Annual Report
वार्षिक प्रतिवेदन 1999 - 2000

Indian Lac Research Institute
Ranchi 834 010, India

भारतीय लाख अनुसंधान संस्थान
राँची 834 010, भारत

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भारतीय लाख अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
नामकुम, राँची 834 010, भारत

Indian Lac Research Institute
(Indian Council of Agricultural Research)
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Cover : Images of the beginnings of the Institute and those of the present, depicting the transformation over the past 75 years

Contents

PREFACE

The Institute has just crossed an important milestone of its history. Seventy-five years back, on September 20, 1924, His Excellency Sir Henry Wheeler, the then Governor of Bihar and Orissa laid the foundation stone of this institute. This stone lies embedded in one of the walls of then Biochemistry Laboratory which along with the Entomological Laboratory was the earliest laboratories established in 1925. Mrs. Dorothy Norris was the Founder-Director of the Institute. Ever since this modest beginning, the institute has grown into a premier institution on lac in the country. It has undergone vast organizational changes, from time to time, during its seventy-five years of existence, constantly transforming itself to orient towards the changing needs. During these long years, it has not only built up a vast body of knowledge on lac but also generated a large number of technologies for boosting lac production, improved lac processing techniques including value-addition as well as a large number of lac-based products for a wide range of application areas.

Identification of research priorities of an R&D institution is vital for accentuating the impact of its output. The Research Advisory Committee of the Institute is the apex body which carefully scrutinizes the research programme of the institute in the light of the mandate and current thrust areas. The first meeting of the newly constituted RAC, under the able chairmanship of Dr. B.L. Amla, Former-Director of CFTRI, Mysore, was held in the beginning of the year. A number of useful recommendations emerged which would help in developing an effective R&D and extension support to lac.

Technologies developed will be of no value if they are not passed on to the target groups. Strengthening of linkages of the institute with different agencies has received particular attention, especially, in recent years. Organizing an NGOs' Meet was one such step in this direction. A large number of organizations took part in this meet and showed enthusiasm to utilize the services of IILRI for propagating production technologies developed by the institute and also in promoting lac-based cottage industries for rural development.

A Buyers' Meet was also organized with the sponsorship of SIDBI, Patna, targeting entrepreneurs and industrialists for creating awareness about lac-based products for increasing domestic consumption. The participants showed interest on lac-based enterprises and it was felt that more awareness campaigns should be launched to promote consumption of lac.

Dr KK Kumar
Director

EXECUTIVE SUMMARY

The Indian Lac Research Institute is the premier R&D institution exclusively devoted to lac. The institute continually reviews its programmes as per the changing needs of the production and industrial requirements as development of technology and its adoption are directly linked with this. The institute has always made relentless endeavour for providing the research support for enhancement of lac production and its utilization. A summary of salient achievements made by the institute on various fronts, during the period under report is given below:

Research

The research projects of the institute are mainly organized under four core programmes in two research divisions: Lac Production and Lac Processing & Product Development. The major contributions made under these research programmes have been summarized below:

Lac Production

- Experiments conducted have revealed that desiccation of male *kusmi* lac insect during its psuedo pupal stage in summer, is the main constraint and partial pruning of the trees 2-4 months before inoculation during September / October helped in protecting the male, due to new flush during summer.
- Field release of egg parasitoids *Trichogramma pretiosum* and *T. chilonis* was carried out during *katki* '99 crop reared on *bhalia (Flemingia macrophylla)* bushes and *palas* trees, respectively. Results have indicated that the reduction of *Eublemma amabilis* population was 82 to 87 percent and of *Pseudohypatopa pulverea* was 89 to 92.5 percent over control, due to the release of *T. pretiosum*. In case of release of *T. chilonis* the percent population reduction of *E. amabilis* over control was 65 to 79 percent and in case of *P. pulverea* it was 57 to 74 percent. The yield ratio with respect to brood used : brood obtained was nearly 100% higher than control. The study has indicated that these parasitoids hold promise for pest management in lac cultivation.
- Out of total shoot length of tillers / primary branches available for lac insect settlement, only 22.1 and 21.3 percent shoot length were preferred by lac insect for their settlement in *Flemingia macrophylla* and *F. semialata* respectively in winter season lac crop (*aghani*) of which 52.2 and 22.3 percent were found to be covered with significant lac encrustation on the respective hosts. The suitable twig girth for insect settlement was recorded to be 3.37 to 2.39 and 3.45 to 2.50 cm, respectively, in these hosts.

- Different plant spacings tried on *Acacia auriculaeformis* had no significant effect on yield index (kg/plant), viz., harvested biomass, broodlac, rejected lac sticks and sticklac (scraped lac), whereas plant density played a major role in contributing to higher yield. Significant differences were recorded in yield index with increasing levels of fertilizers.
- New lac insect stocks were collected from Kerala, Karnataka and Assam and maintained at ILRI Farm.
- A hand-operated roller-type lac scraper has been designed and fabricated. It scrapes about 6 kg lac sticks per hour with a separation efficiency of 97%.

Hand-operated lac scraping machine

Lac Processing & Product Development

- (*Z*)-9-Hexadecen-1-al, a pheromone component of *Helicoverpa armigera* and many other insects pests, was synthesised from *threo*-aleuritic acid for the first time.

  Hydroxy-Δ^9-dodecenoic acid, a plant growth stimulant-reported in peas, was synthesised for the first time from *threo*-aleuritic acid, adopting simple reaction sequence.
- Spiritless melfolac was found better then spirit-based melfolac as regard gloss and the remaining characteristics are same. One metal lacquer composition was found to pass the tests as per IS:5818 (1988) as tested by M/s Synthetic and Polymer Industries, Ahmedabad.
- The hot-melt adhesive developed from lac was found to be non-toxic, non-inflammable and developed fast bond strength within 1 hr. It was found that it can be used in book-binding, packaging, footwear industries and bonding in ceramics, for making ply-wood boxes etc. The adhesive was found to be impervious to water when dipped for 24 hrs.
- Two high thermal resistant baking type insulating varnish compositions have been developed, based on gummy mass and a synthetic resin, which possessed high dielectric strength and thermal resistance (tested) up to 240°C. The varnishes also showed increased resistance

towards tracking when tested as per IS : 10026-1982.

- Studies have been made on impact strength of particle boards prepared from sticks of lac host *bhalia*, using shellac and gummy mass as binder.
- Another composition (Comp. II) of high thermal resistant (230°C) varnish has been developed, based on shellac and a synthetic resin, whose films possess high dielectric strength in air and the property does not detoriorate much when tested after immersion in water for 24 h. Three weaknesses of shellac, viz., brittleness of films, low water and thermal resistance could be overcome in this composition. The performance of the varnish was found to be satisfactory, by a local consumer, when applied on the coils of a 3.3kV 400 H.P. electric motor.

  The varnish Comp. I, reported last year, stored under normal room temperature conditions upto 22 months, has been found to retain all the good properties.

Transfer of Technology

Training

The Transfer of Technology Division conducted a number of training programmes for farmers, students, trainees, probationers and entrepreneurs on different aspects of lac which have been summarised below:

Thirty-two participants successfully completed the four-month Certificate Course on 'Modern Methods of Lac Culture.'

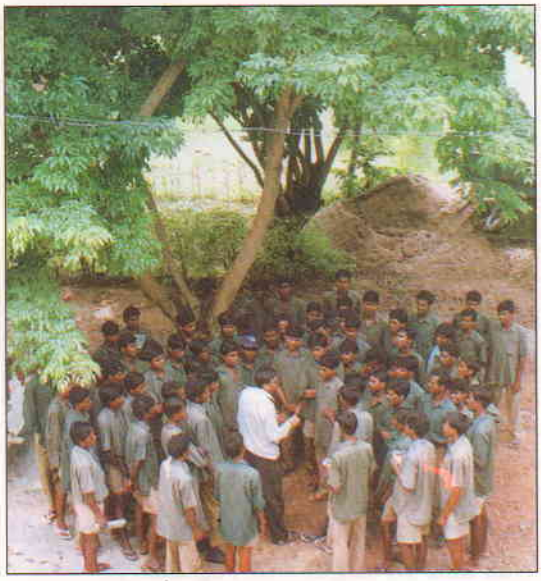
Thirty-two one-week training programmes were organized in which 365 farmers and others participated.

Students of Certificate Course at the Institute Farm

Special one-week training programmes were also organized for forest officials and students in three batches in which 31 participants took part.

One-day Orientation Programme on lac cultivation was organised in 30

Participants of special one-week training programme, from State Forest Dept.



Trainees from R. K. Mission at ILRI Farm

batches from which 1356 participants were benefitted.

Off-campus training programme was held in 7 locations of Bihar and W.B. from which 1463 participants were benefitted. Four on-farm training camps were also organised in four villages, in different States, in which 139 farmers participated.

NGOs' Meet

A one-day 'NGOs' Meet with ILRI' was organized on June 16, 1999 at the institute. It was inaugurated by Mr. S.S. Verma, IAS, Commissioner, South Chhotanagpur Division. Forty representatives from thirty NGOs participated in the meet. Besides, there were twelve invited officials from the GOs. The programme included : presentation of activities of ILRI; guest lectures from officials of IFP, NABARD, TRIFED, BOI and State Forest Dept. on their support role in the area of lac; interaction session with NGOs to discuss about the modalities of working together and problems faced in development of lac. The proceedings of the meeting were well publicized by the local press and AIR.

NGOs' Meet in progress

Buyers' Meet

A Buyers' Meet was organized by the institute on October 13, 1999 mainly to create awareness about lac and lac-based technologies and also to boost domestic lac utilization. It was attended by 58 entrepreneurs, representatives from SSIs and other agencies besides those concerned with lac.

