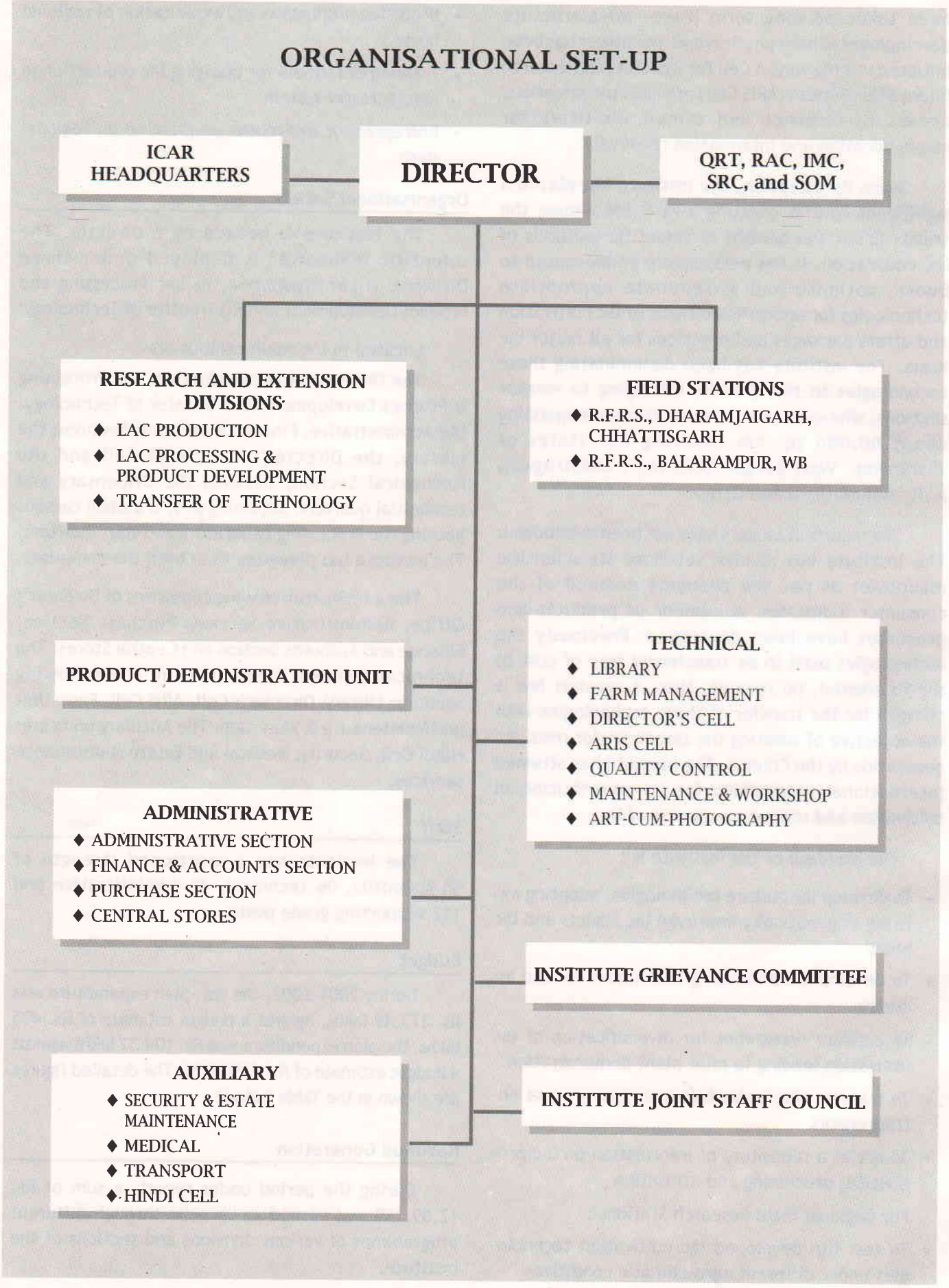
Budget

During 2001-2002, the non-plan expenditure was Rs. 373.49 lakhs, against a budget estimate of Rs. 405 lakhs, the plan expenditure was Rs. 104.37 lakhs against a budget estimate of Rs. 115 lakhs. The detailed figures are shown in the Table below:

Revenue Generation

During the period under report, a sum of Rs. 12,09,139 was earned as revenue through different programmes of various divisions and sections of the Institute.

ORGANISATIONAL SET-UP



Budget during 2001-2002
(in Rs. lakhs)

Head of account	BE : 2001-2002	RE : 2001-2002	Actual expenditure
[A] Plan			
Establishment charges	–	–	–
Wages	–	–	–
O.T.A.	–	–	–
T.A.	3.50	3.50	3.50
Other charges including equipment	54.50	58.50	58.46
Works	7.00	7.00	6.91
Catch-up grant			
Equipment	15.00	15.00	14.92
Works	30.00	20.00	19.97
Other items, HRD	5.00	1.00	0.61
Total	**115.00**	**105.00**	**104.37**
[B] Non-Plan			
Establishment charges	350.00	294.00	290.89
Wages	–	–	–
O.T.A.	0.05	0.05	0.05
T.A.	2.50	2.75	2.74
Other charges including equipment	48.00	70.00	69.86
Works & other items	4.45	10.00	9.95
Total	**405.00**	**376.80**	**373.49**
[C] Pension	89.70	80.00	80.00
[D] P-Loan	8.00	25.00	23.18

RESEARCH ACCOMPLISHMENTS

LAC PRODUCTION

EVALUATION AND IMPROVEMENT OF LAC CROP MANAGEMENT PRACTICES UNDER INTEGRATED AGRO-FORESTRY SYSTEM COVERING SOIL, HOST PLANT AND PEST MANAGEMENT

To evolve management practices of *kusmi* lac production on *ber*

An experiment was laid out in RBD on the basis of indication obtained last year to evolve schedules of water spraying during summer for good broodlac production. The schedules of water sprayings were daily, alternate day, two days interval, weekly and without spraying, which served as control, and were replicated five times. Each treatment consisted of three *ber* bushes and sufficient plants were left along the borders of a block to avoid the drift of spraying from one plant to another.

Seventy-five *ber* trees were inoculated with brood lac, in February of seven g/m estimated shoot length. Water spraying of *ber* trees was done as per schedule during April and May till the onset of monsoon. Samples of 9 cm. long lac stick were drawn from trees before spraying and after 3 and 6 weeks of spraying, for recording subsequent changes in lac insect population. At crop maturity, random samples of lac stick, each of one meter length, were drawn from every treatment and the quantity of stick lac obtained after scraping and drying from each sample was recorded. Broodlac obtained from each treatment was inoculated on five *ber* bushes for *aghani* lac crop.

Significant difference was observed in male mortality between control and in various treatments of water spraying where, daily water spraying exhibited lowest mortality to the tune of 32% as against 82.7% in control. Difference in mortality of females on the other hand was not significant. Non-significant differences were recorded in the surviving female percentage after sexual maturity. All the treatments produced lac bearing sticks. The highest sticklac yield per metre brood lac used was obtained with alternate day spraying (0.42g). In control it was 0.24g (Table 1).

It was inferred that males were more susceptible to high temperature and low humidity, during pseudopupal stage as they stop feeding during that stage. It was also observed that emergence of surviving males in control was delayed by 10 days which caused difficulty in mating with the aged mature females. Males under this stage also showed sluggishness and were short lived. However, performance of brood lac obtained in alternate day and at two days interval sprayings was found to be better during *aghani* crop season.

Table 1 Performance of *kusmi* lac insect during summer (*jethwi*) lac crop on *ber* in 2001

Water spraying schedule	Mortality at sexual maturity (%)		Surviving female after sexual maturity (%)	Stick lac yield per metre brood lac length (g)	Yield ratio
	Male	Female			
Daily	32.04	18.93	55.74	0.31	3.62
Alternate day	36.62	10.32	49.92	0.42	4.10
2-day interval	32.58	16.56	52.94	0.36	2.05
Weekly interval	45.12	16.02	37.14	0.38	1.42
Control	82.72	15.50	45.84	0.24	1.32
Mean	41.82	15.54	51.32	0.34	2.50
S. Em.	4.53	4.15	5.99	0.21	0.28
CV %	24.25	59.97	26.09	13.51	25.28
CD at 5%	13.55	NS	NS	0.062	0.84
CD at 1%	18.67	–	–	0.085	1.16

Bio-rational approaches for management of pests of lac insect and host plants

Rearing of beneficial parasitoids

Five egg parasitoids viz., *Trichogramma pretiosum*, *T. chilonis*, *T. brasiliense*, *Telenomus remus* and *Trichogrammatoidea bactrae* were reared under laboratory condition on *Corcyra cephalonica* eggs for release under field condition.

Biological control of lac predators by egg parasitoids under field condition

Field release and evaluation of the egg parasitoid *Trichogramma brasiliense* (by means of tricho-cards) were carried out during *jethwi* 2001 crop on *Schleichera oleosa* (*kusum*) in the ILRI farm. The release dose rates of the egg parasitoids were @ 100 (T_1), 200 (T_2), and 300 (T_3) insects per tree in the crop. Altogether six releases were made during 3rd, 4th, 6th, 7th, 9th and 10th week after inoculation, coinciding with the peak period of incidence of the population of both the predators. An insecticidal treatment was also included for comparison. A marginal reduction was observed in the population of both the predators, *Eublemma amabilis* and *Pseudohypatopa pulverea* by about 6.9 - 15.6% and 10.2-21.30% respectively. The yield ratio (brood obtained to brood used) was 2.68, 5.91, 5.77 and 1.60 in case of T_1, T_2, T_3 and control, respectively. Sticklac obtained per kg broodlac was 530 g in case of T_3. It was observed that the reduction in the population of *E. amabilis* was greater by release rate of 300 insects per tree compared to other release rates and insecticidal treatment (Table 2).

Evaluation of pesticides on lac culture

a) Field evaluation was carried out of safer insecticides viz., *Nukil* 10 EC (ethofenprox) @ 0.005, 0.01, 0.02, 0.03, 0.04 and 0.05 percent, *Caldan* 50 SP (cartap hydrochloride) @ 0.05, 0.075 and 0.1 percent and *Thiodan* 35 EC (endosulfan) @ 0.05 percent against lepidopterous predators of lac insect during *aghani* 2001-02 crop. Insecticidal sprays were carried out on two-month-old lac crop and observations were taken 15 days after treatment. Results have indicated 80-85% control of predators of lac insect with *Nukil* (0.02%) and 70-80% with *Caldan* (0.05%) without any adverse effect on the lac insects.

b) Lac insects developing on *kusum* trees in the farm were sprayed with *Nukil* 10 EC (ethofenprox) @ 0.005, 0.01, 0.02, 0.03, 0.04 and 0.05 percent for management of *Chrysopa* sp. Observations were taken within 24 hours of spraying. Severe knockdown effect of the insecticide was observed in case of all the treatments as the *Chrysopa* larvae were dislodged from the trees and fell on the ground, which later on were dragged away by ants.

c) Five dosages of *Nukil* (0.005, 0.01, 0.02, 0.03 and 0.04 percent) were sprayed on lac insect colonies during *katki* 2001 crop, ten days prior to the probable date of male lac insect emergence. The treatment did not have any detrimental effect on the insects, as emergence time of male lac insects was at par in treatment and control and the emerged males mated and fertilised the females without any difficulty. Thus *Nukil* can safely be applied 10 days prior to male lac emergence time.

d) For recording the effect on lac yield, *katki* 2001 crop was sprayed at one month stage with *Nukil* (0.05, 0.01 and 0.02 percent), *Caldan* (0.05, 0.075 and 0.1 percent) and *Thiodan* 0.05 percent. Yield of broodlac under *Nukil* treatment was 3 to 8 times higher than that of control and 3 times more than *Thiodan*. The yield in case of *Caldan* treatment was 3-4 times higher than control and 1.3 to 2 times more than *Thiodan* treatment.

Management of important lac hosts under agro-forestry system for *kusmi* lac production

Lac based cropping model for *bari* (Tanr I/ Upland) was laid out to integrate lac cultivation with general agriculture for sustainable lac and higher biomass production per unit area and time. The model consisted of four lac hosts of different canopy spread and height, viz., *bhalia* (*Flemingia macrophylla*), *semialata* (*F. semialata*), *galwang* (*Albizzia lucida*) and *ber* (*Zizyphus mauritiana*), which were raised along the boundary of the field and the main plot was utilized for raising of vegetable crops namely, okra (*Abelmoschus esculantus*), French bean (*Phaseolus vulgaris*) and bitter gourd (*Mamordica charantia*).

The winter season lac crop (*aghani* 2000-01), raised on two *Flemingia* spp and *A. lucida*, was

harvested towards the end of February 2001. Ratio of broodlac obtained to broodlac used were 2.46, 1.50 and 5.55 whereas, total scraped lac obtained to scraped lac of brood used were 2.62, 1.89 and 4.38 in *F. semialata*, *F. macrophylla*, and *A. lucida*, respectively. At crop maturity, out of the total inoculable shoot length available for lac larvae settlement, only 0.82, 0.64 and 5.9m shoot lengths were covered with thick lac encrustations in *F. semialata*, *F. macrophylla*, and *A. lucida* respectively, which can be utilized for broodlac purposes. The suitable ranges of girth of plants (lower and upper) for lac larval settlement for producing significant lac encrustation were 4.45-3.42 cm in *F. semialata*, 4.58-3.41 cm in *F. macrophylla* and 4.40-2.92 cm in *A. lucida*. These host plants were also exploited for summer season lac crop (*jethwi* 2001), and the insects survived and completed their life cycle till maturity on *F. macrophylla*. Lac insects, however, failed to complete their life cycle and yield was not significant on *F. semialata* and *A. lucida*.

Plant growth attributes before lac inoculation for winter season lac crop (*aghani* 2001-2002) have been presented in Table 3. Almost all plant growth characters of *F. macrophylla* were better compared to those of *F. semialata*. Four host plants, raised around the boundary of the field, were exploited for *aghani* 2001-02 lac crop and the crop was developing well. It was also noticed that removal of 5-6 lower leaves of *Flemingia* spp., just before the inoculation for *aghani* lac crop, was beneficial for settlement and development of lac larvae.

Three vegetable crops (mentioned above), were raised in the main field during the monsoon season under rain-fed condition. Low yield was obtained due to incessant rain after sowing. The yield of okra was, however, 15 q/ha.

Management of *akashmani* (*Acacia auriculaeformis*) for lac cultivation

The study is aimed at developing a suitable technique for rapid raising of *akashmani* plantation through agronomic manipulation for *kusmi* lac cultivation, under rainfed condition. Two experiments were laid out in split plot design to study the effect of plant densities, height of

Table 2 Field release of *Trichogramma brasiliense* against lepidopterous lac predators in *jethwi* 2001 crop raised on *kusum* (*Schleichera oleosa*)

Treatment	*E. amabilis*		*P. pulverea*		Broodlac obtained per kg used (kg)	Sticklac obtained per kg broodlac (kg)
	Mean no. per kg broodlac	Percent reduction over control	Mean no. per kg brood lac	Percent reduction over control		
T_1 -100 insects/tree	150	6.87	45.0	16.66	2.68	0.405
T_2 -200 insects/tree	148	7.5	48.5	10.18	5.91	0.490
T_3 -300 insects/tree	135	15.6	42.5	21.29	5.97	0.530
T_4 -Insecticide	149	6.87	41.5	23.14	1.60	-
T_5 - Control	160	-	54.0	-	1.60	0.395

Table 3 Growth attributes of different lac host plants prior to lac inoculation for *aghani* 2001-2002

Lac hosts	Plant height (m)	Basal girth (cm)	No. of tillers/ bush	Total shoot length (m)	Inoculable shoot length (m)	Canopy spread (cm) N-S	Canopy spread (cm) E-W
Flemingia macrophylla	2.58	6.01	21.18	37.05	18.68	151.10	177.60
Flemingia semialata	1.24	3.00	13.40	16.56	9.66	79.80	84.47
Albizzia lucida	3.51	24.33	10.00*	32.46	15.61	211.67	258.00
Zizyphus mauritiana	3.30	17.40	10.5*	30.38	10.38	240.00	204.00

*Primary branches

coppicing with different levels of fertiliser. Plants raised at different plant densities with fertiliser levels were exploited with *kusmi* strain of lac insects for raising *aghani* 2000-01 crop, which was later harvested towards the end of February, 2001. High plant densities (2778 plants/ ha) played a major role in increasing the yield of harvested bio-mass (dry wt.), broodlac and stick lac (scraped lac) by 256.0, 219.8 and 217.5 percent respectively over low plant density (694 plants/ ha). During the summer season lac crop (*jethwi* 2001), primary and secondary shoots had only 33.4 and 37.4 percent of initial coverage respectively and the dense lac encrustation accounted for broodlac yield.

Similarly, plants raised to study the effect of height of coppicing with different fertiliser levels, were also exploited for winter season lac crop (*aghani* 2000-01). Plants coppiced at 60 cm above the ground level, were found to be superior to those of other treatments. The highest harvested bio-mass (dry wt.) production was 20.46 tonnes/ha at fertiliser level of 120, 160 and 80 g./plant of N + P_2O_5 + K_2O respectively.

Destructive sampling was carried out on six and half year old *akashmani* plants and it was found that the contribution of different plant components such as main stem, branches, twigs, leaves and roots were 22.84, 20.56, 21.03, 15.00 and 20.75 percent respectively on dry weight basis.

Nutrient management in soil for maximising lac yield

Effect of nitrogen on plant growth and lac yield of palas

All trees, inoculated with 20 g broodlac per metre shoot length during October 2000, were harvested during October 2001. Weight of harvested biomass and stick lac yield for different treatments are shown in Table 4. Highest yield of bio-mass was found in the treatment T_2 followed by T_5 and T_8. It was also observed that for the same level of nitrogen treatment, effect of addition of FYM had yielded more bio-mass. The yield of sticklac (lac bio-mass) was highest in T_6 where only 20g of inorganic nitrogen was applied. However, the same dose of nitrogen when supplemented in organic form (FYM) produced significantly low yield of lac.

Table 4 Effect of inorganic and organic nitrogen on harvested bio-mass and sticklac yield

Treatments	Harvested bio-mass (kg)	Sticklac (kg)
T_1- Control	0.45	0.26
T_2- N_{20} (1/2 Urea + 1/2 FYM)	0.87	0.34
T_3- N_{40} (1/2 Urea + 1/2 FYM)	0.72	0.42
T_4- N_{60} (1/2 Urea + 1/2 FYM)	0.63	0.56
T_5- N_{80} (1/2 Urea + 1/2 FYM)	0.78	0.39
T_6- N_{20} inorganic	0.76	0.66
T_7- N_{40} inorganic	0.50	0.46
T_8- N_{60} inorganic	0.76	0.44
T_9- N_{80} inorganic	0.65	0.34
T_{10}- N_{100} (1/2 inorganic + 1/2 organic)	0.67	0.39
GM	0.68	0.43
CD 5%	0.2030	0.1924
CD 1%	0.2744	0.2601

IMPROVEMENT IN PRODUCTIVITY AND QUALITY OF LAC THROUGH DIFFERENT BREEDING APPROACHES FOR INSECT AND THEIR HOST PLANTS

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

Evaluation of Flemingia *spp. as* kusmi *lac host*

Plants of eight biotypes of *Flemingia* spp. namely, *F. macrophylla* (ICPW 193, 194, 196, 198), *F. paniculata* (ICPW 200), *F. semialata* (ICPW 201), *F. stricta* (ICPW 202) and *F. strobilifera* (ICPW 204), collected from ICRISAT, Hyderabad were raised from seeds and grown in RBD with 4 replications after transplanting. These plants were pruned in January - February and six month old shoots were utilized for raising *aghani* (2001-02) lac crop of *kusmi* strain of Indian lac insect. The data on plant attributes (Table 5) revealed that the maximum variation in inoculable shoots per bush was found in *F. macrophylla* (ICPW 193) and *F. paniculata* respectively, followed by in *F. macrophylla* (ICPW 196 & 198) and *F. semialata* respectively. °The length of settlement of lac insects on primary branches was found maximum (33.8%) in *F. semialata* though the maximum length (1.05 m) of primary shoots was recorded in *F. stricta*. The maximum length of internode (23.8 cm) and diameter (1.8 cm) were found in *F. semialata*. The mortality of plants due to lac insect stress and water was

Table 5 Performance of different plant attributes of *Flemingia* spp. for *aghani* lac crop 2001-02

Treatments	Total number of shoots per bush	Inoculable no. of shoots per bush	Number of inoculated shoots per bush(%)	Length of primary shoots / bush (cm)	Length of initial larval settlement on primary shoots/bush (%)	Internode length (cm)	Diameter of primary shoots (mm)	Survival of inoculated plants (%)	Mortality of plants (%)
T2 *F. macrophylla* (ICPW 193)	4.6	4.25	91.4	423.9	33.7	13.0	15.5	68.75	6.25
T3 *F. macrophylla* (ICPW 194)	6.1	4.7	78.2	543.4	33.7	15.8	12.4	68.75	0.00
T4 *F. macrophylla* (ICPW 196)	4.2	3.6	84.7	501.5	25.4	13.2	14.4	60.75	6.25
T5 *F. macrophylla* (ICPW 198)	4.8	4.2	86.5	623.8	28.7	14.4	14.3	56.25	0.00
T6 *F. paniculata* (ICPW 200)	4.7	4.4	94.6	565.6	29.8	15.0	16.5	87.5	12.5
T7 *F. semialata* (ICPW 201)	4.7	4.1	87.2	618.4	33.8	23.8	18.1	87.5	25.0
T8 *F. stricta* (ICPW 202)	15.3	8.3	53.9	1046.8	33.4	20.1	17.2	62.5	0.00
T10 *F. strobilifera* (ICPW 204)	14.3	5.8	40.9	460.9	21.3	10.1	09.2	62.5	0.00
CD at 1%	4.4**	3.45**	–	N.S.	N.S.	8.2**	N.S.	–	–
h^2	81.0	33.0	–	–	–	42.0	–	–	–
GA	13.74	4.53	–	–	–	5.15	–	–	–

Table 6 Performance of lac yield attributes of different *Flemingia* spp. at crop maturity in *aghani* lac crop 2001-02

Treatments	Length of lac coverage on primary branches per bush (%)	Length of lac coverage on secondary branches per bush (%)	Brood yield on primary branches /bush (%)	Brood yield/ m(g)	Scrap lac yield /m(g)	Brood yield/ bush (g)	Scrap lac yield /bush (g)	Biomass /bush (Kg)	Lac yield/ living cell (mg)	Total no of cell/g	Surviving mother cell (%)
T2 *F. macrophylla* (ICPW 193)	41.2	46.3	72.7	118.8	46.7	284.4	56.1	0.890	58.0	31.1	55.5
T3 *F. macrophylla* (ICPW 194)	58.2	70.8	86.6	128.7	71.7	103.5	79.6	0.950	29.1	47.8	71.7
T4 *F. macrophylla* (ICPW 196)	25.2	51.6	88.7	151.7	70.0	116.5	80.0	1.140	31.1	41.8	77.0
T5 *F. macrophylla* (ICPW 198)	19.0	27.1	66.4	116.2	62.5	101.6	73.0	0.880	32.7	43.4	70.3
T6 *F. paniculata* (ICPW 200)	22.6	34.1	74.9	160.6	57.3	111.4	66.0	0.477	35.9	47.0	59.1
T7 *F. semialata* (ICPW 201)	36.6	80.0	100.0	187.5	128.8	364.5	139.3	1.510	33.4	36.6	81.8
T8 *F. stricta* (ICPW 202)	38.0	69.2	20.7	93.7	37.3	161.7	43.9	0.717	35.1	45.1	63.1
T10 *F. strobilifera* (ICPW 204)	66.5	63.3	69.1	163.2	33.5	125.4	36.7	0.264	38.2	36.3	72.0
CD 1%	–	–	–	N.S.	–	222.22	228.32	0.58	–	–	–
h^2	–	–	–	–	–	42.00	44.0	35.0	–	–	–
GA	–	–	–	–	–	7.74	8.32	5.37	–	–	–

recorded to be 25% in *F. semialata*, followed by 12.5% in *F. paniculata* and 6.25% in both the biotypes of *F. macrophylla* (ICPW 193 and 196) after inoculation during *aghani* lac crop.