Discussion during Buyers' Meet

The meeting included a presentation session on various lac-based technologies by the Scientists followed by interaction session. This programme was sponsored by Small Industries Development Bank of India (SIDBI), Patna.

Publicity

The institute participated in thirteen exhibitions/*kisan melas* in differents places and put up stalls for promotion of lac and lac-based technologies developed by the institute.

Two-part educational video films on lac were made in Hindi and English for the first time. The Premiere was inaugurated by Dr Anwar Alam, DDG (Engg.) in a well-attended ceremony.

Publications

The institute brought out ten publications, which included a book, booklets, leaflets etc. on lac and lac technologies. ILRI Newsletter (biannual) was also brought out regularly.

Dr. Anwar Alam, DDG (Engg.) inaugurating the premiere of video films on lac

Quality Control

The institute provides testing facilities for different lac and lac products received from various Govt. organizations /private industries etc. The institute earned a revenue of Rs 16,595 as testing charges during the period.

Scientist explaining the students from Nirmala College, about lac

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.

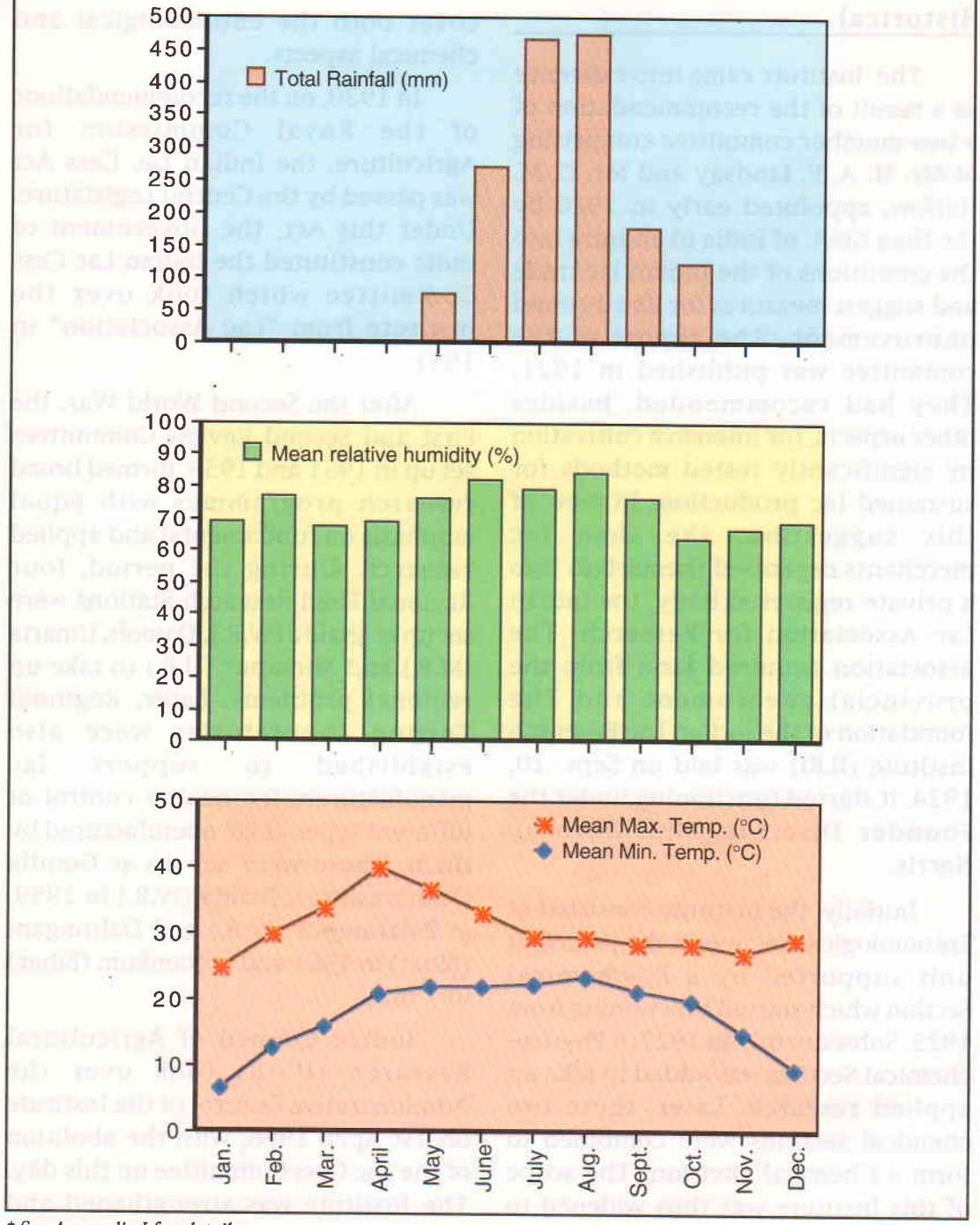
Initially, the Institute consisted of Entomological Section as the principal unit supported by a Biochemical Section which started functioning from 1925. Subsequently in 1927, a Physico-chemical Section was added to take up applied research. Later, these two chemical sections were combined to form a 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 (Bihar) in 1961 and at Namkum (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

Meteorological Profile of Namkum* (1999)



** See Appendix I for details*

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 in the peaceful suburbs, nine kilometers East of Ranchi town, on the Ranchi-Tatanagar Highway, at an altitude of about 650 m above sea level at 23°23' N latitude and 85°23'E longitude. The soils of the Institute are developed on granite gneiss showing advance stage of weathering. The soil of the plantation is lateritic type. The total estate of the Institute at Namkum including experimental plantation (about 36.5 ha) covers an area of 49 ha. The area has ecologically mild salubrious climate; the mean minimum temperature varied between 6.7°C in January and 23.5°C in August and mean maximum temperature varied between 25.1°C in January and 40.1°C in April. The total rainfall during the period was 1593 mm of which the monsoon rainfall was 1391 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 re-defined. 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 three Regional Field Research Stations at Madhya Pradesh, West Bengal and Orissa. 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) has been set up to provide the scientists, access to the Super-Information Highway 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 Bihar, West Bengal, U.P., M.P. and Orissa.

The industrial aspects have not been overlooked. The Institute has always polarised its scientific manpower into 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 are :

- 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 : (1) Lac Production (2) Lac Processing and Product Development and (3) 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 56 scientific, 84 technical, 43 administrative and 112 supporting grade posts.

Budget

During 1999-2000, the non-plan expenditute was Rs. 317.93 lakhs, against a budget estimate of Rs. 392.00 lakhs, the plan expenditure was Rs. 82.93 lakhs against a budget estimate

of Rs. 85.00 lakhs. The detailed figures are shown in the Table I.

Revenue Generation

During the period under report, a sum of Rs. 9.68 lakhs was earned as revenue through different programmes of various divisions and sections of the Institute, as per details given in the following table :

Head	Revenue (In lakhs)
Sale of farm produce, product etc.	2.04
Testing charges	0.27
Receipt from service rendered	0.95
Income from internal schemes	0.30
Training and consultancy	2.14
Other receipts	3.98
Total	9.68

Table I Budget during 1999-2000
(in Rs. lakhs)

Head of account	BE : 99-2000	RE : 99-2000	Actual expenditure
Plan			
Establishment charges	3.50	1.35	1.35
Wages	—	—	—
OTA	—	—	—
T.A.	2.50	2.00	1.98
Other charges including works	40.00	47.50	47.30
Works	34.00	10.16	10.16
Catch-up grant			
Equipment	13.00	3.00	1.19
Works	11.00	16.44	16.42
Library books and other items	16.00	4.55	4.53
Total	**120.00**	**85.00**	**82.93**
Non-Plan			
Establishment charges	373.00	327.90	270.80
Wages	—	—	—
O.T.A.	0.05	0.05	0.05
T.A.	2.50	2.50	2.50
Other charges including equipment	46.45	61.55	44.58
Total	**422.00**	**392.00**	**317.93**

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*

To determine the effect of nitrogenous fertilizer and irrigation, on shoot growth and survival of lac insects, during summer

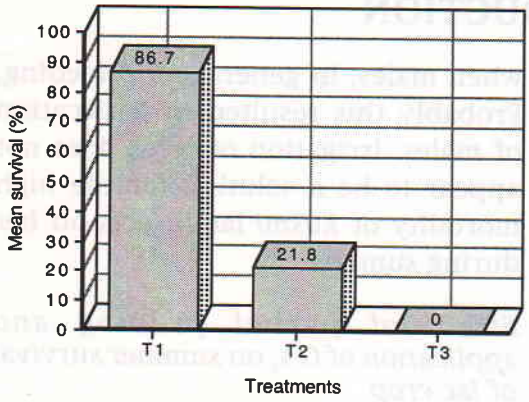
The experiment was laid out in split-plot design with fortnightly interval of irrigation from April onwards and control as main plot treatments, with four subplot treatments of fertilizer application viz., 200g, 400g of urea as basal in two splits, one percent foliar application of urea and no urea (control). High mortality of males was observed during summer in all the treatments resulting in virgin females at the time of crop maturity.

There was no winter and summer pre-monsoon precipitation resulting in the loss of crop and high male mortality, which might be due to exposure of insects to scorching sun in summer, when maximum and minimum temperature ranged between 38 - 43.3°C and 18 - 25.3°C respectively during the month of April, when males, in general, stop feeding. Probably this resulted in desiccation of males. Irrigation of trees does not appear to be a solution for the high mortality of *kusmi* lac insects on *ber* during summer.

Effect of partial pruning and application of GA_3 on summer survival of lac crop

An experiment was laid out in RBD with six treatments (T_1 - T_6) using different combinations of early and late variety of *kusmi* lac insects and three cultural practices. Randomly selected 24 trees, pruned during May 1999, were equally divided into six treatments, each tree representing one treatment of the replicate. Sixteen trees under partial pruning treatments and GA_3 application (T_1, T_2, T_4 & T_5) were subjected to removal of tertiary shoots during first week of October 1999. Application of GA_3 at 40 ppm was done after sprouting of new buds in the month of November 1999 in treatments T_2 and T_5. Inoculation of early variety of lac insects was carried out in the month of November while the late variety of lac insects will be inoculated during February / March. Data on mortality, collected at the time of *phunki* removal have been shown in Fig. 1. Survival of *kusmi* lac insects at sexual maturity could only be recorded in case of trees subjected to

Fig. 1 Survival of nymphs of *kusmi* insects during summer season on *ber*



T_1 : Early variety + partial pruning

T_2 : Early variety + partial pruning + GA_3

T_3 : Early variety (Control)

pruning in the month of October. In other three treatments, 100% mortality of lac larvae was recorded, in spite of the fact that all the insects were found surviving at the initial stages on *ber* branches. The crop is in progress.

To determine the appropriate brood rate for summer and winter kusmi *crop production on* ber

An experiment was laid out in RBD for *aghani* inoculation with four treatments of brood rate, viz., 5, 10, 15 and 20g/m shoot length; each *ber* tree represented one treatment with 5 replicates. Inoculation of all 20 trees, pruned a year before, was done during July, 1999 with late *kusmi* variety.

Highest weight of brood lac sticks per metre was obtained for 15 g/m brood rate (Table 1), in agreement with the results obtained in the previous year. Although the maximum coverage of the tree was recorded to the tune of 41.25% in case of 20 g/m brood rate, the brood yield was higher in case of 15 g/m where only the best shoot had been covered by lac insects.

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

Rearing of beneficial parasitoids

Five egg parasitoids viz., *Trichogramma chilonis, T. brasiliensis,*

Table 1 Effect of brood rate on coverage and yield of lac on *ber* during *aghani* crop season

Treatment (Brood rates)	Mean coverage (%)				Weight of brood lac	Yield ratio	
g/m	Primary	Second-ary	Tertiary	Total	g/m	Broodlac obtained/ used	Sticklac obtained/ used
5	2.82	12.49	5.2	20.72	58.5	4.25	2.50
10	6.70	13.40	2.84	22.79	76.25	2.32	2.25
15	8.44	30.03	1.38	39.85	125.0	2.75	3.20
20	13.65	18.43	9.15	41.25	96.0	2.00	2.25

T. pretiosum, Trichogrammatoidea bactrae and *Telenomus remus* were reared throughout the year on alternate host, *Corcyra cephalonica* eggs, under laboratory condition. The *C. cephalonica* culture was maintained on broken wheat.

Biological control of lac predators by egg parasitoids under field condition

Field release of egg parasitoids *Trichogramma pretiosum* and *T. chilonis* (by means of trichocards) was carried out during *katki* '99 crop reared on *bhalia* (*Flemingia macrophylla*) bushes and *palas* trees respectively. The release of *T. pretiosum* per bush was @ 10 (T_1), 15(T_2) and 20 (T_3) while the release of *T. chilonis* per tree was 50 (T_1), 75 (T_2) and 100 (T_3). Altogether four releases were made on 3rd, 4th, 9th and 10th weeks after inoculation, coinciding with the peak period of incidence of the predators.

Eublemma amabilis population was found to be reduced by 83 - 87% and of *Pseudohypatopa pulverea,* by 89 - 93% over the control due to the release of *T. pretiosum* (Table 2). In case of release of *T. chilonis*, the reduction of *E. amabilis* population over control was 65 to 80 percent and in case of *P. pulverea* it was from 58 to 74 percent (Table 3). The yield ratio of brood obtained/brood used was found to be 3.83, 3.64, 4.01 and 2.18 in T_1, T_2, T_3 and control respectively in case of *T. pretiosum* released on *bhalia* bushes while the respective yield ratios were 3.17, 4.61, 4.56 and

Table 2 Field release of *Trichogramma pretiosum* against lepidopterous lac predators on *katki* 1999 crop raised on *bhalia* (*Flemingia macrophylla*)

Treatment	*Eublemma amabilis*		*Pseudohypatopa pulverea*		Yield	
	Mean no. per kg broodlac	Percent reduction over control	Mean no. per kg broodlac	Percent reduction over control	Broodlac obtained/ Broodlac used	Sticklac obtained per kg broodlac (kg)
T_1(10 insects/ bush)	3.00 (1.984)	87.06	1.40(1.538)	89.55	3.83	0.100
T_2(15 insects/ bush)	4.00(2.208)	82.75	1.2(1.474)	91.04	3.64	0.080
T_3(20 insects/ bush)	3.80(2.180)	83.62	1.00(1.41)	92.50	4.01	0.125
Control	23.20(4.912)		13.4(3.806)		2.18	0.045
SEM	0.1103		0.0409		0.4211	
CD at 5%	0.3388		0.1256		1.2476	
CD at 1%	0.4750		0.1761		1.7089	

Figures within parantheses are transformed : $\sqrt{n+1}$

Table 3 Field release of *Trichogramma chilonis* against lepidopterous lac predators on *katki* 1999 crop raised on *palas* (*Butea monosperma*)

Treatment	*Eublemma amabilis*		*Pseudohypatopa pulverea*		Yield	
	Mean no. per kg broodlac	Percent reduction over control	Mean no. per kg broodlac	Percent reduction over control	Broodlac obtained per kg broodlac used	Sticklac obtained per kg broodlac used (kg)
T_1(50 insects/ tree)	8.6 (3.068)	65.32	11.8(3.568)	59.86	3.17	0.162
T_2(75 insects/ tree)	5.00(2.428)	79.83	12.1(2.666)	57.82	4.61	0.175
T_3(100 insects/ tree)	7.00(2.820)	71.77	7.60(2.924)	74.14	4.56	0.180
Control	24.8(5.074)		29.40(5.302)		1.90	0.120
SEM	0.1240		0.0960		0.4713	
CD at 5%	0.3810		0.2951		1.3961	
CD at 1%	0.5342		0.4137		1.9125	

Figures within parantheses are transformed : $\sqrt{n+1}$

1.90 in case of *T. chilonis* released on *palas* trees. The study has indicated that these parasitoids hold promise for management of the lepidopterous predators of the lac insects.

Field evaluation of pesticides on lac crop

Different endosulfan formulations of different trade names viz., Arjun, Endocel, Endodhan, Endosulfan and Thiodan were tested under field condition on *baisakhi* 1999-2000 crop raised on *palas* bushes. Percent mortality of lac insects was found almost same for all the treatments.

Combination spray of insecticides (dichlorvos and endosulfan) and fungicides (bengard, krilaxyl and roko) was carried out on *bhalia* bushes during *aghani* 1999-2000. Treatment of dichlorvos + bengard performed better than other treatments. The yield was found to be better in case of double spray of the different combinations. Experiments will be repeated during next crop season.

Studies on insecticide resistance

Percent mortality of eggs in the treated area was found to be significantly lower than the eggs of untreated area. The study indicated possibility of development of resistance against endosulfan. However, experiment needs repetition with lower doses of the insecticide for further confirmation.

Studies on population fluctuation of lac associated insect fauna

To assess the seasonal abundance of lac associated insect fauna, samples from different lac crops were collected weekly from the field, throughout the year. *Tachardiaephagus tachardiae* and *Tetrastichus purpureus* were found to outnumber the other lac associated inimical parasitoids. Amongst the beneficial parasitoids, *Elasmus claripennis* was found in large numbers on *katki* 1999 crop, in October.

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

The lac based cropping model for upland (Tanr I) was laid out which consisted of four host plants of different canopy spread and height, planted along the boundaries of the field and main plots for raising of two vegetable and one cereal crop (*Annual Report 1998-99*).

During the period under report, two *Flemingia* spp. were brought under lac culture for both *jethwi* and *aghani* crops and *galwang* for *aghani* crop only. Eighteen and six month old shoots of both the *Flemingia* species were utilized for raising summer (*jethwi* '99) and winter (*aghani*, cv. *kusmi* early) lac crops. Similarly, two year old plants of *galwang* were used for *aghani* (cv. *kusmi* early) lac crop before converting them into bushes. Plant growth attributes, recorded prior to lac inoculation for both the lac crops, have been presented in Table 4. The values of almost all the plant growth characters were found to be higher in *F.macrophylla* than those of *F. semialata* except for mean tillers/ bush and mean basal girth recorded prior to inoculation for *jethwi* and *aghani* lac crops, respectively. It was noticed that *F. macrophylla* and *F. semialata* attained a height of 132.9 and 58.9 cm, respectively at the time of inoculation for *aghani* lac crop after harvesting of the preceeding crop.