The data (Table 6) at crop maturity revealed that the maximum yield of brood lac and bio-mass per bush were 364.5 g and 1.51 kg respectively in *F. semialata* followed by 284.4 g brood in *F. macrophylla* (ICPW 193) and 1.14 kg bio-mass in *F. macrophylla* (ICPW 196). The maximum (88.7 and 86.6%) brood yield was produced on primary branches in *F. macrophylla* (ICPW 196 and 194 respectively), though brood yield only on primary branches was recorded in *F. semialata* in which brood and scraped lac yield/m were 187.5 and 128.8 g during the first crop season of *aghani* after pruning. The maximum surviving mother lac insects (81.8%) having productivity potential of 33.4 mg per cell and 36.6 number of cells per gm of lac were recorded in *F. semialata*.

Collection, maintenance and evaluation of lac insect stocks

An exhaustive survey of selected areas in Kerala and Tamil Nadu was undertaken during January-February 2001 to explore the availability and to collect lac insects and host plants. Wild populations of *Kerria* spp. were recorded on *Ziziphus mauritiana* and *Albizzia saman* and *Paratachardina* sp. on *Pongamia pinnata* at Madurai in Tamil Nadu. These were in addition to those reported earlier from Kerala (Ann. Rep. 1999-2000). Samples of living as well as dead lac insects along with seeds of *Acacia auriculaeformis* and *A . saman* were collected for further studies (Table 7). No lac insect was observed

Table 7 Collection of lac insects from different places

Date	Place (State)	Host-Plant	Remarks
27.01.01	Thrissur (Kerala)	*Amhertsia nobilis*	Living and mature
	Palghat (Kerala)	*Albizzia saman*	Living and immature
28.01.01	Kumarakom (Kerala)	*A. saman*	Host plant seeds collected
		A. auriculaeformis	Host plant seeds collected
30.01.01	Madurai (Tamil Nadu)	*A. saman*	Male formation stage
	Madurai (Tamil Nadu)	*Ziziphus mauritiana*	Dead insect
	Madurai (Tamil Nadu)	*Pongamia pinnata*	*Paratachardina* sp. immature

Table 8 Evaluation of lac insect stocks

Collected from	Life cycle	Average Life Period (days)	Male percent Range (Average)
Bangalore (Karnataka)	June-December-June	158-221	68-100 (82)
Thrissur (Kerala)	February-August-February.	191-continuing	60-81 (67)
Amsoi (Assam)	May-October-May	150-215	45-64 (54)
Jodhpur (Rajasthan)	July-November-July	112-224	38-59 (48)

Table 9 Biological and industrial parameters of lac insect from different hosts

Host Plant	Colour index	Life (min)	Flow (mm)	Lac insect survival on (%)
Acacia auriculaeformis (*akashmani*)	9.5*	52	–	4* (26.7)
Albizzia lucida (*galwang*)	12.5	54	61	12* (80.0)
Flemingia macrophylla (*bhalia*)	16.0*	46	50	10 (66.7)
Schleichera oleosa (*kusum*)	13.0	64	57.5	8 (53.3)
Ziziphus mauritiana (*ber*)	11.5	48	55	12* (80.0)

* Significant at 5%

in Kochi, Kottayam and Idduki in Kerala and Salem in Tamil Nadu. During the survey of Sarguja in Chhatisgarh during November-December 2001, lac insect was observed on seven lac hosts viz., *Acacia catechu, Butea monosperma, Peltoforum ferrugenium. Schleichera oleosa, Ziziphus mauritiana, Z. xylopyra, Katai* and *Tewar* (local names). Lac insect was collected from only *S. oleosa* host as the insects were in immature stage on other hosts. Vegetative cuttings from some of the hosts were also collected and have been planted for multiplication.

Four stocks of lac insects collected earlier from different parts of the country were maintained on potted plants of *bhalia (Flemingia macrophylla)* and have been evaluated for life period and sex ratio at Ranchi conditions. Number of days taken to complete one cycle and sex ratio observed during each crop are shwon in Table 8. In addition, seven stocks of lac insects viz., *kusmi* crimson, *kusmi* crimson early, *kusmi* yellow, *rangeeni* crimson are being maintained.

Lac insect breeding

F_{12} progeny, obtained from cross of Orissa *kusmi* yellow female and trivoltine crimson expressing yellow colour and trivoltine characteristics, is being maintained under potted conditions. However, larval emergence of selected progeny particularly during October - November continued for more than 30 days in comparison to 10 -15 days for the parental stocks. Field trials will be taken after biological parameters get stabilized.

Lac insect and host plant interaction

The experiment was laid out in RBD having six treatments (lac hosts) and three replicates (plots). Every plot contained 16 plants planted in 1996 at 1x1 meter distance. Five randomly selected plants from each plot were inoculated with broodlac obtained from *kusum* in July, 2000 with *kusmi* crimson strain of *Kerria lacca* (Kerr). The crop matured in February, 2001. The resin obtained from each plot was converted to seedlac and analysed for resin dye and life. Survival of lac insect on each plant was also recorded after one month of inoculation (Table 9).

Significant differences were observed in crop survival and colour index of resin obtained from different hosts. No conclusion could be drawn for life and flow properties. Lac insect survival on *Acacia auriculaeformis* till crop maturity was only 26.7% while on *ber* and *galwang* it was 80%. Colour index of resin was lowest in *Acacia auriculaeformis* followed by *ber, galwang, kusum* and *bhalia.*

Lac host plant tissue and organ culture

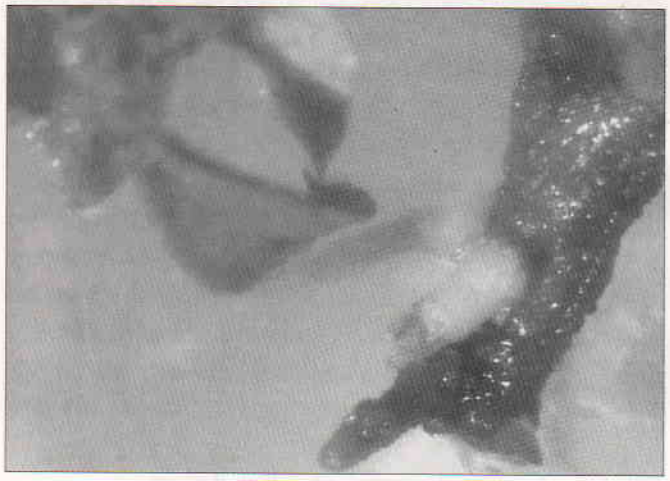


Fig. 1 Initiation of roolets in F. macrophylla *shoot tip culture with PGR analogue incorporated in the MS media*

Exploratory experiment has been carried out for *in vitro* shoot tip culture of *F. macrophylla* using a PGR analogue (10- carboxyl methyl-2-decenoic acid) synthesized from aleuritic acid of lac resin, at the Institute. The PGR analogue, as reported, is supposed to possess herbicidal activity at higher concentrations. To observe its effect at lower concentrations, experiment was carried out on MS media using four different concentrations of the PGR analogue viz., 2.5 ppm, 5.0 ppm 10.0 ppm, 20.0 ppm and control (devoid of PGR analogue). Preliminary observations showed growth of shoot tips in all the concentrations and control with variations in growth rate. Interestingly, at 5.0 ppm concentration of PGR analogue, root initiation was observed after 45 days of inoculation (Fig. 1). This result suggests about the presence of auxin like activity in the PGR analogue, which at lower concentration can initiate root formation. Further experimentation for optimising the concentration of PGR analogue from lac, for *in vitro* rooting of *F. macrophylla* and *F. semialata* shoot tip culture, is under progress.

Mechanization of Post-harvest Operations

Testing of Pedal Operated Roller Type Lac Scraper

The pedal operated roller type lac scraper developed under the project was testes for its

functional performance. The machine scrapes lac under the action of shear and compressive forces. The compressive force acts due to the compression of spring, where as shear force acts due to differential speed of rollers. To determine the effect of two forces on machine performance, five sets of springs (K1, K2, K3, K4 and K5) of different spring constants (7.0, 13.0, 22.4, 24.5 and 29.8 kg/cm) were tried at five different roller speed ratios r1, r2, r3, r4 and r5 (1.2, 1.33, 1.5, 1.66 and 2.0). Experiments were carried out adopting RBD and replicated thrice. The scraping loss was recorded as dependent variable.

Machine was tested using *kusmi* lac sticks, (used up broodlac or *phunki*). One labourer could operate the machine. The labourer did both the jobs i.e., to provide power to the machine by operating the handle with the right hand and feeding of lac stick with left hand. The basket filled with lac stick was kept on a platform at the same level of the feeding hopper for the convenience of the operator. The operator cranked pedal at an average speed of 35-40 rpm.

The following machine performance parameters determined are defined specific for the Pedal Operated Lac Scraper.

Scraping loss

The scraping loss was measured in terms of percentage of lac encrustation remained unscraped and were passed through the machine along with lac stick.

The result of experiment in terms of mean values (%) of the scraping loss at different spring constants and roller's differential speed ratios determined are presented in Table 10. The effects of different design parameters on scraper performance are discussed below.

Table 10 Scraping loss (%) at different rollers' speed ratios and spring constant

Spring Constant	Roller speed ratios				
	r1	r2	r3	r4	r5
K1	15.5	14.5	12.5	8.1	10.4
K2	14.9	14.0	11.5	6.9	9.3
K3	8.6	7.9	7.2	5.4	8.6
K4	8.1	2.4	5.4	3.1	5.6
K5	10.5	9.7	8.9	7.1	8.4

Effect of compressive force on scraping

Spring constant, which contributes to shear force in scraping, affects scraping loss. The scraping loss decreases as the spring constant increases from K1=7.0 kg/cm to K4=24.5 kg/cm (Table 10). However, further increase in spring constant increases the scraping loss. The compressive force breaks the lac encrustation and loosens attachment with the stick. As the spring constant increases beyond 24.5 kg/cm, the lac encrustation is crushed on upper surface and lower portion remains attached with the stick. Further, at higher spring constant or at higher compressive force, shear force becomes less effective in separation of loosened encrustation. The scraping loss was minimum at K4=24.5 kg/cm at all five scraping roller differential speed ratios. It is also evident from ANOVA (Table 11), that effect of compressive force on scraping loss is significant as F value is significant at 1% level.

Effect of differential roller speed ratio on lac scraping

A decrease in scraping loss was observed for an increase of speed ratio from r1 = 1.2 to r4 = 1.66. An increase in scraping loss was noticed for further increase in speed ratio from 1.66 to 2.0.

Table 11 Analysis of variance for the effect of spring constant and speed ratio on scraping loss

Source of variation	Degrees of freedom	Sum of squares	Mean square	Computed F
Replication	2	0.916	0.458	0.889^{NS}
K	4	407.364	101.841	197.562*
r	4	266.125	66.531	129.964*
K x r	16	61.037	3.815	7.48*
Error	48	24.743	0.515	
Total	74	760.186		

^{NS} Not significant

* Significant at 1 % level

The differential roller speed ratio contributes to shear force that helps in separation of loosened lac encrustation. Increase in shear force contributed to better separation of lac encrustation resulting in reduction in scraping loss. But, at very high differential speed ratio, slippage increases and separation is less. Thus, scraping loss increases. The scraping loss was found to be minimum at r4=1.66 speed ratio at all five different spring constants.

The ANOVA in Table 11 also confirms that effect of speed ratio on scraping loss is significant at 1% level. Scraping loss was minimum at spring constant 24.5 kg/cm and differential roller speed ratio 1.66.

Capacity

On testing the machine fitted with spring of 24.5 kg/cm spring constant and roller differential speed ratio 1.66, the capacity was found to be 6 kg/hr in 2 passes (~48kg/day). With traditional tools like scraping knife, one person scraps about 10-15 kg lac sticks in a day. Thus, with the aid of the machine output increases about 3 times. The scraping efficiency was 95% after passing lac stick twice through the machine. It means 5% lac encrustations goes along with lac stick even after lac sticks are passed twice through the machine. If remaining lac encrustations are not scraped, it is lost. Only one person is required to operate the machine. The machine is cheaper and simple in comparison with electric motor operated lac-scraping-cum-grading machine and it is in affordable range for lac growing farmers. Further, it is operated manually and does not require mechanical or electrical power that makes machine suitable for rural use. It does not need skilled labourer for operation and requires least maintenance.

AD HOC RESEARCH SCHEME

Pilot study on forecasting of broodlac yield from *Butea monosperma (palas)*

The second year crop (*Baisakhi*-cum-*katki* 2000-2001) was raised on 110 trees of *palas*, simultaneously at, Bilaspur, Purulia and Ranchi. The biometrical characters were the same as last year. The yield of broodlac per tree was taken as a dependent variable. Based on correlation study, the yield explaining characters were identified from the second year crop data. For Bilaspur, height of tree canopy and diameter, broodlac input, density of living female insects (17-18, 41-42 and 48-49 week stage), length of settlement per shoot, number of shoots with lac insect settlement per tree (41-42 week stage), incidence of parasites (44-45 week stage) showed significant linear relation with yield of broodlac.

The broodlac input at the initial stage of raising lac culture, alone explains 18% variation in yield whereas living female insect density at 17-18 week stage explains only 16%. The three significant characters, viz., number of shoots with lac insect culture, living female density and length of lac insect settlement per shoot at 41-42 week of inoculation explained 67-72% variation in yield as per regression model developed for this purpose. At Purulia also, similar type of result was obtained. Height of host tree canopy, diameter and broodlac input were found significantly linearly related with the yield. Besides, length of settlement per shoot, and number of shoots with lac insect were also significantly correlated. The number of petioles with lac insect per shoot was an additional parameter found to be significantly associated with the yield. Living female insect density at 48-49 and 51-52 week stage was also significantly related with yield as in the case of Bilaspur.

The broodlac input per tree alone explained 34% variation in yield. Upto 41-42 week stage, the number of shoots with lac insect culture and number of petioles with lac culture per tree explained only 41-44% variation in yield. When all the significant paramenters from an early stage upto 41-42 week stage were taken, 56% variation in yield was explained. The model includes number of shoots with broodlac input, number of petioles and density of parasites. The parameters, which were found significantly associated with yield at an early stage, are tree canopy height, diameter and broodlac input for Ranchi district. The other significant characters include length of settlement per shoot, number of shoots with lac insect culture (41-42 week stage), incidence of parasitoids at 44-45 week stage and living female density. At early stage, the host trees' crown height alone explained 25% variation in the yield. The number of shoots at 41-42 week stage alone explained 25% variation in yield. There is improvement in R^2 value further at later stage of crop growth.

The pooled data for two years for Bilaspur and Purulia indicate 78% and 90% variation in brood lac yield respectively upto 41-42 week stage, which

correspond to 10-12 weeks before harvesting. The model is as follows.

Bilaspur : $Y = -0.395 + 0.0463*BI + 0.062*SN$
(+ 0.142) (+0.003)

Purulia : $Y = -0.565 + 0.325*BI + 0.112*Pre + 0.070*SN$
(+0.208) (+0.041) (+0.002)

Where BI = Broodlac input per tree (kg). SN = number of shoots with lac per tree; Pre = Incidence of insect predators (no. /30 cm shoot).

The third year crop was raised during October 2001 on pruned trees at all the three selected sites (Bilaspur, Purulia and Ranchi).

RFRS, Balarampur

During the period under report, the following activities were carried out.

Research

1) Exploratory trial for determining the rate of inoculation on *Flemingia semialata* bushes and other related aspects.
2) The *aghani* 2000-2001 crop under different experiments was harvested and data regarding yield and yield attributes were recorded and analysed.
3) *Ber* plants within the office premises were pruned for utilization during the next crop season.
4) A new plot consisting of approx 300 nos. of *F. semialata* plants was established for further experimentation.
5) Regular observations on the plant growth attributes, mortality of insects and other related aspects were carried out. Recommended insecticidal and fungicidal sprays were carried out on the lac crop.
6) Experimental plots were raised and maintained.
7) *Aghani* 2001-2002 crop was raised on *F. semialata* bushes and related data were collected.

Extension

1) An interview was given by Dr. S. Ghosal on the scientific methods of lac cultivation to ETV. It was telecast on 27th Sept. and 4th Nov. 2001 under the programme "Annadata".
2) Participated in the 'Sarada Mela', organised by KVK, Kalyan at Purulia.

Others

Discussion was held with the officials of West Bengal Govt. District Administration, LDO etc. regarding shifting of the station from Balarampur to Purulia. Several probable sites were inspected within Purulia District and assessed the probabilities of establishing the station along with office building and farm area for demonstration etc.

RFRS, Dharamjaigarh

Dept. of Agriculture, Chhattisgarh has allocated 5 ha land at Bilaspur (Village Sakri, Patwari Halka No. 26, Tehsil - Takhatpur, Khasra No.34) for shifting RFRS Dharamjaigarh. In this connection the District Collector, Bilaspur has been requested by the Chief Secretary and the Commissioner of Agriculture Production (Chhattisgarh) for taking necessary action for allotment of the said land to ILRI, Ranchi.

The documents required have already been prepared by the Collector, Bilaspur and the needful is being done for getting approval from the Secretary Revenue, Raipur for handing over the land.

NATIONAL AGRIULTURAL TECHNOLOGY PROJECT (NATP) ON PLANT BIODIVERSITY

An extensive survey of selected areas of Jharkhand state was carried out during March 2002. Three rare genotypes of lac host plant of *Butea monosperma* (*palas*) were observed and collected from Keshdhari village of Nawadih block of Bokaro district. Of the three genotypes collected, one has white flowers, another yellow flowers and the third is unifoliate. The shoot cuttings/ suckers of those trees have been collected for establishment of plantlets. Another lac host plant genotype of *Flemingia chhapar* with broad leaf size has also been collected from Parasnath hills of Giridih district during the survey.

LAC PROCESSING AND PRODUCT DEVELOPMENT

DEVELOPMENT OF VALUE-ADDED PRODUCTS (SEX PHEROMONES, PGR, POLYBLENDS) AND SURFACE COATING MATERIALS FROM LAC RESIN

Synthesis of some bio-active compounds from aleuritic acid

9-Hydroxy-Δ^2 -nonenoic acid was synthesised from 7-hydroxy heptanal (one of the periodate oxidation products of aleuritic acid) adopting simple reaction sequences.

Testing of 9-hydroxy-Δ^2 -nonenoic acid and its methyl ester was undertaken at IARI, New Delhi against the freshly hatched second stage juveniles of the root-knot nematode, *Meloidogyne incognita* at the concentrations of 1000, 500, 250, 125 and 62.5 ppm after 24 hrs and 48 hrs exposure to the test chemicals. Methyl ester of unsaturated acid showed higher nematicidal activity than its corresponding acid which could be observed from comparing percent mortality values of both the compounds at the above mentioned dose levels.

Exploratory experiments carried out on *in vitro* shoot tip culture of *F. macrophylla* using a PGR analogue (10-carboxy methyl - 2 decenoic acid) synthesised from aleuritic acid of lac resin showed an auxin-like activity of the compound at low concentration.

Development of lac varnish for wood, metal lecquers for food packaging and hot melt adhesive

Two shellac-based varnish compositions (*MSV 001* and *MSV 005*) were developed, using a non-spirit solvent system. Besides, the compositions also contain an accelerator (in MSV 001) or a synthetic resin (in MSV 005) to improve upon the film properties. Both the compositions not only compared favourably with popular commercial ones, but were also found superior to, particularly in respect of drying time. The varnishes were prepared on large scale and sent to M/s Pidilite Co. and recently transferred the process knowhow of MSV 005 to an entrepreneur from Kerala.

In continuation of the work reported earlier, two more can lacquer compositions *viz.*, *CANLAC AOO1* and *CANLAC DOO1* were further improved as regards to acid resistance and gloss. The compositions were based on different synthetic resins and dewaxed lac in non-spirit solvent medium. The lacquers were sent to M/s Synthetic & Polymer Industries, Ahmedabad, for evaluation. The characteristics of the can lacquers are shown in Table 12.