To know the summer survival of lac crop, both the *Flemingia* spp., were

Table 4 Plant growth attributes of two *Flemingia* spp recorded before lac inoculation

Hosts	Lac crops	Mean plant height (cm)	Mean basal girth (cm)*	Mean tillers/ bush (Nos.)	Mean total shoot length (m)
F. macrophylla	*Jethwi* 1999	267.86	10.21	6.00	44.33
F. semialata	*Jethwi* 1999	196.70	7.70	6.29	19.07
F. macrophylla	*Aghani* 1999 (cv early *kusmi*)	132.91	2.44	8.90	9.85
F. semialata	*Aghani* 1999 (cv early *kusmi*)	58.94	2.49	7.30	4.42
A. lucida	*Aghani* 1999 (cv early *kusmi*)	274.09	16.90	1.91*	11.32

* Primary branch

Table 5 Lac yield potential of two *Flemingia* spp. and *Albizzia lucida*

Hosts	Lac crops	Brood lac used (g/bush)		Yield obtained(g/bush)			Yield ratio		Harvested biomass/ plant (dry wt, kg)
		Brood lac	Scraped lac	Brood lac sticks	Rejected lac sticks	Total scraped lac	Brood lac obtained/ broodlac used	Total scraped lac yield/ scraped lac of brood used	
F. macrophylla	*Jethwi* '99	100	35.9	240.0	486.0	138.00	2.40	3.84	3.48
F. semialata	*Jethwi* '99	100	35.0	-	717.4	47.05	-	1.34	0.897
F. macrophylla	*Aghani* '99	100	38.0	240.0	290.0	77.00	2.40	2.03	0.905
F. semialata	*Aghani* '99	100	34.0	193.0	295.0	69.00	1.93	2.03	0.543
A. lucida	*Aghani* '99	125	52.0	525.0	1075.0	287.00	4.20	5.52	2.88

Table 6 Plant growth attributes of two *Flemingia* species at the time of harvesting (*aghani* '99; cv *kusmi* early)

Hosts	Mean plant height (cm)	Mean basal girth (cm)	Mean tillers per bush	Total length of primary shoots/bush (m)	Length of primary shoots with lac insect (m)	Length of shoot with lac encrustation (m)	Shoots' girth below lac encrustation (cm)	Shoots' girth above the lac encrustation (cm)
F. macrophylla	162.0	5.0	10.0	12.3	2.72	1.42	3.45	2.50
F. semialata	140.4	3.9	7.2	9.0	1.92	0.43	3.37	2.39

exploited for *jethwi* '99 crop. The lac crop survival, during summer on *F. macrophylla*, was found to be satisfactory. The ratios of broodlac obtained to brood lac used and total scraped lac yield to scraped lac of brood used were 2.40 and 3.84, respectively. However, the lac insect failed to complete its life cycle on *F. semialata* during summer season mainly due to complete drying of the inoculated plants. The initial settlement and development of lac insects were satisfactory, but the plants dried up completely in the month of April producing only 47.05 g sticklac/ bush (Table 5). *Aghani* '99 (cv. *kusmi* early emergence) performed well on *Albizzia lucida*. The ratios of brood lac obtained to brood lac used and the total scraped lac to scraped lac of brood used were 4.2 and 5.52, respectively (Table 5).

Plant growth attributes of both the *Flemingia* sp. were also recorded (Table 6) prior to harvesting of *aghani* '99 (cv. *kusmi* early emergence). An increase was obtained in plant height

by 22.89, 138.21% and in basal girth of tillers 104.91, 56.63% in *F.macrophylla* and *F.semialata* respectively, during the period of inoculation to harvesting of the crop. Out of total shoot length of primary branches, only 22.11 and 21.33% were found to be covered with settlement of lac insect and of which only 52.2 and 22.3% were covered with significant lac encrustation in *F. macrophylla* and *F. semialata* respectively. The suitable range of girth of tillers for lac encrustation in *aghani* '99 lac crop was recorded to be 3.37 - 2.39 and 3.45 - 2.50 cm in *F. macrophylla* and *F. semialata* respectively.

Two vegetable crops, viz., sponge gourd (*Luffa cylindrica*) and okra (*Abelmoschus esculentus*), and one cereal crop (*Zea mays*) were raised in the main plot of equal size (13.0x 11.5 m). The performance of okra was found to be satisfactory with an yield of 55.0 kg/plot (36.79 q/ha) followed by sponge gourd, 65.0 kg/plot (43.48 q/ha) and maize cobs, 110 kg/plot (73.58 q/ha).

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

Under the project, following two experiments were carried out.

Effect of plant densities and fertilizer

The experiment was carried out in a split plot design, adopting three plant spacings in main plot and four fertilizer levels in sub-plots (Table 7).

Data collected for winter season lac crop (*aghani* 1998-99), harvested towards the end of Feb. '99, are presented in Table 7. No significant effect was observed on yield index (kg/plant), viz., harvested biomass, broodlac, rejected lac sticks and sticklac (scraped lac) adopting various plant densities. However, maximum values were obtained with lowest plant density; on the other hand, the plant density per unit area played major role to attribute more yield. The yield ratio (obtained : used) for broodlac and sticklac was found to be lower with higher densities. Significant differences were recorded in the yield index with increasing levels of fertilizers. Broodlac and sticklac indices were found to be at par amongst different fertilizer levels over control.

Effect of height of coppicing and fertilizers

The experiment was carried out in a split plot design consisting of four heights of coppicing in main plot and fertilizer levels in sub-plots with four replications.

Significant yield could not be obtained for *jethwi* '99 due to severe summer especially, hot winds during male emergence period. However, crop could be saved to some extent where male percentage was found to be more than 9 percent.

Table 7 Effect of plant densities and fertilizers on yield index and yield ratio

Treatment	Plant densities	Yield index (kg/plant)				Yield ratio (obtained : used)	
		Harvested biomass (Dry wt)	Broodlac	Rejected lac sticks	Scraped lac	Broodlac	Sticklac
Planting spacing(m)							
2.0 x 1.8	2778	5.90	1.02	0.68	0.43	3.33	2.77
3.0 x 2.7	1235	5.84	0.96	0.95	0.44	2.86	2.30
4.0 x 3.6	694	7.53	1.58	1.43	0.63	5.17	4.19
CD at 5%		NS	NS	NS	NS	0.972	0.516
Fertilizer levels ($N+P_2O_5+K_2O$)							
0+0+0		4.64	0.83	0.83	0.35	3.56	2.92
25+50+10		6.19	1.29	0.92	0.55	3.91	3.24
50+100+20		6.88	1.38	0.98	0.57	4.21	3.32
75+150+30		7.98	1.25	1.35	0.54	3.47	2.86
CD at 5%		0.626	0.222	0.252	0.078	NS	NS

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

Survey, collection, maintenance, conservation and evaluation of lac insect and host plant and their genetic improvements

Survey and collection of lac insects

Selected areas of Assam (Amsoi, Nawgaon), Karnataka (Bangalore and Chitradurga) and Kerala (Thrissur and Palakkad) were surveyed during October-November, 1999 for occurrence and collection of lac insects. Natural populations of lac insects were found infesting different hosts-plants at the places visited (Table 8). Tribal people inhabiting the Karbi Anglong district of Assam are engaged in lac collection but systematic cultivation is not done. Substantial quantity of lac is collected in the state by the tribals and is sold to the local traders. Lac crop maturing in May/ June is not harvested and is left on the host-plant for self-colonisation. Crop harvested during October is the commercial crop.

Heavy infestation of *Paratachardina sylvestrii* was observed on sandal and two of its host trees near Bangalore. Incidence was quite wide spread. Nearly 50% sandal trees in the orchard were found infested and of those about 10% were found dead.

Table 8 Lac insects collected from different plant-hosts during the survey

Lac insect species	Host-plant	Locality
Paratachardina sylvestrii	*Santalum album* (Sandal) *Casuarina equisetifolia* *Pongamia pinnata*	Sandal orchards of Institute of Wood Science and Technology at Nellal and Gottipuram near Bangalore (Karnataka)
Kerria sp.	*Ficus* sp.	Bangalore (Karnataka)
Kerria sp.	*Accacia auriculaeformis* (*akashmani*)	BBH-Mines, Chitradurga (Karnataka)
Kerria sp.	*Amhertsia nobilis*	Thrissur (Kerala)
Kerria sp.	*Albizia saman* (rain tree)	Palakkad-Coimbatore Highway (Kerala)
Kerria sp.	*Ficus* sp.	Amsoi, Nawgaon (Assam)

Acacia auriculaeformis trees at Chitradurga were found to be heavily infested with lac insect, though number of trees infected was less. Different stages of lac insect development from freshly emerged larvae to sexually mature insects were observed on the plants. While at Bangalore, lac insect was noticed on a few branches of *Ficus* sp.

Occurrence of lac insect, *Kerria* sp. at Thrissur was rare. Only one tree of *Amhertsia nobilis* (an exotic plant) was observed to be infected by lac insect. Colonisation seemed to have occurred in the recent past and had not spread to the nearby trees of the same species. However, large number of rain trees were noticed to have lac insect colonisation at a place about 20 km from Palakkad on the Palakkad - Coimbatore Highway. Surprisingly, on all but 2-3 trees, lac population had died. Lac bearing twigs were heavily infested with predators. The living lac insects though sexually mature had not reached the crop maturity stage. The areas surveyed in Karnataka and Kerala have favourable climatic conditions for growth of lac insect but people are not aware of lac and its cultivation.

Living as well as dead lac insect samples were collected from the places visited for study of associated pests and some of these at proper stage were inoculated on *Flemingia macrophylla* at the Institute for further studies.

Maintenance and evaluation of lac insect germplasm

Eight lac insect stocks are being maintained on *bhalia*, (*Flemingia macrophylla*). Inoculation / crop maturity period of the trivoltine lac insect collected from the coastal region of West Bengal has not yet stabilized in Ranchi conditions. The insect generally matures at its native locality, in the months of February, June and September. Since its first inoculation at Ranchi during September 1996, its

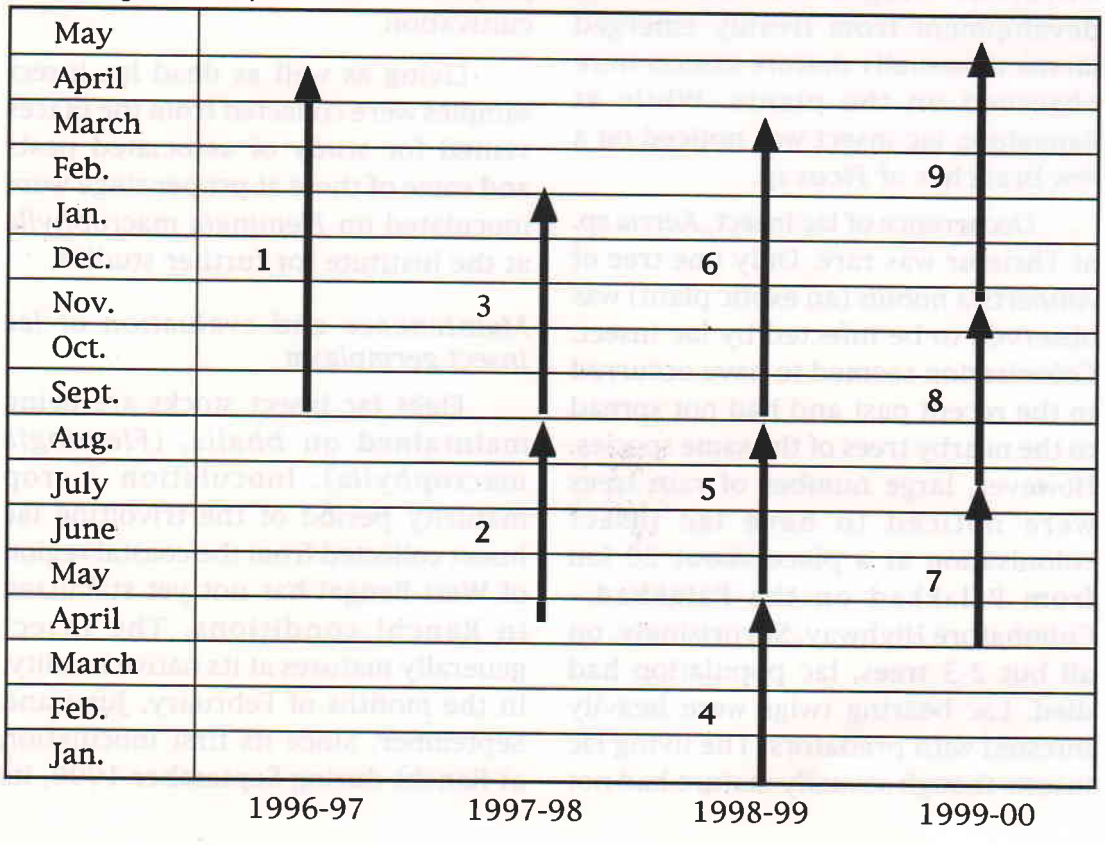
maturity period has kept on shifting (Fig 2). Average life span of each generation starting from the first was 200, 110, 155, 151, 100, 185, 118, 118 and 195 days, respectively.

Kusmi crimson lac insect was inoculated in July 1999 on four lac-hosts viz., *Schleichera oleosa*, *Acacia auriculaeformis*, *Albizzia lucida* and *Flemingia macrophylla* to study their effect on resin dye content and some other important industrial parameters. The cultures are progressing well and the crop will mature in February / March 2000.

Conservation of lac host plants

Kusum (*Schleichera oleosa*), is large sized tree species with wide natural diversity not only with respect to lac production, but also with respect to many other plant attributes such as flower bearing, leaf characteristics, bark colour, leaf size, fruiting ability etc. Success has been achieved in vegetative propagation of *kusum*. *Kusum* shoots of varying girth and length were tried in the month of June using mixture of 100 ppm of indole acetic acid (IAA) and naphthalene acetic acid (NAA) for preparation of

Fig. 2 Life-period of different generations of the trivoltine lac insect (Arrow denotes one generation)



air-layers at Hesal Lac Farm, Ranchi. Study on survival of these air-layers vs shoot girth indicated a sigmoid regression line with highly significant correlation co-efficient (r=0.9856). The reserve food material in thicker girth and longer shoot length might be the reason for survival in this slow growing plant species. The twigs responding to air-layering possessed girth and length in the range of 9-10 cm and 140-160cm respectively with 7-10 leaves as compared to seed born plant maintaining this size only after five years of transplanting of seedlings (Fig. 3).

Vegetative propagation of dwarf *Dalbergia szemaoensis* through stem cutting, using IBA, NAA, IAA at 100 ppm dipping for 24 hours *in situ* showed maximum survival up to 47.8-52.2% with the use of IAA and IBA respectively.

Implication of multiple coitus in lac insect

Sexually mature lac insect females were offered to males to study whether every mating attempt was successful. From some of the cultures of Orissa *kusmi* yellow lac insect, males were manually removed before their emergence and only females were allowed to remain. Three groups A, B and C of 50 females each were formed. Male lac insects were allowed to attempt mating once in group A, twice in B and thrice in C. Mortality, number of virgin and fertilized females were scored at the time of crop maturity. Data revealed that not every attempt was successful (Table 9).

An increase in fertilisation success was achieved with an increase in frequency of mating attempts. Cent-percent success was not realized even after three attempts.

Evaluation of lac hosts

Among the three species of *Flemingia*, viz., *F. semialata*, *F. macrophylla* and *F.stricta*, only *F. semialata* performed well with regard to survival and settlement density of lac insects in summer season. The density of settlement per square cm and mortality percent were 81.07 and 14.2 in case of *F. semialata* as compared to 53.8 and 71% respectively

Table 9 Effect of mating attempt frequency on fertilization success in lac insect

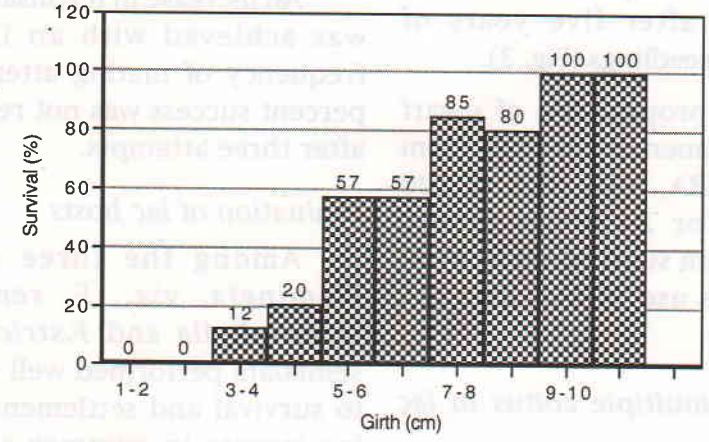
Parameters scored	Number of mating attempts		
	1	2	3
Sample (n)	50	50	50
Surviving females at the time of crop maturity	36	42	39
Percent mortality	28	16	22
Fertilized females	17	25	28
% success (of surviving females)	47	59	72

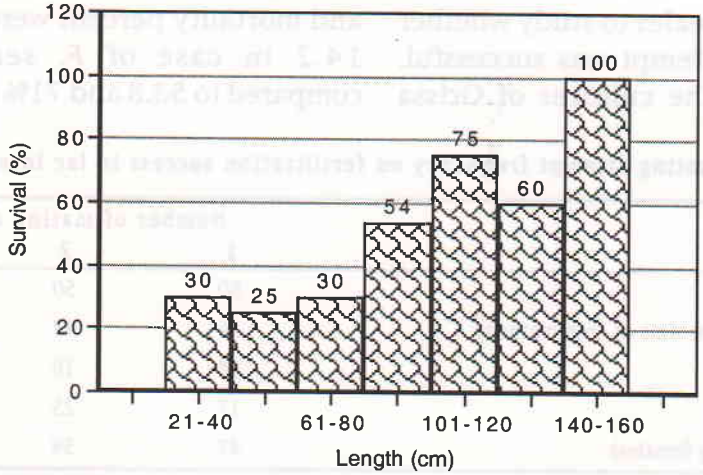
on *F. stricta*. Survival of male insects was less than 9% which can be attributed to intense heat during summer which ultimately led to failure of the crop.

F. semialata was found to be a more suitable host for *kusmi* lac insects out of the species under trial during winter. Early *kusmi* variety showed its promise for brood production whereas late *kusmi* encrustation developed cracks during maturity stage in Feb.-March.

The yield of *kusmi* early variety maturing in November 1999 was 125-225 g/m wheras the late maturing crop yielded 250-350g lac stick per bush.

Fig. 3 Survival of air-layers of *kusum* as affected by girth and length





Mechanization of lac cultivation operation

Design and Development of Hand-Operated Roller-Type Lac Scraping Machine

A hand-operated roller-type lac scraper has been designed and fabricated. The machine comprises of two corrugated mild steel rollers, each 200 mm long and of 125 mm diameter. One of the rollers is fixed and the other one is spring-loaded and thus adjustable. The rollers rotate in opposite directions at a speed differential of 1:1.66 between them. In idle condition, the gap between the fixed and adjustable roller is 2mm. During operation, the gap is adjusted automatically according to the diameter of lac sticks and permit entry of lac sticks between the rollers. In this way, the sticks are caught in between the rollers and lac is scraped by means of compression and shearing actions.

A sieve of 10 mesh size was fitted at inclination of 45° with respect to the horizontal under the two scraping rollers to receive the scraped lac and stick. Most of the lac encrustations of less than 10 mesh size pass through the sieve and fall on the inclined pan which guides the received material towards the outlet of the machine. The scraped lac encrustations which does not pass through the sieve along with the sticks slide down the sieve and come out of the machine.