Table 12 Characteristics of CANLAC lacquer formulations A001 and D001

Product Code	CANLAC A001	CANLAC D001
Stoving schedule	20 min/200 °C	20 min/200 °C
Finish (unpigmented)	Attractive "gold" finish	Attractive "gold" finish
Viscosity (sec.) by F.C. 4	13.9	21.02
Flash point	>27 °C	>27 °C
Dry film thickness (μ)	16	16
Dry film weight	8 g/m^2	10 g /m^2
Flexibility (double fold)	Passes	Passes
Adhesion (Cross cut adhesion test)	<5%	<5%
Scratch hardness	<1500 g	<1500 g
Impact resistance	Passes	Passes
Gloss	100%	100%
Acetone rub test	Passes	Passes
Acid resistance test	Passes	Passes
Sulphur resistance test	Passes	Passes
Test for shelf-life (6 months)	Passes	Passes

UTILISATION OF BY-PRODUCTS (LAC DYE, WAX, REFUSE LAC) OF LAC INDUSTRIES FOR FOOD GRADE LAC DYE, VARNISHES LACQUER AND BONDING MATERIAL FOR PARTICLE BOARD

Varnish composition based on aleuritic acid free gummy mass

The properties of the high thermal resistant insulating varnish based on gummy mass, a synthetic resin and commonly used solvents were reported earlier.

The varnish was supplied to a local consumer for evaluation. The performance of the varnish has been reported to be very good when applied on the coils of a 220 kW 6.6 kV electric motor.

In order to find out further utilization of the gummy mass, an attempt was made to utilize the above mentioned baking-type insulating varnish for preparing laminated fibre-glass reinforced sheets (FRP) by hand lay-up technique and curing by baking at elevated temperature. The sheets did not possess good mechanical properties (Table 13). The sheets were also found to absorb moisture on storage and become flexible.

Success was however, achieved in using gummy mass (10%) as an extender for the polyester resin generally used for preparing fibre-glass reinforced sheets by hand lay-up technique, curing at room temperature and using needle type fibre-glass mats. The sheets possess good mechanical properties (Table 11) when compared with those prepared using baking type varnish. The mechanical properties were evaluated through CIPET, Lucknow. The arc resistance of the gummy mass based sheets (111 sec) was found to be better than those prepared with polyester resin alone (93 sec), which might have arisen due to the presence of water molecules, if any, while preparing gummy mass. Gummy mass was found to disperse evenly within the polymer matrix.

Study on resistance of the FRP sheets, prepared by cold curing towards various chemicals, was also investigated. Gummy mass based FRP sheets showed resistance towards water, transformer oil, kerosene oil. These were found to remain unaffected up to seven days when dipped in acetic acid (25%), NH_4Cl (5%), brine solution, HCl (10%), acetone (10%), ethyl alcohol (50%). The sheets, however, were not resistant towards alcohols.

Thermal resistance of the sheets was found to be 158°C, which was intermediate between those of gummy mass and polyester resin (180°C). It is expected that gummy mass, being cheap (Rs 40/kg), will reduce the cost of the final products.

Water absorption (after 24 hrs immersion in water) was found to be 0.41% for FRP sheets containing polyester and 10% gummy mass. Water absorption after immersion in boiling water (for 30 min) was found to be 0.51%. Gummy mass-free polyester resin based FRP sheets, however, absorbs only 0.08% water under similar tests. Use of gummy mass more than 10% resulted in tackiness in the finished product unless prepared carefully.

Rheological study of gummy mass

The study was made for characterisation of gummy mass. The viscosity of gummy mass at 35°C was found to be 150 PaS, as determined with the help of a Cone and Plate Haake Rheometer. The yield point (which is the minimum force required for flow) was determined to be 105 Pa.

Gummy mass was also characterized by the measurement of specific heat.

Development of lac wax based formulations

A few emulsion compositions were prepared by increasing the solid content upto 25%. These emulsions, which were stable at room conditions, were tested on mango and capsicum for their effectiveness in enhancing the shelf-life of these materials kept at ambient conditions.

Fully matured, unripe mangoes (CV. *Dusheri*) were coated with three different emulsion formulations (T_1, T_2, T_3) by spraying. Properties like physiological loss in weight and the changes in firmness, titrable acidity, total soluble solid content and the organoleptic characteristics of the coated as well as uncoated control samples were determined periodically throughout the storage period (Table 14).

Wax treatment was found to be effective in preventing the weight loss and maintaining the firmness of the fruits. Minimum weight loss and maximum value of firmness were found in the samples coated with emulsion T_1. Coated fruits also showed less variation in acidity, total sugar and total soluble solid content. Based on sensory evaluation and weight

loss, an extended life of 8 -10 days was found in case of mango samples coated with emulsion T_1.

In another experiment, capsicums were coated with these emulsions by directly dipping and then stored at ambient conditions (15-20°C, 40-60% RH). Weight loss, changes in a ascorbic acid content and sensory qualities were compared with non-coated samples during the storage period. 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.

Use of refuse lac/by-products/modified lac for making particle board/composite from various agrowastes

As per suggestions of Staff Research Council (SRC), the refuse lacs namely, *molamma*, machine made *passewa* and *kiri* were tried separately for making medium density particle boards from *arhar* (*Cajanus cajan*) stick particles. *Molamma* is obtained at the time of washing lac while *passewa* and *kiri* are obtained during the preparation of machine-made shellac. Particle boards of 12 mm thickness were

Table 13 Characteristics of fibre glass reinforced sheets prepared in absence or in presence of gummy mass

Characteristics	FRP based on polyester resin alone curing in the cold	FRP based on polyester resin + gummy mass curing in the cold	FRP based on gummy mass based baking-type of varnish
Tensile strength (kgf/cm²)	586	463.5	99.1
Tensile modulus (kgf/cm²)	17,680	18,947	7,818
Flexural strength (kgf/cm²)	953	880	*
Flexural modulus (kgf/cm²)	37,016	48,643	*
Izod impact strength (kg cm/cm of notch)	73	70	35.2
Arc resistance (sec)	93	111	25

*Since the gummy mass based baking type varnish yields flexible films, flexural parameters were not determined.

Table 14 Effect of different emulsion coating formulations on physico-chemicals qualities of mangoes (CV. *Dusheri*) during storage (20-30°C, 70-90% RH)

Storage Period	Physiological loss in weight (%)				Firmness (no.)				Acidity (%)			
(Days)	C	T_1	T_2	T_3	C	T_1	T_2	T_3	C	T_1	T_2	T_3
Initial	-	-	-	-	-	-	-	-	-	0.8	-	-
4	9	5.6	6.6	6.4	18	26	22	25	0.16	0.32	0.3	0.26
8	16	8.7	"	"	12.5	17.5	15.5	16	0.07	0.21	0.18	0.11
12	-	10.7	13.8	14.6	-	15.2	16	15.7	-	0.08	0.06	0.07
16	-	12	15	17.6	-	14.2	14.5	13.8	-	0.05	0.04	0.04
20	-	13.5	16	18.3	-	13.5	13.5	12.5	-	0.03	0.03	0.02

Storage Period	Total soluble solid (°BX)				Total Sugar(%)				Sensory score (out of 10)			
(Days)	C	T_1	T_2	T_3	C	T_1	T_2	T_3	C	T_1	T_2	T_3
Initial	-	8.5	-	-	-	-	6.36	-	-	-	-	-
4	19.8	17	16.8	16.4	16	14	13.2	12.2	8.5	7	6.6	7.2
8	17.2	16.6	16.4	16.2	14	15.5	13.5	13	7.5	8	6.7	8
12	-	17.2	17	16.5	-	13	15	13.7	4.5	8.5	7	7.5
16	18	17.5	17.2	-	-	14.7	19.7	15.2	-	7.5	5	5.5
20	-	20	18.8	18	-	16.5	16	15.5	-	6	5	5

prepared using varying percentage of the above materials (12%, 15%, 20% and 30%) as binders. As expected, the density and impact strength of particle boards were found to increase with the increasing percentage of binder. Particle board made using machine-made *kiri* showed comparatively lower impact strength due to the presence of large amount of impurities. The impurities in the above materials were also seen to affect adversely the texture of the particle boards. Hence, experiments were carried out to prepare particle boards using *molamma* and machine made *kiri* separately in combination with phenol-formaldehyde (PF) resin. Different proportions of *molamma* and machine made *kiri* were mixed with PF resin separately such as 30:70, 40:60, 50:50, 60:40 and 80:20. Particle boards were made with the above binder compositions keeping the binder level as 12%. The ratios upto 60:40 of *molamma* and PF resin while 50:50 of machine made *kiri* and PF resin were found to be satisfactory.

Surface lamination of particle boards was successfully carried out with general purpose polyester resin using chopped glass fibre mat and surface mat as reinforcing materials. TiO_2 and ZnO were used with polyester resin to give opaque surface finish.

Further work to make particle boards conforming to IS specifications is in progress.

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

During the period under report, work was initiated for fabrication of the machine designed last year. Three different designed chambers were fabricated for different operations which are performed in *bhatta* process. These are Main Heating Zone, *Kiri* Zone and Product Zone for performing different operations like melting of seedlac, *kiri* removal and product formation respectively. The overall size (L x B x H) of this machine is 170 x 57 x 125 cm^3. The designed hot air blower system of 2kW capacity was fabricated and fitted with the main chamber at scraper end of the machine. A recirculation duct of size (14 x 15 cm^2) was fabricated and fitted in the suction line of the machine with provision of different suction opening of duct controlled by a flow control knob. The main heating chamber of the machine was tested for 1-2 hr. of running time for determining the temperature rise in case of bare surfaces of chamber. The maximum temperature was found to be 100°C near scraper, by controlling air flow passage of duct, which is designed as the maximum value. For squeezing of bag and scraping of molten material from bag, designed scraping mechanism of inner diameter 11 cm and outer diameter 25 cm has been fabricated.

A separate squeezing mechanism for removal of *kiri* in the *kiri* chamber has been fabricated and fitted in the *kiri* chamber. Further, work of fabrication of removal system of shellac and button lac is in progress.

Ad hoc Research Scheme : Polyblends of shellac with synthetic resins/polymers-formulation, characterisation and application studies

The study was initiated with the following objectives : (a) to identify polymers with which blends of shellac can be prepared, (b) to develop artifacts based on shellac and suitable resins/polymers having improved properties compared to shellac especially, with regard to thermal resistance and flexibility for utilisation in electric insulation, (c) to identify polymers for which shellac can be used as an extender and (d) to recommend fields of application of shellac and the polymer.

High thermal resistant, baking-type insulating varnish

A simple method has been developed for the first time for manufacture of several shellac based high thermal resistant baking-type insulating varnishes. The method involves simple blending of solutions of shellac and one or more synthetic resin (syn1, syn2) in suitable solvent system. The varnishes possess all the basic requirements for an insulating varnish as per IS:10026-1982. The films of the varnishes possess high dielectric strength in air (65-100 kV/mm) and this property does not deteriorate much even after immersion in water (60-85 kV/mm) for 24 hrs. The films of the varnishes are flexible (thus reducing the chance of peeling off from the substrate, unlike brittle shellac films) and possessed thermal resistance (measured up to) 230-250°C (compared to 65-75°C of shellac).

The process of manufacture has been perfected up to semi-pilot scale i.e., 20 kg (about 22.2 litres) per batch. The present process of manufacture of

shellac-based baking-type insulating varnish is extremely simple as compared to the earlier method of preparation involving cooking of shellac in drying oil at elevated temperature (290°C) for an extended period of time. Even unskilled entrepreneurs can adopt the process of manufacture and no large machinery or investment is needed.

The performances of the varnishes have been found to be satisfactory when applied on the coils of electric motors (750 kW 6.6 kV, 3.3 kV 400 H.P.). Thus the varnishes will be useful for application on the coils of electric motors, transformers and manufacture of laminated products etc.

The above information is in addition to the previous knowledge that shellac undergoes curing in the cold with butylated melamine formaldehyde, butylated urea formaldehyde and epoxy resin. In all the cases, however, such high thermal resistance and flexible films could not be obtained from the cured products.

Surface and volume resistivity values of baking type of varnishes (measured at 500 V DC) were found to be higher than those of ordinary shellac based varnish, indicating better insulation property of the formers.

The synthetic resins used in the study do not possess resistance towards tracking (syn1) and transformer oil (syn2). The films of the blends with shellac, however, show increased resistance towards tracking and transformer oil. Thus, shellac can be used along with these synthetic resins for imparting these properties for the latter indicating that shellac can be used as extender for the above resins.

It is now confirmed that curing between shellac and two synthetic resins (syn1 and syn2) is possible in cold blending. Subsequent baking of films, leads to improvement in the properties of shellac especially, dielectric strength, flexibility of films, thermal resistance and resistance to water. Thus, all the three weaknesses of shellac i.e., brittleness of films, low thermal and water resistance could be overcome for the first time in a single formulation.

Coating of sole plates of electric irons

One of the varnish compositions (Sh05XB) can be used for coating of aluminium alloy based sole plates of electric irons. Coating has been found to remain unaffected up to 18 months of domestic use. Process of coating in this case is very economical (Rs 10-15 for two coats) and simpler compared to PTFE based sole plates. Recoating can be done easily domestically, if necessary.

External coating on cook-wares

Preliminary testing has been reported to be satisfactory by M/s TTK Prestige Ltd., Bangalore for external coating of cook-wares, carried out with the high thermal resistant shellac based insulating varnishes supplied to them. Rigorous testing is under progress.

Manufacture of laminated mica paper sheets

The varnish composition Sh05XB has been found to be suitable for manufacture of laminated mica paper sheets as reported by M/s MMTC Ltd., Koderma. The firm has shown interest for the transfer of the technology of manufacture of the varnish. The varnish was tested for manufacture of laminated mica paper sheets, which are currently imported.

The varnish composition (Sh05XB) can also be used for providing a decorative coating on aluminium foils, which, in turn, can be used for packaging.

Fibre-glass reinforced sheets

Baking type of varnishes were used for preparing laminated fibre-glass reinforced sheets by hand lay-up technique and baking at elevated temperature. The final product yielded a decorative finish. The sheets possessed good mechanical properties as tested through CIPET, Lucknow.

Shellac can be used as filler/extender along with the synthetic resin based sheet moulding composition (SMC) for manufacture of fibre-glass (FRP) or jute reinforced (JRP) sheets by hand lay-up technique and curing in the cold. Shellac containing (10%) FRP sheets possessed better mechanical properties compared to shellac-free synthetic resin based sheets.

Since, shellac is known to absorb u.v. rays, shellac containing sheets possess an extra advantage that these will not require any additional treatment for making u.v. resistant.

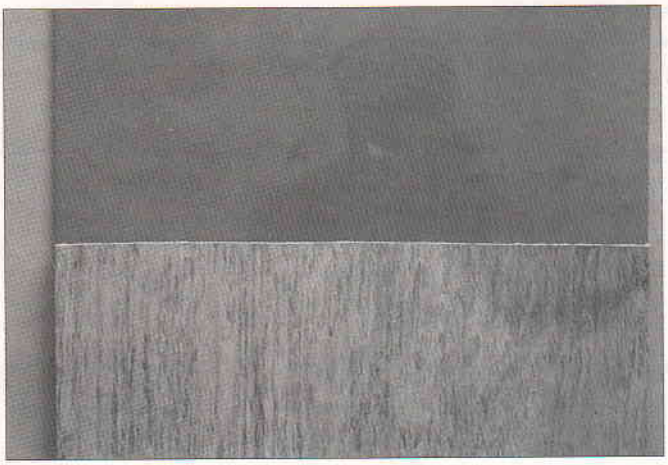


Fig. 2 Plywood laminated with shellac-based formulation

Coating on plywood

Shellac containing sheet moulding compound, for the first time, has been used for coating (laminating) on plywood. The coating provides visually appealing glossy finish similar to that of 'sunmica' type of finish (Fig. 2). The advantage of this type of finish over that of 'sunmica', is that this type of coating will not be removed due to weathering like 'sunmica', if not properly adhered to on plywood.

Transfer of technology

Transferred the technology of preparation of laminated fibre-glass reinforced sheets employing the baking type of varnish ShAKDB by hand lay-up technique, baking at elevated temperature and also by cold curing to an entrepreneur.

Seedlac/sticklac and old shellac can be used also as an extender for the synthetic polyester resin used as sheet molding compound. The thermal resistance obtained (168°C) in the case of moulded sheets was found to be intermediate between that of natural resin shellac (65-75°C) and the synthetic polyester resin (180°C) based sheets. This suggests possible chemical reaction between the reactive groups of shellac and the polyester resin.

Shellac can also be used as an extender for bisphenol and isophthalate polyster resins as sheet moulding compound, as use of shellac along with these synthetic resins did not deteriorate their chemical resistance properties (Table 15). Further, since these synthetic resins are costlier than shellac, the use of the natural resin may reduce the cost of the final product. Thus, shellac possesses potential for use as an extender along with those of the mentioned synthetic resins.

Melt-viscosity of shellac was determined, for the first time, using a modern instrument i.e., a Haake cone and plate Rheometer. The study also has provided information, for the first time, about the yield and thixotropy values of shellac. The melt viscosity of shellac at 100°C was found to be 283 PaS, and the yield point (minimum force required for flow) was obtained 227 Pa. The Flow parameters have also been determined for the first time for shellac-based varnishes.

Studies were also conducted on shellac-free and shellac-containing polyester, isophthalate polyester and bisphenol polyester resins. The study revealed significant change in viscosity of shellac (10%-30%) containing polyester resins (filtered).

Technology Mission on Cotton

Mini Mission (MME-1) "Evaluation of location-specific IPM modules for ecofriendly and sustainable cotton production"

The project has been taken up with the objectives :

a) To synthesise pheromone compounds of cotton bollworm for their eventual use in IPM strategies

b) To carry out qualitative and quantitative studies for pheromones in commercially available formulations (in collaboration with BARC, Trombay)

c) To provide genuine samples of bollworm pheromone components for validation and for mutation of IPM strategies by other co-operating centres to the extent possible.

As per technical programme, literature survey for the synthesis of the following pheromones of cotton pests were completed.

1. *Z*-(9)-Hexadecenal
2. *Z*-(11)-Hexadecenal
3. *Z*-(11)-Octadecenal
4. *E,E*-(10,12)-Hexadecadienal

Table 15 Resistance to different chemicals of various fibre-glass sheets with and without shellac

Material	Polyester (general grade resin)	Polyester+ shellac	Isophthalic polyester resin	Isophthalic polyester + shellac	Bisphenol polyester resin	Bisphenol polyester + shellac
Water	No effect	No effect	No effect	No effect	No effect	No effect
H_2SO_4 (50%)	Surface turns light brown after 96 hrs	Surface turns light brown after 96 hrs	No effect up to 7 days	Slight turbidity in acid after 7 days	No effect up to 7 days	No effect up to 7 days
HNO_3 (50%)	Surface starts to light yellow colour after 24 hrs	Surface starts yellowing after 24 hrs	Surface turns yellow after 72 hrs	Surface turns yellow after 72 hrs	Surface turns darker after 72 hrs	Surface turns slightly darker after 72 hrs
Acetic acid (50%)	Surface becomes rough after 48 hrs	Surface becomes rough after 96 hrs	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	Colour of the acid changes to light yellow after 7 days
HCl (10%)	No effect up ot 7 days	No effect up to 192 hrs	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days
Chromic acid (10%)	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days
Acetone (10%)	No effect	No effect up to 7 days	No effect	No effectup to 7 days	No effect	No effect up to 7 days
NaOH (10%)	No effect up to 7 days	Solution changes to light brown after 3 days	No effect up to 7 days	Solution changes to yellow colour after 7 days	No effect up to 7 days	Solution changes to light brown in colour after 7days
Methanol (100%)	No effect up to 7 days	Solution turns light yellow after 48 hrs	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days
Ethanol (50%)	No effect up to 7 days	Surface turns yellow after 24 hrs	No effect up to 7 days	Surface turns light yellow after 4 days	No effect up to 7 days	Surface turns slight darker after 4 days
$KMnO_4$ (25%)	Surface takes colour of $KMnO_4$ after 24 hrs	Surface takes colour of $KMnO_4$ after 24 hrs	Surface takes colour of $KMnO_4$ after 24 hrs	Surface takes colour of $KMnO_4$ after 24 hrs	Surface takes colour of $KMnO_4$ after 24 hrs	Surface takes colour of $KMnO_4$ after 24 hrs
Transformer oil	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days
Kerosene oil	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days
NaCl (Saturated)	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days	No effect up to 7 days

Syntheses of these pheromones are expected to serve for evaluation against the pests: *Heliothis armigera*, *Earias vitella* and *E. insulana* for the Cooperating Centres. Reaction sequences were developed for eventual synthesis of the above pheromones, using aleuritic acid (a components acid of lac) as well as other starting materials as reported in literature.

Preliminary reactions were carried out regarding conversion of *threo* to *erythro* aleuritic acid, conversion to methyl ester, chromatographic separations etc. before initiating actual synthesis of the pheromones.

Product Demonstration Unit

The unit was established in August 2000. The following products were prepared during the period:

(i)	Lac dye	- 160 g (dye content - 80%)
(ii)	Lac dye	- 1.1 kg (dye content - 74%)
(iii)	Melfolac	- 21 ltrs.
(iv)	Dewaxed bleached lac	- 2.25 kg
(v)	Water soluble lac	- 27.5 kg
(vi)	Hydrolysed lac	- 0.3 kg
(vii)	Seed lac	- 9.2 kg
(viii)	Aleuritic acid (crude)	- 0.3 kg

A proposal for erection of new pilot plants and renovation of existing pilot plants for lac dye, bleached lac, lac wax extraction aleuritic acid, melfolac and water soluble lac was prepared and submitted.

Three schemes for pilot plant production of dewaxed lac, bleached lac and aleuritic acid were prepared and submitted as per request received from Jharkhand State Cooperative Lac Marketing and Procurement Federation Ltd., Ranchi

REVOLVING FUND SCHEME

BALANCE SHEET

(April 2001 - March, 2002)

Fund Received from ICAR in (November 1996) Rs. 6,70,000

EXPENDITURE (Rs.)			INCOME (Rs.)		
Items		**Amount**	**Items**		**Amount**
Labour		57,480.00	Sale of broodlac (*kusmi*)		2,29,410.00
Watch & ward		15,300.00	Sale of broodlac (*rangeeni*)		8,750.00
Other Items		16,081.00	Sale of sticklac		26,635.00
			Sale of synthetic net		7,850.00
			Arrears payment of broodlac		13,000.00
	Total :	88,861.00		Total :	2,85,645.00
Gross profit		**Rs. 1,96,784.00**			
Less Workers share and establishment charges 2001-02		(-) 19,670.00			
Net Profit		**1,77,114**			

Description of Reserve Growth during 2001-02

Items		Withdrawals			
Surplus Captial refunded to ICAR		5,00,000.00	Opening Balance for 2001-02		8,18,185.00
Workers share & establishment charges for 2000-01		4,730.00	Deposited Net Profit		1,77,114.00
Misc. Expenditure		100.00	Other income		52,740.00
	Total	5,04,830.00		Total	10,48,039.00
			Closing Balance for 2001-2002		5,43,209.00

TRANSFER OF TECHNOLOGY

Training Programme for farmers and housewives

The institute conducts one-week training programme with special emphasis on "Scientific Method of Lac Culture." This programme mainly covers lac cultivation, processing at farm level and utilisation of lac at village level. A total of 396 farmers from different States participated in this programme. A summary of this programme conducted during the year is given in Table 16.

Training Programme for Undergraduates

A total of 79 B.Sc. (Ag.) students from College of Agriculture, BHU and Allahabad Ag. Institute attended "One-week training on lac cultivation, processing and uses."

One-day Orientation Programme

This programme is aimed at educating the lac farmers and suggesting remedial measures of their problems. A total of 309 farmers in 11 batches received training under this programme. A summary of this programme is given in Table 17.

Exposure Programme

A total of 836 farmers in 20 batches sponsored through various NGOs visited the institute Museum and plantation; they were explained about lac cultivation, processing and lac based products as detailed in Table 17.

One-day Education Programme on lac

One-day programme on lac cultivation was organised for 136 post-graduate/graduate students in 3 batches from various colleges and universities (Table 17).

Field Education Programme

This programme was organised at 11 places in Jharkhand and one each at Andhra Pradesh and Madhya Pradesh. A total of 1184 persons were benefited from this programme (Table 18).

On-Farm Training

This programme was organised in collaboration with other organisations in the states of Orissa, Chhattisgarh, M.P. and A.P. (Table 19).

Demonstration on Lac Cultivation

Demonstrations of pruning technique, use of 60 mesh synthetic net bag for inoculation of host trees, removal of used-up broodlac sticks (bundles in net bag) and spraying of fungicide/ insecticides, were carried out on 30 and 100 trees of *palas* in Jhalda, Purulia (W.B.) and Kharsidag village of Ranchi district, respectively.

Lac Process/Product-Demonstration Programme

A total of seven entrepreneurs were imparted training on the preparation of bleached lac, lac dye, lac processing, spiritless varnish, etc. as given in Table 20.

Consultancy on Lac Cultivation

Consultancy was provided to "Society for Elimination of Rural Poverty" for introducing lac cultivation in Adilabad district of Andhra Pradesh. Two experts from the institute visited many areas in

Representatives from Ms Liny Chem. Industry undergoing training on insulating varnish

Students from BHU, Varanasi at Institute Plantation

the district along with officials of DPIP (District Poverty Initiative Project). The report was submitted to SERP, Hyderabad. The survey revealed that there is immense scope of lac cultivation in the district. A large number of *palas* trees are lying unexploited in most of the areas. The villagers know very little about lac. Although lac is being collected in a very small quantity, there is lot of potential for increasing the economic benefit through introduction of lac cultivation on larger scale.

Table 16 One-week Training Programme on lac culture and other aspect

Sponsoring Organization	Nominating Organization	Period	No. of Participants
Farmers			
TRIFED, Ranchi	Alternative for India Development (AID), Arki, Ranchi	19-24 Feb.	36
TSRDS, Jamshedpur	TSRDS, Jamshedpur	26 Feb to 3 Mar.	12
		20-25 Aug.	10
Gramin Vikas Trust, Ranchi	Gramin Vikas Trust, Ranchi	19-24 Mar.	12
		3-7 Dec.	09
Forest Dept., Ranchi	Forest Dept. Ranchi	26-31 Mar.	19
		16-21 April	32
		23-28 April	26
		30 April to 5 May	63
		28 May to 2 June	10
Nav Bharat Jagriti Kendra, Murhu (Ranchi)	Nav Bharat Jagriti Kendra, Murhu	27 Aug to 1 Sept.	28
Jharkhand Govt.	TUDA*	3-8 Sept.	23
	CVS*	10-15 Sept.	10
	VARDAN*	24-29 Sept.	27
ECRECSOCULIS, Ranchi	ECRECSOCULIS	24-29 Sept.	12
Jharkhand Govt.	CVS	1-6 Oct.	22
ECRECSOCULIS, Ranchi	ECRECSOCULIS	1-6 Oct.	02
Jharkhand Govt.	VARDAN	10-15 Dec.	16
Forest Dept., Seoni	Forest Dept., Seoni	15 Oct. to 20 Dec.	20
		Total	**396**
Undergraduates in Agriculture			
College of Ag. BHU, Varanasi & Allahabad Ag. Inst. (B.Sc. Ag. Students)		4-8 June	59
Allahabad Ag. Inst. (B.Sc. Ag. Students)		15-20 Oct.	20
		Total	**79**
		Grand Total	**475**

♦ **TUDA** - Tribal Humanity Development Activity, **CVS** : Chakriya Vikas Sansthan, **VARDAN** : Voluntary Action for Research Development and Networking

Table 17 One-day Training Programme on lac culture and related aspects

Beneficiary	Sponsoring Organization	No. of batches	No. of participants
Orientation Programme			
Farmers	R.K. Mission, Ranchi	6	223
	Nav Bharat Jagriti Kendra, Ranchi	1	22
	SPAR, Ranchi	1	20
	IFFCO, Jamshedpur	1	20
	Agri Gold Project, Hazaribag	1	15
	Agriculture Trg. Centre, Ranchi	1	09
	Total	11	309
Students	St. Columbas College, Hazaribag	1	44
	YMCA, Ranchi	1	20
	XISS, Ranchi	1	72
	Total	3	136
Exposure Programme			
	Society for Rural Industrialization, Ranchi	12	462
	R. K. Mission, Ranchi	5	240
	Gramin Vikas Trust, Ranchi	1	20
	St. Gabrial, Hazaribag	1	70
	Munda Development Community, Ranchi	1	44
	Total	**20**	**836**
	Grand Total	**34**	**1281**

Table 18 Field education on lac cultivation

State	District/Block	Venue/Village	Collaborating agency	No. of participants
Jharkhand	Simdega/	Chandan	Support for Sustainable Society	300
	Bano	Bagicha	- do -	
	Ranchi / Khijri	Sarengtoli	Agricultural Trg. Centre	60
	Ranchi/Taimara	Burudih	Parvatiya Durgam Siksha Vikas	60
	Simdega /Tethaitanger	Kurpani	Sahbagita Vikas	400
	Ranchi	Taimara	Forest Dept. Ranchi	70
	Ranchi/Raniya	Torpa	Swa-Shakti (JWDA)	81
	Ranchi/Raniya	Torpa	PRADAN	22
	Ranchi/Khijri	Huridag	Swa-Shakti (JWDA)	25
	Ranchi/Khunti	Karpadiya	Jan Uthan Kendra	26
	Ranchi/Torpa	Lohajimi & Jari	PRADAN	25
	Gumla/Palkot	Bajra	PRADAN	35
Andhra Pradesh	Adilabad	Adilabad	DPIP	80
			Total	**1184**

Table 19 On-farm training programme

State	District/Block	Venue/Village	Collaborating agency	No. of participants
Orissa	Balasore	Notapara	Kishore Chandrapur Lac Industrial Co-operative Society	100
	Mayurbhanj	Derakochi	-do-	25
Chhattisgarh	Korba	Bhaisawa & Jhalnoda	Vishnu Shellac, Shakti	25
	Raigarh	Jobi	-do-	
Madhya Pradesh	Seoni	Barghat	Forest Dept., Seoni	150
		Takhalkhurd		20
	Mandla	Sahajani, Bamini, Bichia & 5 other villages	TRIFED, M.P.	125
Andhra Pradesh	Adilabad	Dasnapurgudi	Dist. Poverty Initiative Project (DPIP)	25
		Keslapur	-do-	15
		Utnoor	-do-	15
			Total	500

Table 20 Details of transfer of knowhows of lac-based processes/products

Name	Sponsored by	Duration	Topic
Mr. Samir Ray	M/s Society for Rural Industrialisation, Ranchi	29.06.01 to 10.06.01	Processing of lac
Mr. M.L. Das	M/s Eastern Chemofarb Pvt. Ltd., Purulia	02.07.01 to 10.07.01	Regular and dewaxed bleached lac
Mr. D.N. Agarwal	M/s D. Manohar Lal Shellac Pvt. Ltd., Sakti	25.09.01 to 04.10.01	Lac dye
Mr. Amit Kr. Roy Mr. Gautam Datta	Shellac Export Promotion Council, Kokata	02.11.01 to 17.11.01	Testing and Analysis of lac and lac products
Mr. Paul Abraham	M/s Liny Chem. Industry, Kerala	07.11.01 to 08.11.01	Spiritless varnish
Mr. Paul Abraham	M/s Liny Chem. Industry, Kerala	08.11.01	Air-drying type insulating varnish (SHA 64)
Mr. Vijay Kr. Chhaparia	Self	29.11.01	FRP sheet based on synthetic resin & shellac / baking type insulating varnish

Technology transfer through MoU

Technologies for manufacture of "Hand Operated Roller Type Lac Scraper" and "Tree pruner" were transferred to M/s National Enterprises, Ancillary Industrial Area, Hatia, Ranchi - 834003 through MoU.

Solving of Industrial Problems

A problem relating to properties of gravure ink for pharmaceutical industry posed by a private company was solved by quality optmization of shellac.

Farmer Adoption Programme

Work has been intiated for the implementation of the Farmer Adoption Programme in 31 villages of Murhu, Arki, Angara, Bundu blocks of Ranchi district encompassing 673 farmers. Data on the lac host plant holdings and current status of lac production and host plant utilization have been collected to start the lac crop demonstrations from *baisakhi* 2001-02 crop onwards.

PUBLICITY

Participation in Exhibitions and *Kisan Melas* :

The institute participated in 17 exhibitions/ *kisan melas* in Jharkhand, Delhi, Chhattisgarh and West Bengal and distributed literature on lac cultivation and utilization.

Exhibitions on lac and lac technologies : exhibits on lac were put up during the following special on-farm training programmes organized by the institute.

Table 21 Participation in *Kisan melas* and exhibitions

Date	Event & Venue	Organized by
3-7.1.2001	Agrivision 2001, IARI, New Delhi	Indian Science Congress, Kolkata
1-3.2.2001	Annual *Kisan mela*, Getalsud, Ranchi	Divyayan KVK, R.K. Mission, Ranchi
10.2.2001	*Kisan mela*, S.S. High School, Silli	INDAL, Chotamuri
3-4.3.2001	*Kisan mela*, Ghatotand, Hazaribag	Tata Steel Rural Development Society, Jamshedpur
5-6.3.2001	*Kisan mela*, BAU Campus, Kanke	Birsa Agricultural University, Kanke
17.3.2001	Rural Exhibition, Bano	Support for Sustainable Society, Gumla
26.3.2001	Annual SHG Meet, Angara	Rural Technology Park, Angara
29.3.2001	Annual Kisan Mela, Kendra, Ranchi	Gramin Vikas Trust, Ranchi
30.5.2001	*Kisan mela*, village Kurpani, Tethaitangar Block, Simedga District	Sahbhagita Vikas, Simdega
23-24.7.2001	Training-cum-exhibition, Sisai, Mandar Block	*Akhil Bhartiya Sajal Sharadha Samudayik Vikas Samiti*
6-7; 14-15 21-22.9.2001	Training-cum-exhibition, Centre for Women Development, Torpa	Swashakti Project by Jharkhand Women Development Society
15-19.10.2001	Farmer training-cum-exhibition, Mandla, Madhya Pradesh	TRIFED, Bhopal/Mandla
2-3.11.2001	Training-cum-exhibition, Hurindag, Ranchi	Nav Bharat Jagriti Kendra, Ranchi
7.11.2001	Training-cum-exhibition, Torpa	PRADAN, Ranchi
14-27.11.2001	India International Trade Fair, Pragati Maidan, New Delhi	IITF Authority, New Delhi
22.12.2001	One-day exhibition, Palandu, Ranchi	HARP, Palandu

PUBLICATIONS

Research papers

- Jaiswal, A.K., Bhattacharya, A., Sushil,S.N. and Kumar, P. (2001) Incidence of lac associated insect fauna in a few lac growing areas of Orissa, *J. Appl. Zool. Res.*, **12** (2) : 75-77
- Prasad, N., Pandey S. K., and Agarwal, S. C. (2001) Scope of mechanisation in lac production, *AMA*, **32** (2), 65-67.
- Prasad, N., Kumar, K.K. Pandey, S. K. And Bhagat, M.L. (2000) Status of mechanisation and scope of improvement making seedlac, *Agric. Engg. Today*, **34** (3), 70-74.
- Singh, B.P., Ghosal, S., Kumar, P., Srivastava, S.C. and Choudhary, S.G. (2001) Effect of fertilizer levels on plant growth and biomass production in *Acacia auriculaeformis*, *Indian J. Forestry*, **24** (1) : 38-42
- Singh, B.P. (2001) Effect of plant densities and fertilizer levels on plant growth and lac yield of *Acacia auriculaeformis* (Benth) A. cunn. (*Akashmani*), *Indian J. Forestry*, **24** (2) : 166-170
- Singh, B.P. (2001) Effect of lac muds from yard manure and inorganic fertilizers on growth and yield of rice (Oryze sativa L.) *Agric. Sci. Digest*, **21** (1), 21-24.
- Yadav, S.K., Mishra, Y.D., Singh, B.P. and Kumar, P. (2000) Leaf area estimation of *Flemingia semialata* Roxb., by linear regression, *Agri. Sci. Digest*, **20** (4) : 234 -237

Popular article

- Prasad, N., Bhagat, M.L., Pandey, S. K. and Kumar, K.K. (2001) *lakh ki kheti - kuch upoyogi yantra* (Hindi), *Kheti*, **54** (1), 29-31.

Papers presented at Seminar / Symposia

- Giri, S.K., Prasad, N. and Kumar, K.K. (2001) Lac wax based emulsion coating to extend post harvest life of mangoes in XXXVI Annual convention of ISAE at IIT, Kharagpur during 28-30 January 2001.
- Prasad, N., Kumar, K.K., Pandey, S.K. and Bhagat, M.L., Design and development of hand operated roller type lac scraper in the 35th Annual Convention of ISAE held at O.U.A.T., Bhabaneswar during 22-24 January 2001.
- Prasad, N., Kumar, K.K. and Jaiswal, A.K., Energy requirement in lac cultivation, in the National Workshop on Energy and Environment Management held at CIAE, Bhopal, M.P. during 8-9 July 2001.
- Ramani R., Kumar K.K. and Kumar P. (2001) Use of lac and lac host plants in medicine- the past, the present and the future in "National symposium on Advances in Production Technology and use of Medicinal and Aromatic Plants" held at BAU, Ranchi 14-15 Dec., 2001.
- Ramani, R., Sharma, K.K. and Sarkar, P.C. (2001) Networking villages for Agricultural Information exchange in Seminar on "Growth of Jharkhand with the help of IT" during 14th June, 2001.
- Sushil, S.N., Bhattacharya, A. and Kumar, K.K. (2001) Impact assessment of exotic egg parasitoids against lepidopterous predators of lac insect, *Kerria lacca* (Kerr) under field condition - a first approach, *in* Proceedings of symposium on "Biological based pest management for quality crop protection in the current millennium" held at P.A.U., Ludhiana, 18-19th July 2001, p 72.

Publications of the Institute

- *Lakh ki kheti : kab, kyon, kaise* (in Hindi), a booklet, 24pp
- *Hasta- chalit lakh chhilne ki machine* (in Hindi), a booklet, 4pp
- *Krishaker sevai satat tatpar : Bhartiya Lakha Anusanthan Sansthan* (in Bangla), 4pp
- *Jahan chah tahan lah* (in Nagpuri), a booklet, 14pp

- *Lakh ki kheti : Sawal kisanon ke jawab visheshagyon ke* (in Hindi), a booklet, 40pp
- Profile of some recently developed shellac-based anti-tracking insulating varnishes, a leaflet, 2pp
- *Rajbhasha rashmi*, a booklet in Hindi, 18pp
- ILRI Newsletter, Oct.-Dec. 2000, Jan-Mar 2001, Apr-Jun 2001, July-Sept. 2001, 4pp

Patent filed through ADG, (IPR), ICAR

1. A method for preparing anti-tracking air-drying type shellac based insulating varnish

   - D. N. Goswami

   [Application No. 254/DEL/2001 dated 07.03.2001]

2. A method for preparing baking type high thermal and water resistant anti-tracking insulating varnish based on modified shellac

   D. N. Goswami, K. Mahto, P.C. Jha and D.D. Singh

   [Application No. 255/DEL/2001 dated 07.03.2001]

LIST OF APPROVED ON-GOING PROJECTS

1. Evaluation and improvement of lac crop management practices under integrated agro-forestry system covering soil, host plant and pest management

- To evolve management practices of *kusmi lac* production on *ber*
- Bio-rational approaches for management of pests of lac insects and host plants
- Management of important lac hosts under agro-forestry system for *kusmi* lac production
- Management of *akashmani (Acacia auriculaeformis)* for lac cultivation
- Nutrient management in soil for maximixing lac yield
- Management of *Flemingia semialata* for sustainable lac production under different crop geometry and irrigation

2. Improvement in productivity and quality of lac through different breeding approaches for insect and their host plants

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

3. Development of value-added products (sex pheromones, PGR, polyblends) and surface coating materials from lac resin

- Synthesis of some bio-active compounds from aleuritic acid
- Development of lac varnish for wood and metal lacquers for food packaging

4. Utilisation of by-products (lac dye, wax, refuse lac) of lac industry for food grade lac dye, varnishes/ lacquer and bonding material for particle board

- Varnish composition based on aleuritic acid-free gummy mass
- Development of lac wax based formulations
- Use of refused lac/by-products/modified lac for making particle board/composite from various agro-wastes
- Mechanisation of *bhatta* process

5. Transfer of technology to farmers and entrepreneurs through training, demonstration, consultancy, information service and quality certification

- 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

- Polyblends of shellac with synthetic resins/polymers - formulation, characterisation and application studies
- Pilot study on forecasting of broodlac yield from *palas (Butea monosperma)*

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

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

Attended by the Director

2-8 Jan. 2001	Indian Science Congress, New Delhi.
4-5 Mar. 2001	National Symposium on "Empowerment of Women in Agriculture" held at R.A.U., Pusa, Samastipur, Bihar and presented a Paper.
21-24 May 2001	Delivered a lecture on Lac Culture in Summer School at RAU, Pusa Samastipur, Bihar.
26 June 2001	Workshop at BAU, Kanke, Ranchi
8-9 July 2001	Workshop on Energy and Environment Management held at CIRCOT, Mumbai.
23-25 July 2001	Directors' Conference at ICAR, New Delhi.

Attended by Scientists

- Dr. N. Prasad, Scientist participated in 35th Annual Convention of Indian Society of Agricultural Engineers held at O.U.A.T., Bhubaneswar during 22-24 January 2001.
- Sri S. K. Giri, Scientist, attended XXXVI annual convention of ISAE at IIT Kharagpur during 28-30 January 2001.
- Dr. P. C. Sarkar, Dr. S. N. Sushil, Dr. N. Prasad, Shri S. K. Pandey, Scientists and Shri D. Ganguly, T.O., attended a training program " Computer Applications : Internet, Web design, Networking and MS Project" from 19 February - 1 March 2001 at MECON Computer Academy, Ranchi.
- Dr. P. C. Sarkar, Scientist, attended National Workshop on evaluation of location specific IPM modules for eco-friendly and sustainable cotton production at NCIPM, New Delhi, 7-8 March, 2001.
- Dr. P. Kumar, Head, LPD & CCPI, NATP (PB) attended National Workshop on National Agricultural Technology Project on Plant Biodiversity under Jaivigyan National Science & Technology Mission on Conservation of Agro Biodiversity (P.G.R.) at NBPGR, New Delhi, 18-20 April, 2001.
- Dr. D. N. Goswami, Principal Scientist and Dr. A. K. Jaiswal attended Annual Workshop of AICRP at CIPHET Ludhiana during 16-19 May 2001 for presentation of progress of their respective Adhoc Research Schemes.
- Dr. S.N. Sushil, Scientist participated in Symposium on "Biological based pest management for quality crop protection in the current millennium" held at P.A.U., Ludhiana, 18-19 July 2001.
- Shri G. Singh, Sr. Scientist participated in a workshop on "*Bagwani avam krishi phaslon ka bazaronmuhk utpadan*" at HARP, Ranchi 28-29 July 2001.
- Dr. P. C. Sarkar, Scientist attended ICAR sponsored " Training on IPR and WTO to NARS scientists" during 5-7 September 2001 at IISR, Lucknow.
- Sri G. Singh, Sr. Scientist participated in "National Level Training Programme on Command Area Development Programme with special emphasis on *warabandi*" organized by WIPRO, New Delhi and Horticulture and Agro forestry Research Programme at HARP, Palandu, 13-19 September 2001.
- Dr. N. Prasad, Scientist, Attended training on 'Computer aided design of farm machinery' organised by computer Aided Design Cell, Central Institute of Agricultural Engineering, Bhopal under DST, New Delhi, SERC visiting Fellowship (1999) programme from 24 September to 22 December 2001.
- Sri D. Saha, Scientist, participated in a two day workshop on 'Bio-informatics and its application' organised by the Department of Biotechnology, I.I.T., Kharagpur during 28-29 September 2001.
- Dr. K. K. Sharma and Dr. P. C. Sarkar, Scientists attended a Refresher Course on "Information Technology in Agriculture", 3-23 December 2001 at NAARM, Hyderabad.