A feed hopper is situated at the top of the machine which guides the lac sticks between the scraping rollers safely. The drive mechanism comprises of a handle, V-groove pulleys and V-belt to transmit power from handle to the fixed and spring loaded rollers. The basic structure of the machine i.e., angle frame on which various components are fixed is made of mild steel angle iron (50x50x5 mm). The feed hopper frame is made up of mild steel flat (25x5 mm).

The machine scrapes lac encrustation of about 6 kg lac stick *(kusmi phunki)* in an hour and separates about 97 percent lac encrustations from lac stick in two passes.

Extension research

Survey of Lac Growing Areas

A total of 12 villages in 7 blocks of Bankura, Purulia and Midnapur (W.B.) districts comprising of 295 families/households were surveyed. The area is predominantly a paddy grown area and this crop alone contributes to about 52% of total agriculture and forest income, followed by vegetable (31%), sesamum (5.5%), mustard (4.3%) and wheat (4.1%). The other crops are pigéon pea, kidney bean and horticultural crops of lesser importance. The holding size of lac host trees ranges from 0-5.4, 1.3-10.1 and 0-30.1 for *kusum, ber* and *palas*

respectively, the average figure was 1.68, 4.14, 6.34 and 21.27 for *kusum, ber, palas* and *akashmani* was 21.27 per household, respectively. No. of *kusum* trees was largest in Kundulia village of Taldangra block (5.4 per household) whereas, no. of *ber* trees was maximum in Masanjhar Vill. of Khatra II block (10 per household). The *palas* trees were maximum in Chirugara vill. of Raipur block (30 per household). Inspite of presence of sufficient number of host trees, the lac cultivation is being carried out at only 3 villages namely, Hatirampur village of Khatra II block, Masanjhar of Khatra II block of W.B. and Ghaghra vill. of Garhbeta block in Midnapur district. *Palas* and *Ber* trees are utilised for lac cultivation in all the 3 villages whereas *kusum* only in Masanjhar village where earning per household is only Rs. 500/- per annum from lac.

Survey of equipments used for lac cultivation operations

In order to know the status of mechanization in lac cultivation operations, a survey was conducted on 84 farmers belonging to the three districts of Bihar (Ranchi, Gumla and and Hazaribagh) and one of W.B. (Purulia). Each farmer was given proforma and requested to list the equipments used by them, whether they felt need for development of new tools and modification in the existing tools. The summary of information collected is presented in Fig. 4 and Table 10.

It is evident from Fig. 4 that 70.2% farmers are either small or marginal having less than 2 ha of land and majority of them are economically poor. Their poor economic condition becomes major hurdle in mechanization. It is evident from Table 10 that farmers either use locally made hand tools for lac cultivation operations or different operations are performed manually. However, 92.8% farmers wanted development of new or improved equipments for lac cultivation operations which suggests scope of work for mechanization.

Fig. 4 Size distributon of land holdings of lac growing farmers

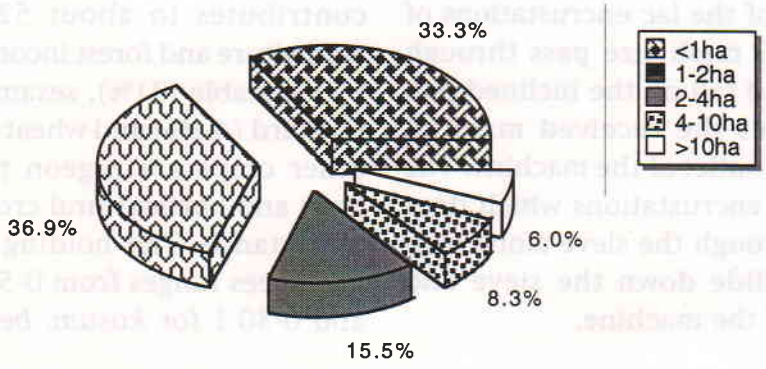


Table 10 Equipments and methods used for different lac cultivation operations by farmers

Pruning		Broodlac placement		*Phunki* removal		Insecticides/Pesticide application		Harvesting		Scraping	
Equipment/ Method	Used by farmer (%)	Equipment/ Method	Used by farmer (%)	Equipment/ Method	Used by farmer (%)	Equipment/ Method	Used by farmer (%)	Equipment/ Method	Used by farmer (%)	Equipment/ Method	Used by farmer (%)
Dauli	84.5	By climbing on tree	65.5	By climbing on tree	71.4	Don't use insecticide/ pesticides	92.8	*Dauli*	78.6	*Dauli*	42.8
Axe	79.8	V-shape bamboo hook	57.1	Bamboo hook	40.5	Sprayer	3.6	Axe	57.1	Small *Dauli*	52.4
Secateur	1.2	Ladder	3.6	Ladder	2.4	Don't use machine for spraying	3.6	*Bolha*	1.2	Knife	33.3
Sickle	1.2	Clôth bag to carry brood lac on tree	15.5	Cloth bag to carry *phunki*	14.3			Secateur	1.2	*Baithi*	4.8
Bolha	1.2									Sickle	4.8
										Secateur	3.6

Ad hoc Research Schemes

Lac productivity rating of different lac insects on conventional and promising host plants

Studies conducted on productivity rating of different lac insect stocks have revealed marked phenotypic, genotypic and environmental variation in productivity and linked attributes on each of the traditional lac hosts, *palas, ber* and *kusum*. For lac productivity, the estimated genotypic coefficients of variance and heritability (h^2) in broad sense in case of *ber* were 40.94 and 0.64, whereas in case of *kusum* 26.58 and 0.38 and in case of *palas*, 22.09 and 0.82, respectively. The highest value of genotypic correlation coefficient of lac productivity was recorded with quantity of resin per female to the tune of 0.98 on *ber*, 0.75 on *kusum* and 0.67 on *palas*. Thus serving as most important genetically determined character for productivity lac insect. The stocks, LR-5316 and LR-5314 showed 86.3% and 61.3% respectively higher productivity from mean recorded for eleven stocks of lac insect on *ber*. Similarly on *kusum*, LR-5313 and LR-5312 showed 40.3% and 36.1% higher productivity than the mean performance of eight stocks during winter season, whereas 10.0% and 30% respectively, during summer season crop. On *palas*, out of five stocks, LR-5712 and LR-5101 showed better performance to the tune of 31.9% and 19.5% during rainy season crop while 25.0% and 5.0% respectively during summer season crop.

Fig. 5 Diagnostic morphological characters of adult female *K. nagoliensis*, LR 5316 & LR 5312

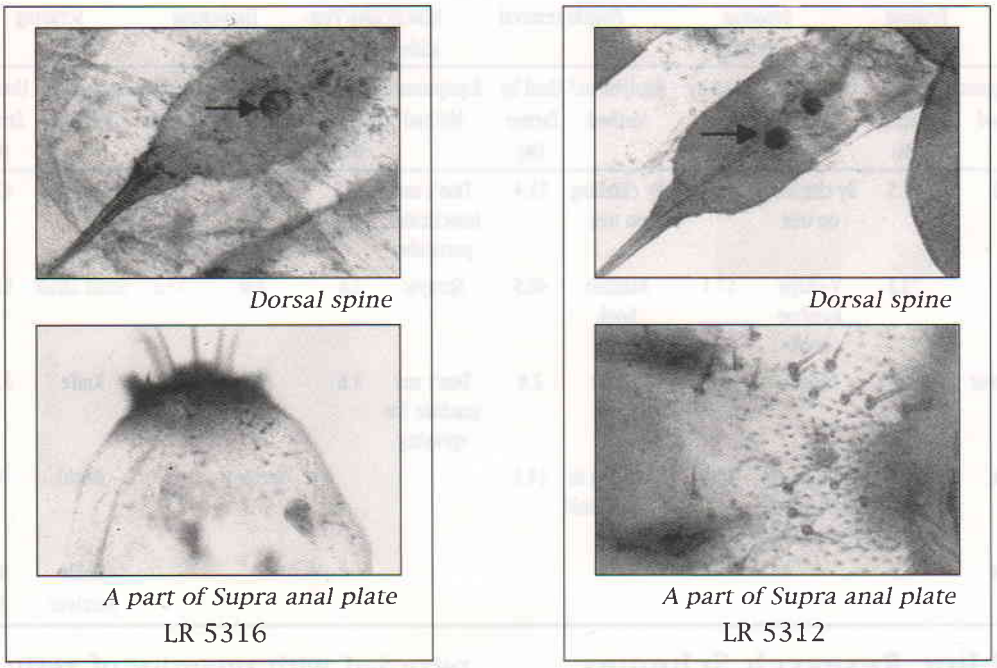
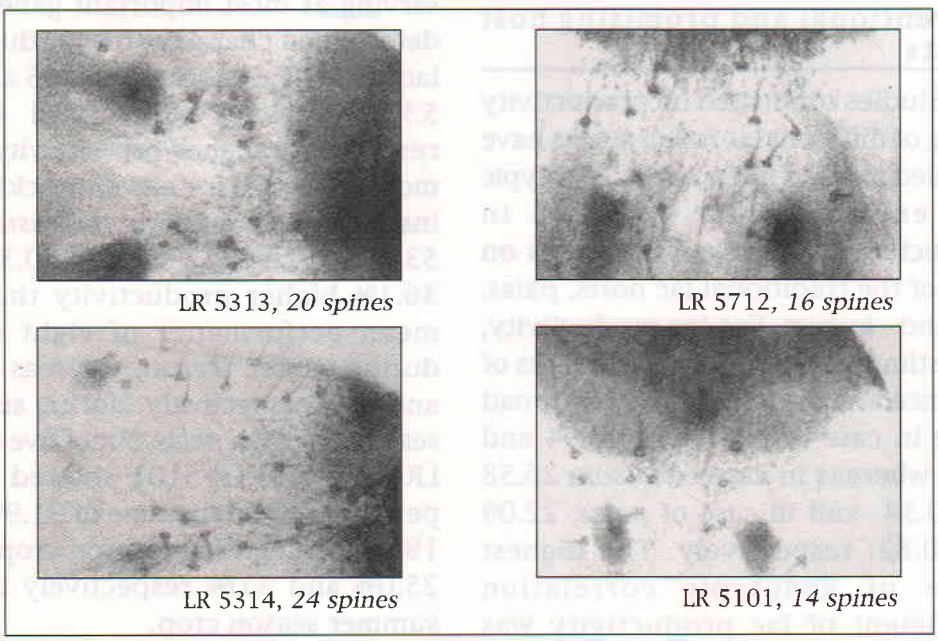