PROMOTION OF LAC CULTIVATION IN NEH REGION

Dr. K. K. Kumar, Director and Dr. A. Bhattacharya, Pr. Sc. visited NEH region during June 2001 and held discussions with the officials of TRIFED (NE), Guwahati, Institute of Rain and Moist Deciduous Forests Research, Jorhat, Entomology Department of Assam Agricultural University, Jorhat and Defence Research Laboratory, Tezpur regarding promotion of lac cultivation in the region. A questionnaire was also formulated for collection of basic information regarding lac in the region.

A detailed programme regarding lac cultivation in Kokrajhar area was worked out along with Sri K. Basumatary, Advisor of Assam Tribal Marketing and Manufacturing Co-operative Society, an NGO in association with Trifed. Accordingly, about 50 kg. of *kusmi* broodlac was transported form the Institute during July for inoculation on *ber* trees at Kokrajhar. Shri M. L. Ravidas, T-4 visited Kokrajhar and supervised the inoculation operations and demonstrated the pruning of host plants.

As a follow up action, the scientists of RARS, Shillongani (under Assam Agric. Univ.) have initiated collection of basic information on lac cultivation. Necessary literature and information have been supplied from the Institute.

IMPORTANT COMMITTEES

Research Advisory Committee

The Seventh Meeting of the Research Advisory Committee of the Institute was held on March 22-23, 2001. The following members were present:

Dr. B.L. Amla Former-Director CFTRI, Mysore	Chairman
Dr. R.P. Kachru Assistant Director-General (PE) ICAR, New Delhi	Member
Dr. K.K. Kumar Director ILRI, Ranchi	Member
Dr. N. Krishnamurthy Retd. Deputy Director & Head Organic Coatings and Polymers Division IICT, Hyderabad	Member
Prof. D.R.C. Bakhetia Retd. Senior Entomologist & Ex-Head Dept. of Entomology Punjab Agricultural University Ludhiana	Member
Dr. M. Yaseen Retd. Deputy Director & Head Organic Coatings & Polymers Division, IICT, Hyderabad	Member
Sri R.L. Sharma Managing Director Tajna Shellac (P) Ltd., Khunti, Ranchi	Member
Mr. Madhu Agarwal Secretary, Maharashtra Rajya Lah Utpadak & Chapra Nirmata Sangh, Gondia	Member
Sri R. Ramani Principal Scientist, TOT Division ILRI, Ranchi	Member- secretary

In his welcome address, Dr K.K. Kumar, Director, ILRI highlighted the achievements of the institute, during preceding year. Dr. R.P. Kachru, ADG(PE), in his introductory remarks emphasized the need for strengthening the partnership with the industries to take up research in need-based areas.

The Member-Secretary, Mr R. Ramani. presented the action taken reports on the recommendations of the previous RAC Meeting (Feb 3—4, 2000), received from various Divisions. The committee carefully reviewed them and made specific suggestions for further improvement.

The progress made by the three major divisions of the institute was then reviewed.

An interaction session was held by the committee with the scientists of the Institute. Elaborate discussions were held about progress and problems of various projects of the division. The committee members gave specific suggestions for improvement of output under various projects of the Institute.

The observations made in the concluding session of the meeting summarized below:

- Efforts should be made to ensure that the products and processes developed in the institute were released to the industry with remunerative returns. He also appealed for improvement in the functioning of the Field Research Stations.
- It was felt that the institute had developed a number of products, but there appeared to be some limitations in taking them out in the market. The importance of good leadership was also stressed upon.
- Work should be taken up to improve the economics of lac cultivation.

- Facility should be created for preparation of aleuritic acid in large (pilot plant) scale.
- Various organic reactions may be exploited using aleuritic acid as starting material.
- The product purity of synthesized/isolated compounds should be done employing latest techniques.
- Technology profile should be prepared for products developed. There should be internal evaluation by TOT Division.
- The institute should aim at giving at least one technology per year.
- The institute should develop strong interaction with those industries, which are willing to cooperate with the institute.
- About 10% of the library budget should be spent on purchase of useful reference books.
- The institute should contact suppliers of chemicals like Sigma, Aldrich etc. and work towards an arrangement for marketing of fine chemicals like aleuritic acid prepared by the Institute. This could lead to impressive revenue generation as well.
- Forecasting models should be based on database on field biology of the lac insect, its hosts and the seasonal fluctuations in the lac harvest in relation to the biotic as well as abiotic factors, which have additive and substractive effects.

As the meeting was concluding one of the Committee, Shri R. Ramani, Member-Secretary expressed his contentment over his experience with all the meetings held till then and the affectionate cooperation given by each and every member of the Committee. He expressed his happiness over full presence of the Committee in all the meetings except the first one, in which Dr Krishnamurthy could not come due to some unavoidable reasons. He reiterated that the RAC not only gave directions to the Institute but also helped in several ways to build up confidence among the scientists. He expressed his gratitude to all the members and everyone associated with the functioning of the RAC. The meeting was then formally concluded.

Institute Management Committee

The 31st meeting of the Institute Management Committee has held at the Institute during 8-9 February 2002. The following members were present:

Dr. K. K. Kumar Director, ILRI	Chairman
Dr. R. P. Kachru, ADG (PE), ICAR, New Delhi	Member
Dr. G.S. Dubey, Dean (PG), BAU, Ranchi	Member
Shri Krishnan Mishra, Social Worker, Ranchi	Member
Dr. J. B. Tomar In-charge, NBPGR Station, Ranchi	Member
Dr. P.C. Gupta Head, Div. of LP & PD ILRI, Ranchi	Member
Sri G. Singh Sr. Sc., ILRI, Ranchi	Member
Sri A Rastogi, Admin. Officer, ILRI, Ranchi	Member Secretary

In the beginning, the members mourned the death of thousands in the disastrous earthquake on 26.01.2001 in Gujarat.

Dr. K. K. Kumar, Chairman welcomed all the members of the newly constituted IMC. Dr. Dubey and Mr. Mishra expressed their happiness for giving them opportunity to serve the Institute.

Director, ILRI reported the salient research achievements of the Institute during August 2002 - Feb. 2001. It was reported that the Institute had organised a National symposium on "Lac in New Millennium" on 20-21 Sept. 2002, which was attended by more than 150 delegates from the states of Bihar, Jharkhand, Orissa, West Bengal, Kerala, Delhi and M.P. During the period, a revenue of Rs. 92,793/- was earned through several training programmes for unemployed youth, students, farmers etc.

Dr. Kachru, ADG(PE) also welcomed the new members of the IMC. He requested to start working in formulation of X Plan for the Institute which requires to be prepared with vision and pragmatic outlook for future.

The Proceedings of the 30th meeting of the IMC who approved. The action taken on the proceedings of the 30th meeting of the IMC was reviewed.

The progress of research work carried out under different Divisions/Sections of the Institute, as well as work done under different Adhoc Research and revolving fund schemes, work done in NEH region was also reviewed.

The Committee also considered various proposals pertaining to normal functioning of the Institute. The Committee also approved purchase of few equipments for the Institute.

XXXII Meeting

The 32nd meeting of the Institute management committee was held at the Institute on 19th July, 2002. The following members were present :

Dr. K. K. Kumar Director, ILRI	Chairman
Dr. R. P. Kachru, ADG (PE), ICAR, New Delhi	Member
Sri C.B.N. Hansda Joint Director, Industries (Textile), DRI, Ranchi	Member
Dr. G.S. Dubey, Dean (PG), BAU, Ranchi	Member
Sri Krishnan Mishra, Social Worker, Ranchi	Member
Dr. J. B. Tomar In-charge, NBPGR Station, Ranchi	Member
Dr. P.C. Gupta Head, Div. of LP & PD ILRI, Ranchi	Member
Sri S. Satyanarayan F&AO, CICFRI, Barrackpore West Bengal.	Member
Dr. D. N. Goswami P.S., ILRI, Ranchi	Member
Sri G. Singh Sr. Sc., ILRI, Ranchi	Member
Sri A Rastogi, Admin Officer, ILRI, Ranchi	Member Secretary

In the beginning, Dr. Kumar, Director, ILRI presented the research achievements made during the period. The members were apprised that the Institute had organised a one-day "Krishak Sammelan" which was inaugurated by the State Chief Minister, Sri Babulal Marandi. the Sammelan was a grand success and it was attended by more than 1000 lac farmers. The proceedings of the 31st meeting of the Management Committee were read out and adopted.

The IMC members appreciated the efforts of the State Govt. to collaborate with ILRI, for popularising lac cultivation and related technologies in the state. Progress made in different research projects of the Institute, Ad-hoc reserch Schemes, Revolving Fund Scheme, work done in the NEH region was discussed.

The Committee members agreed in principle for construction of a 'Kisan hostel' to be funded by Jharkhand Govt., The necessary approval was given.

Approval was given for shifting the RFRS from Balarampur to Purulia (West Bengal) and from Dharamjaigarh to Bilaspur, Chhattisgarh. The members recommended that a self contained proposal may be submitted to the Council. Dr. K.K. Kumar Director, first explained the position prevailing in both the Stations.

The Meeting ended at 5.45 p.m. after vote of thanks to all the IMC members for their contributions.

XXIII Meeting

The 33rd Meeting of the Institute Management Committee was held on 28.11.2001 at the Institute. The following members were present.

Dr. K. K. Kumar Director, ILRI	Chairman
Dr. R. P. Kachru, ADG (PE), ICAR, New Delhi	Member
Dr. G.S. Dubey, Dean (PG), BAU, Ranchi	Member
Sri C.B.N. Hansda Joint Director, Industries (Textile), DRI, Ranchi	Member
Sri Balbir Ram, IAS Director, CSSI, Kolkata, W.B.	Member
Sri K. Mishra Pandra, Ranchi	Member

Dr. P. Kumar Head, LPD, ILRI	Member
Dr. N. Prasad P.S., LP&PD division, ILRI	Member
Sri R. Ramani P.S., TOT division, ILRI	Member
Sri A Rastogi, Admin Officer, ILRI	Member Secretary

In the beginning Director, ILRI welcomed the newly nominated member of the Committee. Director also requested members to offer valuable suggestions/guidelines for the Xth Plan proposal for the Institute which is under preparation. The Chairman, presented the salient research achievements made in different research projects at the Institute. He informed the IMC that the technologies have been transferred for manufacturing of scraping machines, tree pruners on charge and royalty basis and two compositions of spiritless varnishes on one time charge basis. Technologies of lac dye and dewaxed lac have also been transferred during the period under report.

The Institute also organised a four days training programme on Medicinal and Aromatic plants sponsored by CIMAP, Lucknow. The Institute earned Rs. 17.0 lakh under resource generation against the target of Rs. 12,00 lakh for 2001-2002.

Dr. R. P. Kachru welcomed new members of the Committee. The members expressed their concern over erratic price fluctuation of lac resulting into decrease in demand/supply of lac based products. Shri B. Ram, Director, CSSI stressed upon the need to organise a forum of Institutions like ILRI, exporters and R&D oriented personnel for boosting up lac production, processing and marketing issues. He promised all support from the West Bengal Government. The members approved the Xth Plan proposals submitted by the Institute after discussion. IMM approved holding of 2-3 "Kisan Melas" in a year.

IMC meeting in progress

Proposal for two borewells for drinking water was also approved.

Proceedings of the 32nd Meeting was adopted after discussion and action report on the recommendation of 32nd Meeting was reviewed.

The progress made under different research projects of the Institute was discussed.

The Committee approved the Budget proposal, RE for 2001-2002 and BE for 2002-2003 (Plan and Non-plan).

The Committee suggested to prepare policy paper, regarding burning problems of lac marketing. It was also suggested to make budgetary provision for working towards increasing internal consumption.

STAFF RESEARCH COUNCIL (SRC)

SRC meetings were held on 15-16 March, 2001 and 15-16 November, 2001 under the Chairmanship of Dr. K.K. Kumar, Director of the Institute. The progress made in research projects was presented by Project Leaders and was thoroughly discussed. The progress made in different adhoc research schemes and revolving fund was also discussed.

Director informed that the Institute has been identified as a support centre as a part of the overall " Technology Mission on Cotton" at CICR, Nagpur.

EXTENSION RESEARCH

Survey of Lac Growing Areas of West Bengal

The socio-economic data collected from 274 farmers belonging to 12 villages of 3 blocks namely, Khatra of Bankura and Jhalda and Baghmundi of Purulia districts respectively. The average holding sizes of lac host trees *kusum*, *ber* and *palas* in these areas are 1.1, 5.13 and 41; in terms of host trees utilised for lac cultivation, the figures are, however, 44 and 48 percent respectively. The percentage share of income from different professions are lac – 21.5%, agriculture – 59.5%, forest produce – 8%, horticultural crops – 6%, cattle, pigs and poultry – 5%.

Survey of Lac-farmers

A survey was carried out to identify the problems of lac growers. The importance of problem was identified by two approaches (i) by assessing the number of growers facing each problem and (ii) by giving grades to each problem and ultimately the overall ratings of each problem. The problems faced by the lac growers, belonging to sixty-three villages of eight blocks and four districts namely, Ranchi, East Singhbhum, Saraikela and Gumla in Jharkhand state shown below :

Problem	Priority rating
Crop mortality during fog	90%
Shortage of broodlac	83%
Destruction of lac by ants	61%
Theft of broodlac and mature crop	54%
Lack of information on market price of lac	49%
Crop mortality, if rain occurs after intense heat in summer. (Non-remu nerative price)	44%
Destruction of lac encrustation and felling of broodlac sticks on ground by squirrels	42%
Mortality of lac insects in Dec./ Jan. on *Zizyphus mauritiana (ber)*	37%
Lack of technical knowledge of lac cultivation	32%
Damage by lac insect predators and other enemy insects	27%
Marketing of produce	23%
Mortality of lac insect culture due to high temperature in summer	22%
Dearth of capital, drying of lac insect infested shoots	18%
Felling of broodlac sticks from tree by rats	16%
Lac crop mortality on *Schleichera oleosa (kusum)* in rainy season	13%
Spider net on tree resulting in lac crawlers trapping and peeling of bark of *Z. mauritiana* shoot by rats	11%
Attack of termites on shoots and trunks, damage of lac encrustations by woodpeckers, *kusmi* lac insect mortality due to self-colonisation	8%
Damage of lac crop during thunderstorm	6%

A few problems are widespread over a large area whereas others are localised in specific areas only.

Current Status Technology Assessment, Product Promotion and Problem of Lac Industries

During the period under report, a survey work was continued and few lac processing units at Khunti, Bundu and Purulia were visited to find out the current status of lac industries and their problems.

Khunti

At present, four factories are in operation. Total annual production is about 33 thousand tonnes (seedlac, shellac, button lac), 90% of which are exported and only 10% are consumed internally.

Bundu

There are 20 factories, out of which only 16 are in working condition. The total annual production is 1.15 thousand tonnes (shellac, seedlac, button lac) only. Mostly they are consumed internally and only a minor part is exported. Some industries are interested in the production of lac dye and bleached lac.

Purulia

One industry is engaged in producing dewaxed decolourised lac, aleuritic acid and varnish. The total annual production is 12 tonnes only.

Problems solved

The problems, faced by a firm manufacturing bleached lac, were solved through appropriate guidance. They were related to presence of spirit-insolubles and colouration in the product. Both could be tackled based on the suggestions given by the reports from the institute.

EVENTS ORGANISED

Annual Lac Kisan Mela

Shri R. T. Choudhary, MP inaugurating the Mela

The Annual *Kisan Mela* was organized on February 15, 2001 with a view to promote lac cultivation and to show latest lac production technologies. The *Mela* was inaugurated by Shri Ram Tahal Choudhary, Hon'ble Member of Parliament and presided over by Swami Shashankanand ji, Secretary of Ramkrishna Mission Ashram, Ranchi. Farmers were also shown around the institute Plantation and Museum to make them aware of the latest technologies developed by the institute. Screening of educational video films on lac was also arranged in the lecture hall of the institute. Later, a *Kisan Goshthi* was organised in the institute wherein the queries of the farmers regarding lac, horticulture and sericulture were answered by experts from different institutions. Nearly 500 farmers from various parts of Jharkhand participated in the Mela. The event was covered widely by the local media including AIR which carried a 20 minute feature on the *Mela*.

Lakh Krishak Sammelan

A one-day '*Lakh Krishak Sammelan*' (Lac Growers' Meet) sponsored by Tribal Welfare Department of Jharkhand Government was organized on June 11, 2001 at the Institute premises. The Sammelan was inaugurated by Shri Babulal Marandi, Honourable Chief Minister of Jharkhand and presided over by Shri Arjun Munda, Welfare Minister of the State. Dr. Anwar Alam, DDG (Engg.), ICAR was the Guest of Honour on this occasion. State Forest &

Inaugural Ceremony (from left to right) : Shri Babulal Marandi (CM), Shri Arjun Munda, Shri Yamuna Singh (Mins.) and Dr. K. K. Kumar (Director)

Environment Minister, Shri Yamuna Singh and Agriculture Minister Shri D. D. Kushwaha also graced the occasion. The Sammelan also marked the launching of 'Lac Growers' Adoption Programme' Fully sponsored by the Tribal Welfare Department of the State Govt. and to be executed by the ILRI with the co-operation of NGOs. Welcoming the distinguished guests Dr. K. K. Kumar, Director of the Institute expressed his gratitude to the State Govt. especially, Tribal Welfare Department for initiating steps to promote lac cultivation in the State. He also briefed the audience about the activities and achievements of the institute. Acknowledging the importance of lac in tribal-economy Dr. A. Alam, DDG (Engg.) said that keeping in view of the importance of lac, the Council regcognizes the contribution made by the ILRI. He said that ICAR was ready to establish Krishi Vigyan Kendras in Jharkhand in collaboration

Dr. Anwar Alam, DDG (Engg.), ICAR receiving the cheque for Farmer Adoption Programme

with the State Government. He said that his is a first major initiative taken by State Govt. with ILRI to promote lac culture in the State. He said that this marked the beginning of a new partnership which is a good sign.

Hon. Chief Minister Shri Babulal Marandi, in his inaugural address stressed on co-ordination of Forest, Agriculture, Industry and Tribal Welfare Departments of the State with Indian Lac Research Institute of betterment of the lac growers. He exhorted the scientists to work on need-based research catering to the local problems. Referring to the eco-friendly nature, he hoped that demand for lac would increase in the future. He responded favourable to the proposal of opening Krishi Vigyan Kendra in the State and assured all possible help from the Govt. He also handed over a cheque of Rs. 20 lakhs provided by Tribal Welfare Department to the Institute for the Farmer Adoption Programme to be implemented in four village clusters of Ranchi District.

Forest and Environment Minister Shri Yamuna Singh expressed Commitment of his ministry in promoting lac-cultivators. He instructed the officials of his Ministry to give importance to lac-host plants in afforestation programme to be undertaken by the department. He also appealed to the scientists of the Institute to visit the farmers' fields more frequently and to provide the latest information on scientific methods of lac cultivation in the local language. Shri D. D. Kushwaha, Agriculture Minister stressed upon the farmers to integrate lac cultivation with agriculture for better returns. Reacting to the demand of abolition of agriculture marketing tax on lac, he told that it was the legacy of the undivided Bihar and department would consider the demand sympathetically.

While delivering his presidential address, Shri Arjun Munda, Welfare Minister assured that his Ministry would continue to strive for economic upliftment of the farmers. Sponsorship of lac-growers adoption programme is only the beginning of the events to be unfolded in the future. He declared that his department plans to build a Hostel in ILRI for lac-growers.

Two extension publications, viz., *'Jahan Chah Tahan Lah* (in Nagpuri) and *'Lakh Ki Kheti : Sawal Kisanon ke Jawab Visheshagyon ke'* (in Hindi) were released by the Chief Minister. Shri A. C. Ranjan, Agriculture Secretary; Shri J. B. Tubid, Industry Secretary; Shri A. K. Singh, Director (Industries); Shri R.M. Vaidya, General Manager, TRIFED; Managing Director, BISCOLAMF. Besides scientists of the Institute and sister organisations were also present on the occasion. Ms. Raj Bala Verma, Tribal Welfare Commissioner conducted the proceedings of the Sammelan. More than 1000 farmers were present in the Meet. A number of NGOs particularly, Xavier Institute of Social Service, Ranchi; Chakriya Vikas Sansthan, Ormanjhi; VARDAN, Ranchi and TUDA, Namkum participated actively in making the programme a success; the other NGOs included INDAL, Parvatiya Durgam Shiksha Vikas and Adim Jati Sewa Mandal; The Chief Minister also planted a sapling of *kusum* at the Institute Plantation and visited the Museum of the Institute to apprise himself about lac, its processing and application. Participating farmers were shown around the Institute plantation and Museum to make them familiar with he latest technologies of lac cultivation and to motivate them to take lac cultivation on commercial scale, Extension literature on latest technologies and equipment developed by the Institute was distributed free to all the farmers.

Workshop on Medicinal and Aromatic Plants

Jharkhand is one of the richest havens of biodiversity in the country. Scholars had always been harping on about the exploitation of medicinal plant wealth in the region. As an initiative in this direction, a regional workshop on "Production and processing of Viable Medicinal and Aromatic Plants" under the Skill-cum-Technology Upgradation Programme was

Shri Samresh Singh, Min. of S&T, Jharkhand Govt., addressing the audience

organized jointly by Central Institute of Medicinal and Aromatic Plants, Lucknow and the Institute under the sponsorship of SIDBI, Patna. The four-day workshop started on 20th September, the 77th Foundation Day of the Institute. More than 44 participants of the region benefitted from the workshop.

The inauguration of the workshop was done by Hon. Minister of science and Technology, Jharkhand Govt., Shri Samresh Singh. Shri L.C.C.N. Shahdeo. Vice -Chancellor of Ranchi University was present as Guest of Honour.

While appreciating the subject chosen for training, Shri Samresh Singh emphasized the need to demonstrate the actual procedure involved so that participants can translate ideas to entrepreneurship. He told that the Jharkhand Govt., has started cultivation of aromatic and medical plants in 150 acres of land.

Guest of honour, Dr. L.C.C.N. Shahdeo, VC, Ranchi University acknowledged lack of direction for development of rural industries in the newly created state.

Dr. K.K. Kumar, Director, ILRI co-sponsor of the programme in his welcome address told that Jharkhand state has got vast potential and climate of the area is suitable for cultivation of medicinal plants.

Deputy Director of CIMAP, Dr. A. K. Singh viewed that exploiting the potential of aromatic and medicinal plants would lead to creation of employment opportunities in the State. He told that more than 3000 such plants have been identified which are suitable for Jharkhand. Shri B. K. Bose, Deputy General Manager of SIDBI, the sponsor of the training programme said that there was need to bring Financial Institutions and entrepreneurs closer.

The training programme covered production technologies of oil from lemongrass, palmarosa, citronella, vetiver, mint, rose basil, chamomile and geranium; production technologies of ambrette seed, ashwagandha, pyrethrum, mulethi, kalmegh, senna. It also included purification, waste management, marketing, quality control and emerging trends. Demonstrations of planting and distillation techniques were also arranged. The concluding ceremony was graced by Shri M. K. Mondal, Secretary (Agriculture), Govt. of Jharkhand who praised the efforts of CIMAP and ILRI for organizing such a workshop at an opportune juncture for the development of Jharkhand. He assured all the possible support from the State Govt. to the entrepreneurs willing to take initiative in this direction.

ILRI-Industry Interface

An ILRI-Industry Interface was organized on December 12, 2001, to discuss about the problems related to marketing of lac with the representatives from lac industry. Representative from the lac industry as well as those from marketing and promotional agencies participated in the meeting. It was pointed out in the meeting that there is an increased emphasis on natural and biodegradable products in the world market; the lac industry should realize this and respond accordingly. The processing units were encouraged to adopt universal standardization of lac and its products. Strategies for dealing with the problems related to marketing of lac were discussed. Deliberations were also held on the modalities for achieving a favourable environment for sustenance and growth of this unique commodity. It was cautioned that failure to maintain a healthy market would lead to erosion of even the existing market.

Deliberations during ILRI - Industry Interface

DISTINGUISHED VISITORS

The Lac Museum was visited by 2430 persons including 1627 farmers, 521 students and 282 persons from all walks of life.

His Excellency Shri Prabhat Kumar, Governor, Jharkhand at Institute Plantation

HE. Shri Prabhat Kumar, Governor of Jharkhand visited the Institute on 30th January. He took keen interest in the research and extension activities of the Institute. Addressing the scientists of the Institute, he stressed upon the need for integration of lac culture with other cropping systems for sustainable tribal development and preservation of the ecosystem. He also impressed upon the need for strengthening lac-based cottage industries as well as product refinement and diversification for better returns. He assured the support of the State Government for promotion of lac in the region.

Padma Bhushan Dr. R. S. Paroda, DG, ICAR and Secretary, DARE, Ministry of Agriculture visited the Institute on May 9. He press started the drip irrigation system at the Institute Plantation. He also launched the web site of ILRI and released two publications, composed and printed at in-house facility of the Institute. Dr. Paroda underlined the importance of lac to the country and the newly formed Jharkhand. He said that scientists would also be able to learn from the farmers, which would help them in refining the technologies. He also wanted the Institute to ensure adequate adoption of technologies developed by the Institute on lac cultivation and utiization. The following were the other distinguished visitors during the period under report.

Director-General Dr. R. S. Paroda, ICAR and Secretary, DARE Releasing Lac Bulletin

- His Excellency Mr. M.M. Rajendran, Governor, Orissa
- Shri Babulal Marandi, Hon'ble Chief Minister, Jharkhand
- Mr. Pierjioryio Tettamelut, CH-6900 Lugauo
- Mr. Subash Kumar Sharma, Bellar Bandh, Dhanbad
- Mr. A.K. Gupta, Sr. Dy. Director, SAIL- Center for Engineering & Technology
- Mr. M. C. Gupta, IAS (Rtd.), Director IIPA, New Delhi
- Mr. Subodh Srivastava, Chief Editor, *Rashtriya Samachar* Features Network, Lucknow
- Mr. Atul Chandra, Coordinating Editor, *Hindustan Times*, Ranchi

His Excellency Mr. M.M. Rajendran, Governor, Orissa at Institute Plantation

Shri Arjun Munda, Welfare Minister, Jharkhand Govt. being shown around the Museum

- Ms. Rajbala Verma, Tribal Welfare Commissioner, Jharkhand
- Mr. Mrityunjoy Kishor Mittu, Dy. S.P. (Vigilance), Ranchi
- Mr. Satish Chandra Jha, Standing Counsel, Govt. of India, CAT, Patna
- Mr. Arjun Munda, Minister of Welfare, Jharkhand Govt.
- Mr. Jessica Mott, World Bank, Washington D.C., USA
- Mr. Ashok Kumar Chouhan, Min. of Agric., New Delhi
- Group Captain R.L. Dey, Commandant, Emberkation H-2, Kolkata
- Dr. R.N. Verma, Director, NRC for Mushroom, Solan (H.P.)
- Dr. R.S. Gin, Regional Director, CERI, WBBB, Kolkata
- Mr. R.L. Rao, Zonal Manager, Central Bank of India, Patna
- Mr. V. Higtion, Karel Soudam, Belgium
- Mr. Narendra Kumar, Dy. Director, KVIC, Ranchi
- Prof. R. Mitra, XLRI, Jamshedpur
- Mr. S.M. Ali, Advisor, TSRDS, Jamshedpur
- Fr. EA. Augustine SS, XLRI, Jamshedpur
- Mr. Samresh Singh, Minister of Science & Technology, Jharkhand Govt.
- Prof. L.C.C.N. Shahdeo, Vice-Chancellor, Ranchi University
- Dr. S. Natesh, Advisor, Department of Biotechnology, Govt. of India
- Mr. Arun Kumar Singh, Director, Industries, Jharkhand
- Mr. S.K. Naik, Secretary, Ministry of Tribal Affairs, Govt. of India
- Dr. Nawab Ali, Project Coordinator, CIAE, Bhopal
- Mr. N.L. Dasgupta, Tripura Project on TOT
- Dr. S.K. Naskar, Asst. Director, National Commission for SC/ST, Ranchi
- Dr. D.N. Singh, Addl. Commissioner (Crops) DARE, Krishi Bhawan, New Delhi

Students from The Netherlands at Lac Museum

PERSONNEL

(As on 31.12.2001)*

Names of Heads/ I/cs of Division and Sections	Designation
Dr. K. K. Kumar	Director
Division of Lac Production	
Dr. P. Kumar	Principal Scientist & Head of the Division
Division of Lac Processing and Product Development	
Dr. P. C. Gupta	Principal Scientist & Head of the Division
Division of Transfer of Technology	
Dr. K. K. Kumar	Head of the Division
Product Demonstration Unit	
Dr. N. Prasad	Principal Scientist & Head of the Unit
R.F.R.S, Dharamjaigarh, Chattisgarh	
Dr. S. K. Jaipuriar	Senior Scientist (Agric. Entomol.) I/c
R.F.R.S., Balarampur, W.B.	
Dr. A Bhattacharya	Principal Scientist (Agric. Entomol.) I/c
Administrative Section	
Sri A. Rastogi	Administrative Officer
Sri R. K. Singh	Finance & Accounts Officer
Director's Cell	
Dr P.C. Sarkar	Scientist
Library	
Sri R. P. Tewari	Technical Officer (T-6)
Quality Control (Testing Lab.)	
Dr. K. K. Kumar	Director
Farm Unit	
Dr. B. P. Singh	Principal Scientist (Agronomy), I/c
Maintenance and Workshop Unit	
Dr. N. Prasad	Scientist (F,M&P)
Hindi Cell	
Sri Lakshmi Kant	Asstt. Director (O. L.)
Medical Unit	
Dr. N. P. Sahu, M.D.	Authorised Medical Attendant (Part-time)

* See Appendix II for details.

SUPPORT SERVICES

Director's Cell

The Cell continued to provide support for the research management activities of the Institute. Two meetings of the Staff Research Council (SRC) were convened for reviewing the progress of on-going research projects and also to examine the new research projects to be undertaken. Research Project Files for on-going projects were maintained. Assistance in day to day technical correspondence was provided to the Director of the Institute. Necessary support was provided for holding meetings of the Institute Management Committee and Research Advisory Committee. Steps were also initiated for constituting the 3rd Research Advisory Committee (RAC) and the 3rd Quinquennial Review Team (QRT) of the Institute.

Material for various technical reports including Monthly Report for the Cabinet, Quarterly Report on Annual Action Plan, DARE Report and Research Highlights of ICAR etc. were collected and compiled for onward transmission to the Council. Information on various matters / activities related to the Institute, including audit queries was also supplied. The Cell processed the research papers submitted for forwardal to various scientific and popular journals, seminar/ symposia, radio / TV talks etc. Seven Senior Officials Meetings (SOM) of the Institute were convened during 2001. The material for Institute Annual Report 2000 was compiled.

Work was also initiated for formulating the EFC Memo (X Plan Document) for the Institute.

ARIS Cell

The ARIS Cell of the Institute provided the following services during the period under report:

- Network Administration through one LINUX based server and one Windows NT server.
- Photocopying facilities
- Scanning facilities for creating image files
- Word processing facilities for Director's Cell and Quality Control (Testing) Lab.
- Supervision of computer related jobs of institute, particularly software-related problems.
- Providing internet browsing and e-mail facilities to several nodes through KU Band FTDMA VSAT and proxy server.
- Maintaining liaison with NIC, CMC, CET (SAIL) etc.
- Assistance in preparation of Power Point presentation for seminars, meetings etc.

An HP-CD Writer was procured by the Cell during the period under report. The institute website was totally developed in - house, and hosted as a sub domain of the ICAR website at http://www.icar.org.in\ilri\default.htm. The website was formally launched on 9th May 2001, by Dr. R.S. Paroda, Secretary (DARE) & D.G. ICAR on his visit at ILRI. The institute website was subsequently updated on 1st Nov. 2001.

Library & Documentation Centre

The library of the Institute a repository for scientific and technological information on lac. Besides catering to the need of the institute, the library also renders services to other researchers, academicians, students and lac industrialists from all parts of country.

The Library maintains appropriate linkages with the leading reference libraries e.g., National Library, Kolkata; INSDOC, New Delhi; American Centre Library, New Delhi and INSA Library for strengthening the information resources. This library also supplies photocopies of rare research articles to National Science Library, New Delhi.

Four nos. of new CD-ROM Discs of AGRIS Data Base (2000-2001) and "Current Contents, Life Sciences, Agriculture and Biology" have been acquired from NATP funds. Renovation of library furniture was done during the year under report. Three additional computers of high speed and higher HDD capacity were ordered during the period.

Library holdings (as on 31st March 2002)

Documents	Additions during the year under report	Total Holdings
Books	43	7112
Bound Journals	382	17481
Annual Reports	193	4053
Reprints/Research papers	2	307
Bulletins/Research notes	4	522
CD-ROMS	4	40
ISI-Specifications	2	95
Maps	–	37
Patents		
(a) Foreign	–	327
(b) Indian	–	15

Journal Subscriptions & Periodical Receipts

Foreign Periodicals (Subscribed)	–	23
Foreign Periodicals (Gratis/Exchange)	–	22
Indian Periodicals (Subscribed)	–	61
Indian Periodicals (Gratis/Exchange)	–	47

The library also maintains the mailing lists as detailed for regular mailing of the Annual Reports/ Newsletters and other publications of the Institute :

1. INDIAN

a) Exchange (for Libraries) - 56
b) Complimentary/ gratis - 75
c) NGOs and others - 127

1. FOREIGN COUNTRIES

a) Exchange - 6
b) Complimentary/ gratis - 9
c) Embassies & others - 8

Services rendered :

- 8603 pages of photocopies were supplied to the readers on payment and 2106 pages of photocopies were also been provided to the staff.
- Circulation : 947 Books were issued to borrowers.
- Sale of institute publications (Priced and unpriced) are also being looked after by the library section. 147 no. of priced and 4121 nos. of unpriced publications have been supplied to various costomers and NGOs, industrialists and farmers etc. A revenue of Rs. 8603 was earned.
- Mailing of the institute publications to various dignitaries of the Council and other Govt/Semi Govt./ PSUs/NGOs/Industry people/farmers free of charge.
- Laminations - Heat-fuse-lamination facility has been provided for official purposes. Lamination of the covers of DTP documents produced by the Institute has also been done.
- Downloading of web-based scientific journals: The facility has also been extended to the bonafide staff of this Institute only : following journals are available on e-line.
  - i Scientific American
  - ii Nature
  - iii Bulletin of Entomological Research.

Farm

Management and maintenance of farm including roads, paths, channels, hedges and edges were carried out. Hoeing, weeding and mulching of various plots, removal of termite from lac host trees, plots and roads and spraying of insecticides to control the termites wherever and whenever necessary were done. Unwanted and obnoxious weeds were eradicated from *ber, khair, kusum, putri, palas, sisam, galwang, akashmani* plots manually as well as by frequent ploughing. Harvesting of *jethwi* 2001 crop and inoculation, *phunki* removal and scraping of lac for *aghani* 2001-2002 crop were carried out. Seedlings of various host plants *viz., kusum, ber, galwang, palas akashmani, khair, F. semialata* were raised in polythene bags as well as in nursery beds for filling up the vacant space in respective plots for research experimental use and distribution amongst the farmers for sale.

Seasonal flowers, shrubs and ornamental foliage plants were planted on various spots in the office premises including dispensary, guest house, divisions and sections from time to time. Various cultural operations such as weeding, hoeing, spraying of pesticides etc. were carried out. Irrigation, application of manures and fertilisers were also performed for proper maintenance of landscaping area.

For utilisation of vacant space between lac host and waste land area, seedlings of paddy (*Mansuri*, IR36, *Basmati* 1310, BR10) were raised, transplanted

in low land area of farm and satisfactory yields were obtained.

Soyabean, turmeric, ginger, *arhar*, maize, *Gora* paddy, sweet potato were raised in between the rows and plants of *kusum* and *palas* plots and in mixed plantation of *bhalia* and *galwang*.

For development of irrigation facility and up keep of farm, a pond and *pucca* road have been constructed. A deep bore well was tried with the help of C.G.W.B. as an exploratory trial.

About 2000 trainees/ farmers / students visited the Institute plantation under short and long term training programmes organised by the T.O.T Division. Proper arrangements were made to acquaint them with insect, host plants and improved methods of lac cultivation. An amount of Rs. 76,392/- was earned through the sale of farm produce.

Mechanical Section

The following electrical, mechanical and civil works were undertaken during the period under report.

- Electrical maintenance/repair work for residential quarters, admn. building, labs and street/ road lights including pump houses etc.
- Work for repair/reconditioning of lab. instruments, equipments and other elect. emergency units.
- Repair/overhauling and changing of spares in water lift pumps, engines, motors and control starters including servicing of genset.
- Machine shop (related to lathe, drilling, grinding and fabrication work) for projects, machines and other equipments.
- Electric welding/cutting job work in M. S. fabrication, repair of farm implements and structural.
- Carpentry fabrication and wood repair work with regard to lab, office furniture including door, windows of residential quarters.
- Laying of water pipe lines including their repair and fitting work in labs, guest house, hostels and residential quarters.
- Water supply to residential quarters/labs and of office including farm for drinking and irrigation purposes daily.

Health Care

Medical needs of the staff members and their dependents are taken care of by the Institute. A part time Authorised Medical Attendant visits the Institute dispensary on all working days. Assistance is given by one stockman-cum-compounder and an attendant. During the period under report, 6125 consultations were made by the staff members and their dependents. Besides, 80 cases were referred to different specialists at RMCH and other authorised hospitals.

SUMMARY REPORT IN HINDI

रिपोर्ट का हिन्दी में सारांश

कार्यकारी सारांश

बेहतर उपज के लिए लाख फसल एवं परिपालक वृक्षों का प्रबन्धन

- ग्रीष्म ऋतु में फसल परिपक्व होने पर समयानुसार संचारण एवं बीहन लाख के उत्पादन सुनिश्चित करने और अप्रैल एवं मई माह की अवधि में एक/दो दिनों के अन्तराल में बेर पर जल छिड़काव नर कीट को डेसिकेशन (Desiccation) से बचाने के लिए उपयुक्त पाया गया।
- शीत ऋतु में एफ. माइक्रोफाइला एवं ए. लूसिडा के पौधों की उपयुक्त मोटाई (नीचे एवं उपर) में लाख लार्वा स्थापन के लिए पर्याप्त मात्रा में लाख पपड़ी आच्छादन क्रमश 4.6-3.4 एवं 4.4-2.9 सेंमी तथा एफ. सेमियालाता में 4.5-3.4 सेमी. पाया गया।
- ग्रीष्म ऋतु में फसल की परिपक्वता (जेठवी 2001) केवल 33.4 एवं 37.4 प्रतिशत आकाशमणि के प्राथमिक एवं दूसरे क्रम के डंठल पर क्रमशः बीहन के उपयोग के लिए मोटी लाख परत पायी गयी।
- सूखे वनज के आधार पर साढ़े छः वर्ष का आकाशमणि के पौधों के विभिन्न भाग जैसे, मुख्य तना, शाखा, टहनी, पत्ते एवं जड़ जैसी संरचनाओं का क्रमशः योगदान 22.8, 20.6, 21, 15 एवं 20.8 प्रतिशत था।
- एन 20 +1/2 यूरिया + एफ. वाइ. एम. के प्रयोग से वायोमास (जैव पदार्थ) का अधिकतम उपज पाया गया? कच्ची लाख (लाख जैव पदार्थ) का उत्पादन एन 20 (अकार्बनिक) के प्रयोग से ही सर्वाधिक था।

लाख कीड़े के नाशीकीट का दमन

- कुसुम के पेड़ पर 300 प्रति पेड़ अण्ड परजीवी का निर्गमन कराना सबसे उपयुक्त पाया गया।
- नुकील (इथोनफेनप्रोक्स) एवं कालदान (कैरटैप हाइड्रोकलोराइड) कीटनाशक लाख कीट परभक्षी के प्रबंधन में उपयुक्त पाया गया।

लाख कीट-परिपालक पौधों का पारस्परिक संपर्क

- शीत ऋतु के लाख फसल (अगहनी 2000-01) में एफ सेमियालाता, एफ. माइक्रोफाइला एवं अलबिजिया लुसिडा में कुल उपलब्ध डंठलों में से केवल क्रमशः 0.82, 0.64 एवं 5.9 मीटर लम्बी डंठल ही लाख पपड़ी से आच्छादित थी।
- अगहनी लाख फसल उपजाने के लिए आठ फलेमेंजिया के जेनोटाइप को कुसुम लाख उपजाति को संचारित करवाया गया। इनमे से एफ. सेमियालाता (आई.सी.पी. डब्ल्यू 201) 187.5 ग्राम बीहन लाख औसत उच्चकोटि के लाख उत्पादकता दर्शाया। एफ. पैनीकुलाता एवं एफ. सेमियालाता दोनों प्रजातियों की झाड़ियों में संचारण के बाद 87% उत्तरजीविता पाया गया। पूर्व वर्नित लाख बीज उत्पादन के लिए बेहतर पाया गया। जबकि एफ. सेमियालाता में अगहनी फसल के परिपक्वता के समय दरार पाया गया। एफ. सेमियालाता, एफ. पैनीकुलाता की तुलना में अधिक वृद्धियुक्त, उत्पादकता एवं गुणवत्ता वाला पाया गया।
- एफ. सेमियालाता (आई.सी.पी.डब्ल्यू 201) के अगहनी लाख फसल की अवधि में प्रारंभिक शाखाओं (33.8%) में लार्वा स्थापन में अच्छा प्रदर्शन पाया गया।
- संचारित पौधों में लाख कीटों एवं जल के प्रभाव से एफ. सेमियालाता में 25 प्रतिशत एवं एफ. पैनीकुलाता (आई.सी.पी.डबल्यू. 200) में 12.5 प्रतिशत सर्वाधिक मरणशीलता पाई गई।

लाख की खेती का यंत्रीकरण

- परियोजना के अन्तर्गत विकसित रोलर के जैसा पेडल से चलने वाली लाख छीलने की मशीन का कुसमी लाख की डंठल का उपयोग कर परीक्षण किया गया। विभिन्न रोलरों का गति अनुपात एवं स्प्रींग स्थिरता पर छिलाई के दौरान क्षति का निर्धारण एवं विश्लेशण किया गया।

पलास पर बीहन लाख की उपज का अनुमान

- तीन अलग-अलग स्थानों पर वैशाखी सह कतकी 2000-2001 फसल में पलास के वृक्ष पर बीहन लाख उत्पादन, परिपालक वृक्ष एवं लाख कीट के विभिन्न प्राचालिक का बहुचर विश्लेषण किया गया। अध्ययन किये गए परिवर्त्ती में प्रति वृक्ष बीहन लाख की उपज, टहनियों की संख्या एवं कीट भक्षी की पूर्व सम्पात को महत्वपूर्ण पाया गया।

एल्यूरिटीक अम्ल से नेमाटीसाइड का संशलेषण

- 9 हाइड्रोक्सी Δ^2 ननइनोयिक अम्ल को 7 - हाइड्रोक्सी हेप्टानल के साथ संशलेषित किया गया। असंतृप्त घोल को मिथाइल 9- हाइड्रोक्सी ननइनोएट मिथाइल इस्टर के रूप में