Fig. 6 A part of Supra anal plate of adult female lac insects, LR 5313, LR 5314, LR 5712 & LR 5101



The stocks LR- 5316 and LR- 5312 possess two distinct chitinised black spots on the dorsal spine (Fig.5) along with 30 and 24 spines on their supra anal plate, respectively whereas LR- 5314 and LR- 5313 do not possess any spot on the dorsal spine and have 24 and 20 spines on SAP respectively (Fig. 6). These stocks resemble with typical *K. nagoliensis* characters. Productive stocks for *palas*, LR- 5712 and LR- 5101 possess 16 and 14 spines on supra anal plate (Fig. 6) and resemble with *K. lacca* characteristics. These lac insect stocks have been recommended as productive breeds for Chotanagpur, Bihar and adjoining area of West Bengal.

Productivity of lac insect species viz., *Kerria chinensis* and *K.sharda* belonging to NEH region and eastern ghats of Orissa, respectively was studied on their respective host plant at their native localities which has been provided as reference for promoting lac production in these abandoned localities.

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

The work was started from July 99 with the objective of identifying the factors affecting yield of broodlac from *palas* trees and develop yield forecast model.

Experiments were carried out at the following three places in Bihar, M.P. and W.B.

1. Namkum in Ranchi district of Bihar
2. Lachanpur in Bilaspur district of M.P. and
3. Putidih (Jhalda) in Purulia district of W.B.

The lac crop was raised on 120 trees of *palas* at 3 places in October 1999. Sixty mesh netting bags were utilised for releasing lac insect. *Baisakhi*- cum-*katki* crop will be harvested in October 2000. Data on size of host tree, weight of *phunki* scraped, density of lac insect settlement, density of lac insect on host twigs, initial mortality were recorded from 120 trees at each experimental site. The average density of lac insect settlement was found to be 38 per sq. cm. in all cases and average density of living insect after settlement was observed to be 26, 27 and 18 per sq. cm. on trees at Ranchi, Bilaspur, and Purulia respectively. About 30-40% initial mortality of lac insect was recorded at all the three places.

LAC PROCESSING & PRODUCT DEVELOPMENT

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

Synthesis of some bioactive compounds from aleuritic acid

Pheromones are signalling chemicals released by insects for communication. Chemically synthesised pheromones are increasingly becoming part of integrated pest management, due to their eco-friendly and chemically safe nature. During the period under report, a pheromone component was synthesised from aleuritic acid.

(Z)-9 – Hexadecen-1-al

(Z)-9-Hexadecen-1-al, a pheromone component of *Helicoverpa armigera* and many other insect pests, was synthesised from *threo*-aleuritic acid for the first time. *threo*-Aleuritic acid was converted into unsaturated acid by reacting with triethylorthoformate/benzoic acid followed by alkaline hydrolysis. The unsaturated acid thus obtained was converted into its methyl ester which was mesylated and reduced with lithium aluminium hydride/THF to yield (Z)-9-hexadecen-1-ol. It was then treated with pyridinium chlorochromate in CH_2Cl_2 to obtain crude (*Z*)-9-hexadecen-1-al, which was purified by column chromatography.

12-Hydroxy-(E)-9-dodecenoic acid

The title compound is reported to act as a growth stimulant in peas. *threo*-Aleuritic acid was subjected to periodate oxidation to yield azelaic acid aldelyde as one of the cleavage products. Azelaic acid aldehyde was esterified with diazomethane and condensed with triphenyl salt of OTHP protected 1-bromo-3-propanol under wittig conditions to afford THP protected 12-hydroxy- (*E*)-9-dodecenoic acid. Deprotection of the above compound yielded the title compound, which was purified by column chromatography. Purity was tested by HPLC.

(*Z*)-9-Hexadecen-1-yl acetate, sex pheromone of rice green caterpillar and 9, 11-dodecadien-1-yl acetate of *Diparopis castanea* were prepared in quantity and sent for evaluation/field trials to five places. This synthesis of the title compound from *threo*-aleuritic acid is being reported for the first time.

Development for lac-based wood varnish, metal lacquers for food packaging and hot melt adhesive

Wood varnish

The properties of alcohol-based Melfolac and spiritless varnish developed were reported last year,

which were found to be comparable. During the period, Melfolac in spirit-based and spiritless solvent were prepared by incorporating 20% butylated melamine resin plus small amount of accelerator instead of 40% reported earlier. The characteristics are given in Table 11.

These varnishes could be applied by brush/spray. Gloss of spiritless Melfolac was found to be better (80%) than that of spirit-based Melfolac. 20 lit. of the spiritless varnish was prepared and utilised for polishing the office doors and dressing table etc.

Metal lacquers for food packaging

In continuation with the work reported earlier, attempts were continued for formulating can lacquers based on lac and various synthetic resins e.g., phenol-formaldehyde (resole type), amino resins such as urea formaldehyde, butylated/isobutylated melamine formaldehyde resin (different grades), butylated benzoguanamino formaldehyde resin, polyvinyl butyral resin etc. The extent of synthetic resin in the formulations varied from 2 to 20% on the weight of lac resin. The dry film weight of the lacquers ranged from 4 to 10 gm/m^2 as per IS : 5818 (1988), Specifications for oleoresinous can lacquers' and stoving schedules ranged from 10 to 20 minutes at temperatures ranging from 150 to 210 °C. All formulations, were based on spiritless solvent

Table 11 Comparative performance of Melfolac (spirit - based) and Modified Melfolac (spiritless)

Characteristics	Melfolac (spirit-based)	MSV 005 (spiritless)
Appearance	Clear Solution	Clear Solution
Colour	Dark Brown	Dark Brown
Drying Time		
1. Touch Dry	10 minutes	10 minutes
2. Hard Dry	1 hour	1 hour
Water Resistance	No blushing (15 days)	No blushing (15 days)
Heat Resistance at 99°C	No disfiguration (2 minutes)	No disfiguration (2 minutes)
Gloss (% of standard black glass)		
1. Brush	40	80
2. Spray	74	83
Surface coverage (by brush 3 coats)	7.5m^2/kg	7.5m^2/kg
Shelf life :	No gelling upto 1 year	No gelling upto 1 year
Varnish Coat	Cannot be removed by sand paper	Can be removed by sand paper
Cost of varnish/lit.	150/-	70/-

medium. Five formulations A, B, C, D and E and two commercial samples were subjected to differant tests, e.g., acid resistance, impact resistance, scratch hardness, gloss, flexibility etc. Samples of lacquers A to E were also sent to M/s Synthetics and Polymer Industries, Ahmedabad and to Regional Testing Centre, Calcutta for evaluation. The results of the tests are summarised in Table 12. Viscosity, non-volatile matter and in some cases, flexibility, (as indicated in the test report of M/s Synpol, Ahmedabad) of the shellac-based can . lacquers needed improvement. Further work is in progress in the light of the above findings.

Hot-Melt adhesives

Hot-melt adhesive composition based on lac was prepared (2kg per lot) for book binding, paper and packaging, footwear, ceramics, cork and metal etc. The adhesive was evaluated through IICT, Hyderabad. The results are shown below :

Substrate	Kg/cm	MPa
1. Stainless steel to stainless steel	33.3	3.26
2. Mild steel	15.5	1.52
3. Brass to brass	19.4	1.90
4. Aluminium to aluminium	15.5	1.52
5. Copper to copper	48.8	4.78
6. Wood to wood	49.6	4.86

Table 12 Comparative performance of shellac-based can coating lacquer compositions vis-a-vis commercial epoxy-phenolic based synthetic lacquers

Lacquer sample	Colour and appearance	Viscosity (seconds) by Ford Cup No.4	Non-volatile (%) 120°C/ 2 hrs.	Gloss	Flexi-bility	Adhesion	Scratch hardness (g)	Acid resis-tance	Impact resis-tance
A	Yellowish brown clear liquid	13.9	21.2	Excellent	V. good	Good	1400	Fails	Passes
B	Yellowish brown clear liquid	16.9	26.2	Excellent	Poor	Good	2000	Passes	Passes
C	Dark golden yellow clear liquid	14.8	25.77	Moderate	Poor	Good	2000	Passes	Passes
D	Light yellowish brown clear liquid	21.0	22.35	Poor	V. Good	Good	1400	Passes	Passes
E	Light yellowish brown clear liquid	14.6	24.21	Excellent	Poor	Good	1400	Passes	Passes
Comm. Sample-1	Brownish yellow clear liquid	50	38.0	Excellent	Poor	Poor	1800	Passes	Passes
Comm. Sample-2	Reddish brown clear liquid	120	40.0	Excellent	V. Good	Good	1700	Passes	Passes

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

Varnish composition based on aleuritic acid-free gummy mass

Results of the studies made on the modification of aleuritic acid-free gummy mass with shellac, a cellulose derivative and epoxy resin were reported last year. Satisfactory, defect-free finish of the films of the modified gummy mass compositions could not be obtained, although one of the compositions yielded a high value of dielectric strength.