परिवर्तित किया गया। हाइड्रोक्सी Δ^2 ननइनोयिक अम्ल एवं इसके मिथाइल इस्टर को नेमाटीसाइडल गुणों के लिए परीक्षण किया गया। नेमाटोड के जड़ की तरुण गॉठ के द्वितीय स्तर के विरूद्ध मेलोडोजाईन इनकोगनिटा के 1000, 500, 250, 125 ओवं 62.5 पीपीएम संतृप्ता पर क्रमश: 24 घंटे एवं 48 घंटे वाला एक्सपोजर में दोनों समिश्रणों ने अच्छी नेमाटिसाइडल अभिक्रिया पाई गई।

चपड़ा आधारित लकड़ी वार्निश एवं लाख रोगन (लैकर)

- स्प्रीट रहित के घोल पद्धति चपड़ा आधारित दो लकड़ी वार्निश (एम.एस.भी. 001 एवं एम.एस.भी. 005 तैयार किया गया। बाजार में उपलब्ध वार्निश के साथ इसकी तुलना करने पर समानता पाई गई। इस तकनीकी को केरल राज्य के एक उद्यमी को प्रदान किया गया।
- व्यवसायिक प्रयोग हेतु आवश्यक गुणों वाला दो कैन लैकर कम्पोजिसन भी तैयार किया गया।

गमी मास (एक उपोत्पाद का उपयोग)

कृत्रिम रेजीन जो सामान्य उपयोग में लाया जाने वाला विलायक है पर आधारित एक कृत्रिम गमी मास विद्युतरोधी वार्निश का परीक्षण एक स्थानीय उपभोक्ता के माध्यम से किया गया। तथा 220 के डब्लू 6.6 के वी विद्युत मोटर के क्वायल पर प्रयोग करने पर इसका प्रदर्शन संतोषजनक पाया गया।

- फाइवर ग्लास रेनफोर्सड सीट (एफआरपी) तैयार करने के लिए पौलिस्टर रेजीन आधारित शीट मोल्डिंग यौगिक हेतु इक्सटेनडर के रूप में गमी मास के उपयोग के प्रयास किए गए। हाथ से तैयारी के तकनीक से बने एफ.आर.पी. शीट में अच्छे यांत्रिकी गुण है तथा विभिन्न रसायनों से मध्यम प्रतिरोधक क्षमता रखते हैं। चूँकि गमी मास पॉलिस्टर रेजीन की तुलना में सस्ता है अत: इन क्षेत्रों में उपयोग की इसकी क्षमता अधिक प्रतीत होती है।
- लाख मोम आधारित लेपन सूत्रण

  क. फल और सब्जियों को सामान्य अवस्था से अधिक दिनों तक टिकाये रखने के लिए लाख मोम एवं विरंजित लाख से तैयार इमलशन का लेपन के लिए उपयोग किया गया। आम एवं बड़ी मिर्च के उपर उनके लेपन के परिणाम उत्साहवर्द्धक हैं।

  ख. सामान्य में भण्डारण की स्थिति में लाख मोम, विरंजित लाख एवं मोमरहित लाख के मिश्रित इमलशन के लेपन किए गए आम और बड़ी मिर्च आलेपित नमूनों की तुला में क्रमश: 10 एवं 3 दिन ज्यादा टिकाऊ बने रहे।

कृषि अवशिष्ट एवं अनुपयोग्य लाख का विभाजन (पार्टिकल्स) बोर्ड

- अरहर (केजानस कैजन) की डंडियों से विभाजन बोर्ड बनाने के लिए अप्रोग्य लाख मोलम्मा, पसेवा एवं किरी का उपयोग किया गया। उपरोक्त सामग्रियों में अशुद्धि की उपस्थिति में विभाजन बोर्ड की बनावट एवं दृढ़ता को बुरी तरह प्रभावित करता है। उपरोक्त सामग्रियों को विभाजन बोर्ड बनने के लिए फेनोल-फार्मलडिहाईड रेजीन के साथ भी उपयोग किया गया।

  विभाजन बोर्ड का सतह संरक्षण सामान्य पोलिएस्टर से सफलता पूर्वक किया गया। जिसमें चौप्ड ग्लास फाईवर मैट एवं सरफेस मैट का उपयोग समेकित सामग्री के रूप में किया गया।

तदर्थ अनुसंधान योजना

विद्युतरोधी वार्निश के निर्माण की सरल विधि

चपड़ा कृत्रिम रेजीन एवं सामान्य घोलको पर आधारित उच्च ताप प्रतिरोधी भर्जित तरह का विद्युतरोधी वार्निश बनाने की एक सरल विधि विकसित की गई। इस तरह विकसित वार्निश में आई.एस.आई. : 0026-1982 के अनुरूप प्रतिरोधी वार्निश के सभी आधारभूत आवश्यकताओं को पूरा करती है। इस विद्युतरोधी वार्निश को जब 750 के डब्लू 6.6 के वी एवं 3.3 के वी 400 हार्सपावर के विद्युत मोटर पर प्रयोग किया तो संतोषजनक पाया गया। प्रारंभिक परीक्षण में मेसर्स टी.टी.के. प्रेस्टीज लिमिटेड, बैंगलूर द्वारा रसोई के बर्तनों पर बाहरी लेप के लिए भर्जित तरह के वार्निश का प्रयोग करने के परिणाम संतोषजनक रहा। इसमें से एक वार्निश मेसर्स एम.एम.टी.सी., कोडरमा द्वारा अबरख के उपर लैमिनेटेड शीट के निर्माण में उपयोग किया गया तथा संतोषजनक पाया गया।

- एफ.आर.पी. के निर्माण में चपड़ा का फिलर/विस्तारक के रूप में उपयोग हाथ से तैयार करने की तकनीक द्वारा चपड़ा आधारित भर्जित तरह का विद्युतरोधी वार्निश से फाइवर ग्लास समेकित शीट भी बनाया गया। तथा कृत्रिम रेजीन आधारित मोल्डिंग यौगिक के लिए चपड़ा का फिलर के रूप में उपयोग किया गया। एफ.आर.पी. शीट विभिन्न रसायनों के प्रति बेहतर प्रतिरोधी गुणों का प्रदर्शन करता है। भर्जित एफ.आर.पी. शीट तैयार करने के तकनीक को एक स्थानीय उद्यमी को हस्तांतरित किया गया। प्लाईवुड पर चपड़ा भर एस.एम.सी. का प्रयोग करने पर सनमाइका की तरह आकषर्क फिनिश देखा गया।

परिचय

भारतीय लाख अनुसंधान संस्थान की स्थापना 1925 में हुई। भारत में लाख उद्योग की स्थिति की जाँच एवं इसके सर्वांगिण विकास के लिए सुझाव देने हेतु 1920 के आरम्भ में तत्कालिन 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 कों 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 उसकी सहयोगी थी। तत् पश्चात् 1920 के दशक में अनुप्रयुक्त अनुसंधान के लिए भौतिक रसायन अनुभाग बना। तदुपरांत इन दोनो रसायन अनुभागों को मिलाकर एक रसायन विभाग बना। इस तरह इस संस्थान का कार्यक्षेत्र कीट वैज्ञानिक 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) तथा 1962 में नामकुम (बिहार) 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 पूरब 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 मई के बीच औसत न्यूनतम मासिक तापक्रम 5.62° सें. से 23.1° सें. के बीच तथा औसत अधिकतम मासिक तापक्रम दिसम्बर से मई के बीच 25.11° सें. से 41° सें. के बीच रहा। इस अवधि में कुल वर्षा 1258.5 मी.मी. हुई जिसमें मानसून की वर्षा 1107 मी.मी. थी।

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 सटे एक छोटा परिसर है जिसमें संसाधन प्रयोगशाला एवं स्टाफ के आवास गृह हैं। संस्थान के दोनों परिसरों में खेल का मैदान है।

वर्त्तमान स्थिति

सम्प्रति देश की खुली आर्थिक नीति, उद्योगों एवं कृषि उद्यमों की विश्वव्यापकता एवं भा.कृ.अनु.प. का 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 वितरण किया 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 की गई 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 पृथक करने के लिए लगातार प्रयासरत है। संस्थान के पास लाख की खेती के वैज्ञानिक तरीके 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 करती है।

औद्योगिक पहलू की भी उपेक्षा नहीं की गई। 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 है। पूर्व में इच्छुक लोगों के अनुरोध पर निःशुल्क 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 है। 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।

स्टाफ

संस्थान में 56 वैज्ञानिक, 84 तकनीकी, 43 प्रशासकीय एवं 112 सर्पोटिंग ग्रेड के स्वीकृत पद है।

राजस्व

रिपोर्ट की अवधि में संस्थान द्वारा विभिन्न मदों में कुर्ल आय रु. 12,09,139।

बजट

2001–2002 की अवधि में योजना एवं गैर योजना मद में खर्च का विवरण नीचे सारिणी में दिया गया है।

लेखा शीर्ष व्यय	बजट अनुमान 2001–2002 (रु.लाख)	संशोधित अनुमान 2001–2002 (रु . लाख)	वास्तविक व्यय (रु . लाख)
क. योजना			
स्थापना शुल्क	–	–	–
मजदूरी	–	–	–
समयोपरि भत्ता	–	–	–
यात्रा भत्ता	3.50	3.50	3.50
निर्माण सहित अन्य शुल्क	54.50	58.50	58.46
निर्माण	7.00	7.00	6.91
कैच अप अनुदान			
उपकरण	15.00	15.00	14.92
निर्माण	30.00	20.00	19.97
पुस्तकालय की किताबें एवं अन्य मद	5.00	1.00	0.61
कुल	115.00	105.00	104.37
ख. योजनेत्तर			
स्थापना शुल्क	350.00	294.00	290.89
मजदूरी	–	–	–
समयोपरि भत्ता	0.05	0.05	0.05
यात्रा भत्ता	2.50	2.75	2.74
उपकरण समेत अन्य शुल्क	48.00	70.00	69.86
निर्माण	4.45	10.00	9.95
कुल	405.00	376.80	373.49
ग. पेन्शन	89.70	80.00	80.00
घ. भ. ऋण	8.00	25.00	23.18

राजभाषा प्रकोष्ठ

भारत सरकार के राजभाषा विभाग (गृह मंत्रालय) द्वारा तैयार किये गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम व नियमों के संबंध में भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली से समय-समय पर प्राप्त निर्देशों पर अनुवर्ती कार्रवाई तथा सरकारी कार्य में हिन्दी के अधिकाधिक प्रयोग को बढ़ावा देने तथा प्रोत्साहन योजना को लागू करने एवं हिन्दी को और गति प्रदान करने के लिए संस्थान तथा नगर स्तरीय हिन्दी की विभिन्न प्रतियोगिताओं को आयोजित करने के उद्देश्य से संस्थान में राजभाषा प्रकोष्ठ की स्थापना की गई है। इसमें एक सहायक निदेशक (राजभाषा) तथा एक हिन्दी अनुवादक के साथ-साथ एक अंशकालिक चतुर्थ वर्गीय कर्मचारी कार्यरत हैं।

संस्थान के दैनिक कार्य में हिन्दी के प्रयोग में प्रगति एवं उसे सर्वग्राह्य बनाने के उद्देश्य एवं बहुआयामी उपयोग के लिए राजभाषा प्रकोष्ठ द्वारा निम्नलिखित कार्य सम्पादित किये जाते है:-

- संस्थान राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन, कार्यसूची एवं कार्यवृत की तैयारी तथा लिए गए निर्णयों पर अनुवर्ती कार्रवाई।
- वार्षिक रिपोर्ट का सारांश, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा सूचना एवं पत्राचार हेतु विभिन्न सामग्रियों का अनुवाद।
- हिन्दीतर अधिकारियों एवं कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण हेतु नामित करना।
- हिन्दी दिवस, हिन्दी सप्ताह, हिन्दी पखवाड़ा, हिन्दी मास एवं योजनानुसार अखिल भारतीय स्तर की राजभाषा गोष्ठी का आयोजन।
- संदर्भ साहित्य, हिन्दी पत्रिका, शब्दकोष एवं तकनीकी शब्दावली का उपार्जन।
- द्विभाषी मुहर, नामपट्ट एवं साइनबोर्डो के निर्माण में सहयोग।
- प्रचार सामग्रियों एवं विवरणिकाओं के प्रकाशन में भाषान्तरण में सहयोग।
- नगर राजभाषा कार्यान्वयन समिति की बैठकों में सहभागिता एवं संस्थान से संबंधित समिति के निर्णयों का कार्यान्वयन।
- तकनीकी शब्दावली का निर्माण एवं राजभाषा को समर्पित अन्य प्रकाशन की तैयारी। हिन्दी में वैज्ञानिक गोष्ठी के साथ-साथ प्रशासनिक एवं तकनीकी वर्ग के लिए हिन्दी कार्यशाला का आयोजन।

उपरोक्त कार्यो के निष्पादन के लिए वर्ष 2001-2002 में निम्नलिखित सदस्यों की संस्थान राजभाषा कार्यान्वयन समिति कार्यरत रही।

डॉ. कौशल किशोर कुमार, निदेशक	- अध्यक्ष
डॉ. प्रेम चन्द्र गुप्ता, अध्यक्ष, लाख संसाधन एवं उत्पाद विकास विभाग	- सदस्य
डॉ. प्रणय कुमार, अध्यक्ष, लाख उत्पादन विभाग	- सदस्य
श्री रंगनादन रमणि, प्रधान वैज्ञानिक एवं प्रभारी विभागाध्यक्ष, प्रौद्योगिकी हस्तांतरण विभाग	- सदस्य
श्री अशिष रस्तोगी, प्रशासनिक अधिकारी	- सदस्य
श्री रजनीश कुमार सिंह, वित्त व लेखा अधिकारी	- सदस्य
श्री राम प्रताप तिवारी, प्रभारी अधिकारी, पुस्तकालय	- सदस्य
डॉ. अंजेश कुमार, हिन्दी अनुवादक	- आमंत्रित सदस्य
श्री लक्ष्मी कान्त, सहायक निदेशक (राजभाषा)	- सदस्य सचिव

रिपोर्ट की अवधि में दिनांक 22.06.01 तथा दिनांक 20.08.01 को संस्थान राजभाषा कार्यान्वयन समिति की बैठक समिति के अध्यक्ष एवं संस्थान के निदेशक डॉ. कौशल किशोर कुमार की अध्यक्षता में सम्पन्न हुई जिसमें निम्नलिखित निर्णय लिए गए :-

- प्रशिक्षण सामग्री का हिन्दी में प्रकाशन
- हिन्दी में कम्प्यूटर प्रशिक्षण
- हिन्दी में गृह पत्रिका का प्रकाशन
- संस्थान के लिफाफों पर हिन्दी में मुद्रण
- हिन्दी कार्यशालाओं का आयोजन
- हिन्दी में ई.मेल भेजने हेतु ई.लीप सॉफ्टवेयर का क्रय
- हिन्दी निबंध प्रतियोगिता का आयोजन

हिन्दी दिवस समारोह

संस्थान में 14 सितंबर 2001 को पारंपरिक हर्षोल्लास के साथ हिन्दी दिवस एवं 'हिन्दी चेतना मास' के उदघाटन समारोह का आयोजन किया गया। मुख्य अतिथि के रूप में झारखंड राज्य के माननीय मानव संसाधन विकास मंत्री श्री चन्द्र मोहन प्रसाद जी ने समारोह का उदघाटन दीप प्रज्वलित कर किया। डॉ के. के. नाग पूर्व कुलपति एवं विभागाध्यक्ष, स्नातकोत्तर वनस्पति विज्ञान विभाग राँची विश्वविद्यालय ने समारोह की अध्यक्षता की।

मुख्य अतिथि पद से बोलते हुए श्री चन्द्र मोहन प्रसाद जी ने कहा हिन्दी दिवस का आयोजन कर औपचारिकता का निर्वहन करने से हिन्दी राष्ट्रभाषा नहीं बन सकती। इसके लिए सर्वप्रथम हिन्दीभाषियों को हिन्दी के प्रति सम्मान और प्रेम को जनमानस में लाना होगा। तभी हिन्दी को एक सर्वमान्य भाषा के रूप में सारे देश में स्थान प्राप्त हो सकेगा। उन्होंने हिन्दी दिवस के अवसर पर उपस्थित श्रोताओं को हिन्दी के प्रति प्रेम और अपने कार्यो में स्वीकार करने का आग्रह किया। उन्होंने कहा कि संप्रति संचार माध्यमों ने हिन्दी के प्रचार और प्रसार का कार्य प्रभावी रूप से किया है। परन्तु कार्यालय स्तर पर इसका प्रयोग संतोषजनक नहीं हो पाया है। हिन्दी देश को जोड़ने वाली भाषा है। इसलिए इसकी प्रगति में अपना योगदान सुनिश्चित करने की आवश्यकता है। इस अवसर पर इन्होंने संस्थान द्वारा हिन्दी के प्रयोग के लिए किए गए प्रयासों की सराहना की और विश्वास व्यक्त किया कि भविष्य में भी इसी तरह के प्रयास किए जायेंगे।

हिन्दी दिवस समारोह में बोलते हुऐ संस्थान के निदेशक डॉ. कौशल किशोर कुमार

अपने अध्यक्षीय भाषण में पूर्व कुलपति डॉ के. के. नाग ने कहा कि जिस राष्ट्रकी अपनी भाषा नहीं उस राष्ट्र की अपनी पहचान नहीं हो सकती। उन्होंने हिन्दी के प्रसिद्ध कवि भारतेन्दु हरिश्चन्द्र को स्मरण करते हुए कहा ''निज भाषा उन्नति अहै सब उन्नति के मूल, विन निज भाषा ज्ञान के मिटत न हिय को सूल।'' उन्होने हिन्दी के प्रति उपेक्षापूर्ण भाव रखने वालों से यह आग्रह किया कि वे अपनी भाषा की उपेक्षा न करें क्योंकि यह अपने स्वाभिमान की उपेक्षा है। इस समय देश को एकता के सूत्र में बाँधने वाली भाषा की आवश्यकता है।

संस्थान के निदेशक डॉ. कौशल किशोर कुमार ने स्वागत भाषण में कहा कि हिन्दी हमारी मातृभाषा, राष्ट्रभाषा, संपर्क भाषा एवं राजभाषा है अत: इसका प्रचार-प्रसार एवं सरकारी कार्यो में अधिकाधिक प्रयोग आवश्यक है। वर्तमान स्थिति में देश की अखंडता को सुदृढ़ बनाए रखने के लिए हिन्दी को व्यापक स्थान देना आवश्यक है। वैसे भी अहिन्दी भाषियों के लिए अंग्रेजी की उपेक्षा 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 करें तो हिन्दी का सही प्रयोग अनायास ही आ जाएगा। उन्होंने आगे अपील की कि अपने अपने स्तर पर सभी कोई हिन्दी के प्रयोग को प्रोत्साहित करने में सक्रिय सहयोग प्रदान करें।

श्री लक्ष्मी कान्त सहायक निदेशक (राजभाषा) ने राजभाषा संबंधी प्रगति प्रतिवेदन प्रस्तुत करते हुए सूचित किया कि पेंशन निर्धारण एवं उसके पूर्व सेवा निवृत होने वाले कर्मचारियों का दायित्व, सामान्य प्रशासन एवं कार्यसंस्कृति, दूरभाष के विभिन्न आयाम एवं उपभोक्ताओं का दायित्व, कम्प्यूटर विज्ञान का विकास एक विश्लेषण विषय पर हिन्दी कार्यशाला आयोजित किया जा चुका है। किसानों की सेवा में भारतीय लाख अनुसंधान संस्थान सवाल किसानों के जवाब विशेषज्ञों के, लाख की खेती कब कहां कैसे? हिन्दी में प्रकाशित किया है एवं जहां चाह तहां राह नामक प्रचार सामग्री को नागपुरी बोली से प्रकाशित किया गया है।

संस्थान के सहायक निदेशक (राजभाषा) श्री लक्ष्मी कान्त द्वारा संकलित ''राजभाषा रश्मि'' (जिसमें साहित्यकारो, राजनेताओं एवं अन्य हिन्दी सेवियों के हिन्दी के प्रेरक नारे हैं) का विमोचन (लोकार्पण) समारोह के मुख्य अतिथि झारखंड राज्य के माननीय मानव संसाधन विकास मंत्री श्री चन्द्र मोहन प्रसाद जी ने किया।

राँची नगर राजभाषा कार्यान्वयन समिति द्वारा सर्वश्री राम प्रताप तिवारी तथा प्रहलाद सिंह को पुरस्कार एवं प्रमाण पत्र प्रदान किया गया। हिन्दी निबंध प्रतियोगिता में श्री प्रवीण चन्द्र झा को प्रथम एवं श्री रामप्रताप तिवारी को द्वितीय पुरस्कार प्रदान किया गया। अपने-अपने विभाग अनुभाग में सर्वाधिक कार्य हिन्दी में

करने के लिए संस्थान के डॉ दीपेन्द्र नाथ गोस्वामी, श्री राम किशोर स्वांसी, श्री बसन्त प्रसाद केशरी, श्रीमती सुशांति प्रसाद, श्री मुन्ना लाल रविदास, श्री कृष्णानंद सिन्हा, श्री दुधेश्वर राम, श्री बिहारी साहु, श्री कुलदीप पाण्डेय, श्री बैजनाथ गोप, श्री इन्द्रदेव दास, श्री अर्जुन शर्मा, श्री संजय कुमार त्रिपाठी, श्री सतीश कुमार, डॉ केवल कृष्ण शर्मा, श्री लाल चन्द्र चूड़ामणि नाथ शाहदेव, श्री अर्जुन कुमार सिन्हा, श्री मिथिलेश कुमार सिंह, श्री कुमार महेन्द्र सिन्हा, श्री शत्रुधन कुमार यादव एवं श्री कृष्ण कान्याल देवनाथ को पुरस्कृत किया गया एवं सांस्कृतिक कार्यक्रम के अर्न्तगत कविता श्री राम प्रताप तिवारी, डॉ निरंजन प्रसाद, श्री कवल किशोर प्रसाद, श्री प्रवीण चन्द्र झा, श्री मनोज कुमार, व्याख्यान- डॉ निरंजन प्रसाद नागपुरी गीत- श्री बैजनाथ गोप, हास्य कविता- डॉ अंजेश कुमार ने सस्वर पाठ किया। डॉ अंजेश कुमार ने सभा संचालन एवं डॉ प्रणय कुमार अध्यक्ष, लाख उत्पादन विभाग एवं अध्यक्ष हिन्दी दिवस आयोजन समिति ने धन्यवाद ज्ञापन किया।

कार्यशाला:

सरकारी काम काज में हिन्दी के प्रयोग को प्रोत्साहित करने तथा हिन्दी में कार्य करने संबंधी झिझक दूर करने के लिए कार्यशालाओं का आयोजन वांछनीय है। संस्थान में प्रशासनिक मामलों में कार्यशालाओं का आयोजन किया गया। श्री रजनीश कुमार सिंह ने "पेंशन निर्धारण एवं उसके पूर्व सेवा निवृत होने वाले कर्मचारियों का दायित्व" तथा श्री अशिष रस्तोगी ने "सामान्य प्रशासन एवं कार्यसंस्कृति" तथा तकनीकी कार्यशाला में भारत संचार निगम लि. के श्री सुदामा सिंह ने "दूरभाष के विभिन्न आयाम एवं उपभोक्ताओं के दायित्व" तथा वैज्ञानिक कार्यों में भी हिन्दी के प्रयोग को लोकप्रिय बनाने के उद्देश्य से संस्थान के वैज्ञानिक डॉ पूर्णचन्द्र सरकार ने "कम्प्यूटर विज्ञान का विकास एक विश्लेषण" विषयक हिन्दी कार्यशाला में व्याख्यान दिया है।

संस्थान के प्रकाशन:

संस्थान द्वारा प्रचार पत्रक, बुलेटिन एवं पुस्तकों के प्रकाशन की परम्परा को आगे बढ़ाते हुए संस्थान के प्रौद्योगिकी हस्तांतरण विभाग के डॉ अनिल कुमार जायसवाल एवं डॉ केवल कृष्ण शर्मा ने 1. "किसानों की सेवा में भारतीय लाख अनुसंधान संस्थान" 2. सवाल किसानों के जवाब विशेषज्ञों के" 3. लाख की खेती कब कहाँ कैसे? हिन्दी में प्रकाशित किया है एवं 4. जहां चाह तहां राह नामक प्रचार सामग्री का नागपुरी अनुवाद श्री महेश्वर लाल भगत ने किया है।

पुरस्कार:

राँची नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में आयोजित हिन्दी अंताक्षरी प्रतियोगिता में श्री प्रहलाद सिंह तथा निबंध प्रतियोगिता में श्री राम प्रताप तिवारी को पुरस्कृत किया गया है।

प्रतियोगिता आयोजन:

"हिन्दी निबंध" प्रतियोगिता के विजयी प्रतिभागियों के साथ-साथ सरकारी कार्य में सर्वाधिक हिन्दी के प्रयोग करने वाले सदस्यों को पुरस्कृत किया गया है तथा ध्यान रखा गया है कि नये हिन्दी कर्मियों को भी प्रोत्साहित किया जा सके।

व्याख्यान:

भारी अभियंत्रण निगम राँची में आयोजित हिन्दी कार्यशाला में संस्थान के सहायक निदेशक (रा.भा.) लक्ष्मी कान्त ने हिन्दी में टिप्पण व प्रारूप लेखन विषय पर व्याख्यान दिया है।

सदस्यता :

नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों के बीच सर्वोत्कृष्ट कार्य करने वाले कार्यालय के चुनाव हेतु संस्थान के निदेशक डॉ. कौशल किशोर कुमार को निरीक्षण समिति का सदस्य मनोनीत किया गया।

आधारभूत संरचना:

संस्थान के समस्त कम्प्यूटरों में हिन्दी सॉफटवेयर उपलब्ध करवाया गया है। हिन्दी में ई मेल भेजने हेतु संस्थान के कम्प्यूटरों में आई लिप हिन्दी सॉफटवेयर लगवाया गया है।

राँची नगर राजभाषा कार्यान्वयन समिति के बैठकों में सहभागिता

समय-समय पर आयोजित राँची नगर राजभाषा कार्यान्वयन समिति की बैठकों में संस्थान के निम्नलिखित अधिकारियों एवं कर्मचारियों ने संस्थान का प्रतिनिधित्व किया।

बैठक की तिथि	संस्थान के प्रतिनिधियों का नाम
26.02.2001	विभागाध्यक्ष सह प्रभारी निदेशक डॉ. प्रणय कुमार सहायक निदेशक (रा.भा.) श्री लक्ष्मी कान्त
14.08.2001	निदेशक डॉ. कौशल किशोर कुमार, सहायक निदेशक (रा.भा) श्री लक्ष्मी कान्त, पुस्तकाध्यक्ष श्री राम प्रताप तिवारी, हिन्दी अनुवादक डॉ. अंजेश कुमार एवं वरीय लिपिक श्री प्रहलाद सिंह

हिन्दी अन्ताक्षरी प्रतियोगिता का आयोजन

प्रत्येक वर्ष की भांति इस वर्ष भी राँची नगर राजभाषा

कार्यान्वयन समिति के तत्वावधान में राँची स्थित केन्द्रीय सरकार के कार्यालयों के अधिकारियों एवं कर्मचारियों के लिए हिन्दी अन्ताक्षरी प्रतियोगिता का आयोजन दिनांक 01.08.01 को संस्थान के सभाकक्ष में किया गया जिसमें प्रथम पुरस्कार डॉ. अश्विनी कुमार सिन्हा को, द्वितीय पुरस्कार श्री प्रहलाद सिंह एवं श्रीमती तारा जायसवाल को तथा तृतीय पुरस्कार श्री इफ्तेखार अहमद एवं श्रीमती कल्पना मित्रदा को दिया गया।

हिन्दी कार्यशाला में सहभागिता

राष्ट्रीय कृषि अनुसंधान प्रबन्ध अकादमी, हैदराबाद में "राजभाषा नीति की प्राथमिकता एवं उत्तरदायित्व" विषय पर दिनांक 06.11.01 से 09.11.01 तक आयोजित चार दिवसीय कार्यशाला में संस्थान का प्रतिनिधित्व श्री लक्ष्मीकान्त, स. निदेशक (रा.भा.) ने किया।

Appendix I

METEOROLOGICAL DATA

Recorded at Namkum, Ranchi during 2001

Month	Mean Maximum Temp. (°C)	Mean Minimum Temp. (°C)	Mean Dry bulb Temp. (°C)	Mean Wet bulb Temp. (°C)	Mean Humidity (%)	Total rainfall (mm)	Highest Maximum Temp. (°C)	Lowest Minimum Temp. (°C)
January	28.79	5.62	17.99	13.92	65.8	1.0	29.1	3.5
February	30.1	11.7	21.7	18.2	70.9	27.0	31.6	8.0
March	31.6	14.7	23.7	20.3	72.5	31.5	37.0	11.1
April	36.93	19.2	26.65	23.2	65.1	16.0	41.5	16.0
May	38.7	23.1	27.4	23.9	78.9	44.0	43.5	18.0
June	30.5	20.9	25.7	23.2	79.3	503.5	39.0	20.0
July	29.16	21.6	26.3	23.2	77.3	326.5	31.0	20.0
August	30.9	23.0	26.8	24.1	79.8	185.0	32.5	22.0
September	30.6	22.7	26.2	23.8	82.2	92.0	35.0	21.5
October	29.7	18.8	25.8	21.6	70.5	32.0	32.0	15.5
November	28.39	13.82	17.24	14.4	73.8	Nil	31.1	12.0
December	25.0	8.25	12.7	9.8	68.3	Nil	27.6	6.0

The highest temperature - 45°C (09.05.2001)

The lowest temperature - 3.5°C (10.01.2001)

The total rainfall - 1258.5 mm

Monsoon rainfall (June to Sept.) - 1107 mm

Hailstorm - None

Appendix II

PERSONNEL

Present strength (As on 31.12.2001)

Scientific*		
RMD	-	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. Admin. Officer	-	2
Jr. Accounts Officer	-	1
Sr. P.A.	-	1
Steno Gr. - II	-	2
Assistant	-	13
Sr. Clerk	-	13
Jr. Steno	-	1
Jr. Clerk	-	5
Total	-	**40**

Field Stations

		WB	MP	Orissa
Scientific	-	2	2	2
Technical	-	4	5	3
Admin.	-	1	1	
Supporting				

Administrative Non-Ministerial		
Medical Officer	-	1
Asstt. Director (OL)	-	1
Security Officer	-	1
Total	-	**3**
Technical*		
Category - III	-	5
Category - II	-	32
Category - I	-	44
Total	-	**81**
Supporting		
Grade - IV	-	10
Grade - III	-	20
Grade - II	-	34
Grade - I	-	37
Total	-	**101**

* Includes field stations

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. S. N. Sushil	- Scientist (Agric. Ento.)
Sri S. K. Yadav	- Scientist (Agron.)
Sri D. Saha	- Scientist (Biotech.)
Sri R. K. Singh	- Scientist (Soil & Water Conservation)
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 R. L. Ram	- F/F Tech. (T-4)
Sri R. K. Swansi	- Lab. Tech. (T-I-3)
Sri Mohan Singh	- Lab. Tech. (T-I-3)
Sri D. W. Runda	- F/F Tech. (T-2)
Sri R. G. Singh	- F/F Tech. (T-2)
Sri S. K. Tripathi	- F/F Tech. (T-1)

Division of Lac Processing and Product Development

Dr. P. C. Gupta	- P.S. & Head LPPD (Org. Chem.)
Dr. D. N. Goswami	- P.S. (Physics)
Dr. N. Prasad	- P.S. (Org. Chem.)
Dr. R. N. Majee	- P.S. (Org. Chem.)
Dr. K. P. Sao	- P.S. (Physics)
Dr. P. C. Sarkar	- Scientist (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 (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-1)
Sri S. K. Tirkey	- Lab. Tech. (T-1)

PD Unit

Dr. N. Prasad	- PS In-charge
Dr. K. M. Prasad	- PS (Org. Chem.)
Shri R. Singh	- Scientist Sr. Scale (Phys. Chem.)
Sri P. M. Patil	- Scientist Sr. Scale (Phys. Chem.)
Sri K. K. Prasad	- Tech. Officer (Lab.) (T-6)
Sri Jagdish Singh	- Tech. Officer (Lab.) (T-6)
Sri M. K. Singh	- Lab. tech. (T-4)

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.)
Sri Y. D. Mishra	- Sr. Scientist (Agric. Entomol.)
Sri Radha Singh	- Scientist, Sr. Scale (Phys. Chem.)
Dr. A. K. Jaiswal	- Scientist, Sr. Scale (Agric. Entomol.)
Dr. K. K. Sharma	- Scientist, Sr. Scale (Agric. Entomol.)
Sri P. M. Patil	- Scientist, Sr. Scale (Phys. Chem.)
Sri M. L. Bhagat	- Scientist, Sr. Scale (Agric. Entomol.)
Dr. N. Prasad	- Scientist (Farm Machinery & Power)
Dr. G. Pal	- Scientist (Agric. Economics)
Sri L.C.C.N. Sahdeo	- Tech. Officer (F/F Tech.) (T-6)
Sri M. Ekka	- Tech. Officer (Lab.) (T-6)
Sri R. P. Srivastava	- Jr. Asst-cum-photograper (T-4)
Smt. Ratna Sen	- Museum Assistant (T-4)
Sri Anil Kr. Sinha	- (F/F Tech.) (T-4)
Sri V. K. Tewari	- (F/F Tech.) (T-4)
Sri D. K. Singh	- (F/F Tech.) (T-4)
Sri P. A. Ansari	- (F/F Tech.) (T-3)
Sri Binod Kumar	- (F/F Tech.) (T-3)
Shri S. B. Azad	- (F/F Tech.) (T-3)
Sri Madan Mohan	- (F/F Tech.) (T-1)

RFRS for Lac, Dharmjaigarh

Dr. S. K. Jaipuriar - Sr. Scientist (Agric. Ento.) I/c

RFRS for Lac, Balarampur, W.B.

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

Administrative Section

Sri A Rastogi - Administrative Officer
Sri R. K. Singh - Fin. & Accounts Officer
Sri A. K. Yadav - Security Officer
Sri Nagendra Mahto - Asst. Admin. Officer
Sri Md. Samiullah - Asst. Admin. Officer
Sri R. Rabidas - P.A. to Director
Smt. S. Prasad - Stenographer Grade II
Sri A. K. Sinha - Stenographer, Grade II
Sri S. K. Yadav - Jr. Stenographer
Sri K. P. Pandey - Assistant
Sri Budhan Ram - Assistant
Sri K. N. Sinha - Assistant
Sri Ravi Shanker - Assistant
Sri Dudheshwar Ram - Assistant
Sri Sudharshan Ram - Assistant
Sri R. K. Upadhaya - Assistant
Sri N. Tapno - Assistant
Sri Md. Mobark - Assistant
Sri Vijay Ram - Assistant
Sri B. Rajak - Assistant
Sri K. L. Choudhury - Assistant
Sri Emil Gari - Sr. Clerk
Sri Thibu Minz - Sr. Clerk
Sri Baijnath Gope - Sr. Clerk
Sri Anant Pandey - Sr. Clerk
Sri Prahlad Singh - Sr. Clerk
Sri Bihari Sahu - Sr. Clerk
Sri S. C. Lal - Sr. Clerk
Sri Raghunath Mahto - Sr. Clerk
Sri Wilson Guria - Sr. Clerk
Sri K. Oraon - Sr. Clerk
Sri Pranay Kumar - Sr. Clerk
Sri Narayan Gope - Sr. Clerk
Sri A. K. Tripathy - Jr. Clerk
Sri Arjun Gope - Jr. Clerk
Sri R. K. Toppo - Jr. Clerk
Sri K. K. Deonath - Jr. Clerk
Sri Samal Kumar - Jr. Clerk

Hindi Cell

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

Director/ARIS Cell

Dr. P. C. Sarkar - Scientist I/c
Sri A. K. Sahay - Tech. Officer (T-6 F/F)
Sri D. Ganguly - Tech. Officer (T-6 Lab.)
Sri R. K. Rai - Tech. Asst. Lab. (T-1)

RTL

Sri D. Ghosh - Tech. Officer (Lab.) (T-6)
Sri K. M. Sinha - Tech. Officer (Lab.) (T-6)
Sri B. K. Singh - Lab. Tech. (T-1)
Sri Ajay Kumar - Lab. Tech. (T-1)
Sri Anup - Lab. Tech. (T-1)

Farm Unit

Sri R. N. Vaidya - (T-6) Tech. Officer (F/F) Incharge
Sri M. Surin - T-1-3 (Tractor Driver) (F/F Tech.
Sri Satish Kumar - T-1 (F/F Tech.)
Sri S. K. Mukherjee - T-1 (F/F Tech.)

Mechanical Section

Dr. N. Prasad - Scientist O/I
Sri S. K. Srivastava - Tech. Officer, T-5
Sri S. K. Bhaduri - Tech. Officer, T-5
Sri H. L. Bhakta - Instru. Mech., T-II-3
Sri B. L. Dey - Boiler Asstt.
Sri I. D. Das - Asstt. Mech., T-1
Sri A. Sharma - Carpenter, T-1
Sri R. K. Ravi - Wireman, T-1
Sri Kunwar Tirkey - Turner, T-1
Sri B. S. Choudhary - Glass Blower (T-2)

Library

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

Dispensary

Dr. N. P. Sahu	- AMA (Part time)
Sri C. Pandey	- Stockmen-cum-compounder (T-4)

Central Stores

Dr. K. M. Prasad	- PS O/I
Sri Md. Mobarak	- Assistant

Driver

Sri Bandhan Runda	- T-I-3
Sri Jaswant Tiwary	- T-I
Sri Narayan Lakra	- T-1
Sri Arvind Kumar	- T-1
Sri Rajesh Kr. Yadav	- T-1
Sri Mandewswar Singh	- T-1

Promotions, Transfers, etc.

Promotion

Dr. K. K. Kumar	- Promoted to Principal Scientist	w.e.f. 27.7.1998
Dr. D. N. Goswami	- do -	w.e.f. 27.7.1998
Dr. N. Prasad	- do -	w.e.f. 27.7.1998
Dr. R. N. Majee	- do -	w.e.f. 27.7.1998
Sri R. Ramani	- do -	w.e.f. 27.7.1998
Dr. A. Bhattacharya	- do -	w.e.f. 27.7.1998
Dr. K. M. Prasad	- do -	w.e.f. 27.7.1998
Dr. Dr. K. P. Sao	- do -	w.e.f. 27.7.1998
Dr. B. P. Singh	- do -	w.e.f. 27.7.1998
Sri R. P. Tewari	- Promoted to next higher grade T-6	w.e.f. 3.2.2000
Sri V. K. Singh	- do -	w.e.f. 3.2.2000
Sri D. Ghosh	- do -	w.e.f. 3.2.2000
Sri K. M. Sinha	- do -	w.e.f. 3.2.2000
Sri D. D. Singh	- do -	w.e.f. 3.2.2000
Sri T. K. Saha	- do -	w.e.f. 1.7.2000
Sri A. K. Sahay	- do -	w.e.f. 3.2.2000
Sri LCN Sahdeo	- do -	w.e.f. 3.2.2000
Sri M. Ekka	- do -	w.e.f. 3.2.2000
Sri D. Ganguly	- do -	w.e.f. 10.3.2000
Sri J. Singh	- do -	w.e.f. 1.1.2001
Sri K. K. Prasad	- Promoted to next higher grade T-6	w.e.f. 1.1.2001
Sri R. N. Vaidya	- do -	w.e.f. 1.7.2001
Sri Bhola Ram	- Promoted to next higher grade	T-4 w.e.f. 8.6.1997
Smt. Ratna Sen	- do -	T-4 w.e.f. 1.1.2000
Sri B. P. Ghosh	- do -	T-4 w.e.f. 1.1.2000
Sri D. D. Prasad	- do -	T-4 w.e.f. 1.1.2000
Sri H. Das	- do -	T-2 w.e.f. 8.6.1997
Sri M. L. Rabidas	- do -	T-4 w.e.f. 8.6.1997
Sri C. Pandey	- do -	T-4 w.e.f. 1.1.2000
Sri K. P. Gupta	- do -	T-4 w.e.f. 1.1.2000
Sri A. K. Sinha	- do -	T-4 w.e.f. 1.1.2000
Sri R. L. Ram	- do -	T-4 w.e.f. 1.1.2000
Sri V. K. Tewari	- do -	T-4 w.e.f. 1.1.2000
Sri D. K. Singh	- do -	T-4 w.e.f. 1.1.2000
Sri S. S. Prasad	- do -	T-4 w.e.f. 1.1.2000
Sri P.A. Ansari	- do -	T-II-3 w.e.f. 1.1.1996
Sri R. G. Singh	- do -	T-2 w.e.f. 8.6.1997
Sri S. B. Azad	- do -	T-3 w.e.f. 1.7.2000

New Appointment

Dr. G. Pal	- joined on 13.9.2001 as Scientist, Agricultural Economics
Sri R. K. Singh	- joined on 11.12.2001 as a Scientist (Soil & Water Conservation)

Death

Jiwan lal	- T-1-3 on 2.2.2001
Mahadeo Oraon	- SG. III on 29.9.2001

Retirement

Sri U. Sahay	- T-II-3 w.e.f. 31.1.2001
Sri Md. Samiullah	- A.A.O. w.e.f. 31.1.2001
Shri T. Minz	- Chowkidar w.e.f. 30.4.2001
Smt. S. Guha	- Asstt. w.e.f. 30.4.2001
Sri R. B. Singh	- Asstt. w.e.f. 30.6.2001
Sri Chhote Lal Dhimar	- w.e.f. 30.11.2001

Transfer

Sri V. K. Rao	- Scientist, to IIHR., Bangalore w.e.f. 19.1.2001
Sri Arvind Kumar	- Scientist to I.A.R.I., New Delhi w.e.f. 12.4.2001

SCIENTIFIC CADRE STRENGTH

Sl. No.	Name of Discipline	Scientist	Senior Scientist	Principal Scientist	RMP	Total
1.	Director	-	-	-	1	1
2.	Agronomy	2	1	-	-	3
3.	Plant Breeding	1	1	-	-	2
4.	Plant Physiology	1	-	-	-	1
5.	Soil Chemistry/Soil Fert./ Soil Micro Biology	1	-	-	-	1
6.	Agricultural Entomology	8	4	1	-	13
7.	Farm machinery & Power	2	-	-	-	2
8.	Agricultural Structure & Process Engg.	2	1	-	-	3
9.	Soil and Water Conservation Eng.	1	-	-	-	1
10.	Computer Application	2	-	-	-	2
11.	Electronics & Instrumentation	2	-	-	-	2
12.	Organic Chemistry	6	3	1	-	10
13.	Agricultural Chemistry	2	-	-	-	2
14.	Chemical Engineering	2	-	1	-	3
15.	Bio-technology	2	-	-	-	2
16.	Mechanical Engineering	1	1	-	-	2
17.	Electrical Engineering	1	-	-	-	1
18.	Agricultural Economics	1	-	-	-	1
19.	Agricultural Extension	1	-	1	-	2
20.	Bio-Chemistry (PS)	1	1	-	-	2
	Total	39	12	4	1	56

ERRATUM

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Page 16, Table 6

TO BE READ

Table 6 Plant growth attributes of *Flemingia* spp. and *Albizzia lucida* prior to lac inoculation (winter lac crop 2000-01)

Hosts	Plant height (cm)			Basal girth (cm)			No. of tillers/primary branches per bush			Canopy spread (m)		Total shoot length(m)	Inoculable shoot length(m)
	80 DAC	150 DAC	240 DAC	80 DAC	150 DAC	240 DAC	80 DAC	150 DAC	240 DAC	N-S	E-W		
Flemingia macrophylla	41.1	195.0	-	2.05	3.11	-	24.4	19.2	-	-	-	28.3	15.8
Flemingia semialata	19.2	103.0	-	1.57	2.50	-	11.4	10.2	-	-	-	10.2	4.7
Albizzia lucida	-	-	330.0	-	-	23.91	-	-	5.4*	2.86	2.48	20.5	9.4

DAC - Days after coppicing/harvesting

* Primary branches

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