During the period under report, film and electrical properties were studied first on the varnishes prepared from the reaction products obtained by melt-mixing of different proportions of gummy mass and epoxy resin. The films obtained contained pinholes and electrical properties were also not satisfactory. Attempts were then made to modify the gummy mass with another synthetic resin. Two baking type compositions (A&B) have been developed and were subjected to different tests (Table 13) in order to find their suitability for utilisation as an insulating varnish. Both the compositions yielded very high values of dielectric strength tested at room temperature (92-96 and 85 kV/mm respectively). One of the compositions (A) yielded also high value of dielectric strength (76 kV/mm) of films after immersion in water for 24h. It has been reported earlier, that unmodified gummy mass does not produce tack-free films even after baking at 200°C for 60 min. Tack-free, defect free, flexible films were obtained from both the compositions after step-curing at lower temperatures (Table 13). Both the compositions also passed the tests for resistance to tracking as per IS :10026-1982. The films also possessed thermal resistance (tested) upto 240°C.

Development of lac wax-based formulations

A set of experiments was carried out to prepare emulsion-type formulations based on lac wax and bleached lac and other ingredients for protective coating of fruits and vegetables for their preservation for a longer period of time. Lac wax, carnauba wax, paraffin wax and bleached lac were taken in different proportions so as to make solid content in the emulsion approx. 15%. Different compositions were taken in a pre-heated stainless steel beaker, immersed in oil bath and maintained at constant temp (90-95°C). Hot water was added to the melted compositions and the heating was continued under constant stirring for a period of 4 hours. Altogether eleven formulations were prepared and stored in stoppered bottles and all the compositions were found to be stable.

Table 13 Characteristics of two baking type insulating varnish compositions based on gummy mass and synthetic resins

Characteristics	Composition A	Composition B
Specific gravity	0.89	0-91
Viscosity (Gardener Bubble Viscometer)	2.5 St	4.1 St
Finish	Smooth, non-tacky	Smooth, non-tacky
Non-volatile matter (%)	24.5	31.2
Drying in thin film (Baking Schedule)	05h at 100°C and 1.5h at 180°C	0.5h at 65° and 1.5h at 150°C
Dilution ability (%)	100	100
Effect of varnish on enamelled wire (pencil hardness)	>16[>6H]	>16[>6H]
Flexibility test (3 mm mandrel)	Passes	Passes
Dielectric strength (kV/mm)		
*In air at room temperature	92-96	85
*After immersion in water for 24h	76	
Resistance to tracking test (at 135 and 200V)	Passes Both the varnishes showed increased resistance towards tracking	Passes
Reaction with copper	No greening	No greening
Thermal resistance (tested upto)	240°C	240°C
Scratch hardness	1900 g	1700 g

CFTRI, Mysore; CIPHET, Ludhiana; IARI, New Delhi and IIT, Kharagpur were contacted for testing of the formulations regarding their suitability for use as protective coating of fruits and vegetables as per suggestions of RAC in the meeting held in 1999. The proposal received from the Central Food & Technological Research Institute, Mysore has been approved by the Institute Management Committee and further action is being taken for evaluation of the compositions.

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

It has been reported last year that medium density particle boards were prepared from the sticks of *bhalia (Flemingia macrophylla)*, a bushy lac-host, using aleuritic acid free gummy mass and shellac as binder. In order to optimize the various parameters for making particle board, investigations were carried out varying (i) quantity of binder (from 8% to 10%), (ii)

pressure (from 6.5 kg/cm² to 33 kg/cm²), (iii) temperature (from 100°C to 200°C), (iv) time (from 5 mins. to 40 mins.) and (v) particle size (from 80 to 20 mesh size). Particle boards of dimensions 13cm x 13cm x 1.2 cm were thus prepared and tested for their impact and tensile strength. Impact strength was determined by charpy principle using a pendulum type impact tester. It was observed that the impact as well as the tensile strength increased as expected with the increase in percentage of binder and pressure respectively. The curing temperature of 150°C and curing time of 30 mins. were found to give optimum impact strength. Also the impact strength increased with decreasing particle mesh size. Thus, parameters were optimized to make particle board of adequate impact and tensile strength.

Under the above mentioned optimum conditions, different types of particle boards were prepared using chips (av. length 2.5 cm) alone, chips mixed with powdered stick particles in equal ratio and forming three layer mat with core layer of chips respectively, for better impact strength and surface finish (Table 14). Experiments were also carried out using seedlac and sticklac individually instead of shellac in the binder composition for reducing the cost. Particle boards made from seedlac and sticklac respectively were found to have good impact strength, almost comparable to that of shellac (Table 15).

Attempts were also made to use the woody waste material of lac factory obtained from BISCOLAMF, Ranchi for making particle board as per suggestion of SRC. These waste materials were of two types, one having small and fine

Table 14 Comparison of impact strength of particle boards made using shellac and gummy mass with those of commercial samples

Type of particle board	Density (g/cm³)	Impact strength (cm. kg.)
Commercial - 1	0.81	6.9
Commercial - 2	0.40	3.3
Bhalia stick particles	0.71	4.8
Chips (av. length ~ 2.5 cm)	0.71	6.6
Chips mixed with powdered stick particles in equal ratio	0.70	5.4
Three layer particle board with core layer of chips and face layers of powdered stick particles	0.70	5.2

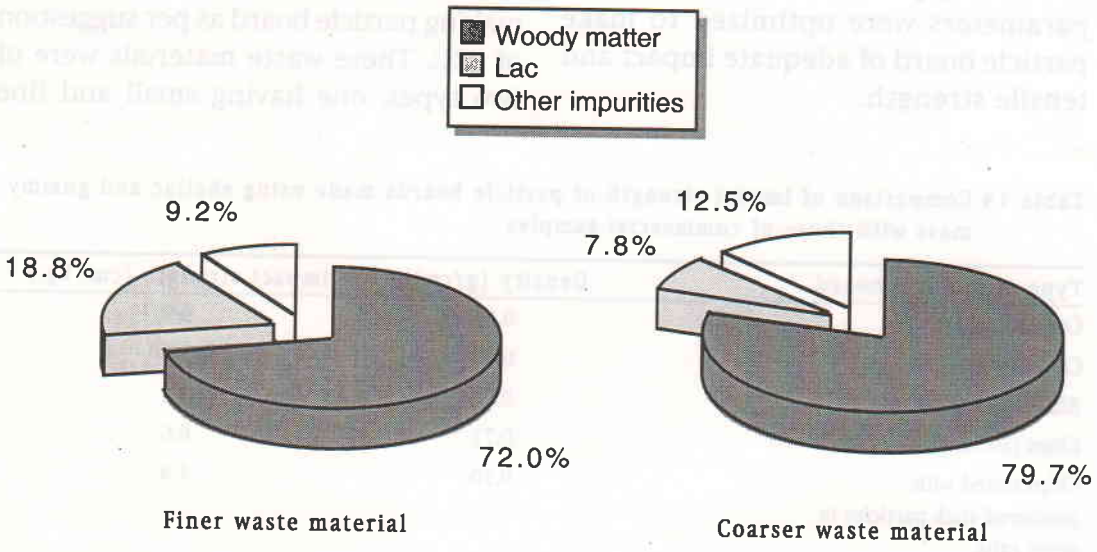
Table 15 Impact strength of particle board from *bhalia* stick particles

Binder	Density (g/cm³)	Impact strength (cm. kg.)
Shellac & gummy mass	0.71	4.8
Seedlac & gummy mass	0.69	4.4
Sticklac & gummy mass	0.73	3.9

particles while the other containing comparatively bigger and coarser particles. The fine materials contain more lac compared to the coarser waste material (Fig. 7). Particle boards were made using these waste materials without addition of any external binder.

The boards showed low impact strength and also were found to stick to mould affecting the surface finish. Further work is in progress to use these woody waste materials in combination with *bhalia/arhar* stick particles for improving the above drawbacks.

Fig. 7 Constituents of woody waste material of lac factory



Ad hoc Research Scheme

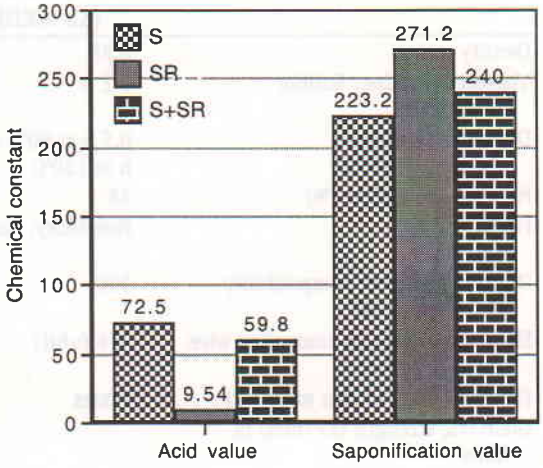
Polyblends of shellac with synthetic resins/polymers-formulation, characterization and application studies

It was reported earlier that a high thermal resistant insulating varnish composition was developed based on shellac, a synthetic resin and commonly used solvents. Further studies were made with the varnish and some of the properties determined are shown in the Table 16 (Comp. I).

It was reported earlier, that the baked films did not show any melting peak upto 230°C when examined by D.S.C, showing absence of the characteristic melting peaks at 52-57 and 72-74°C for shellac, which indicated that some chemical reaction had taken place between the reactive groups of shellac and the synthetic resin. Further experiments were carried out on this aspect. A precipitate was obtained by adding a non-solvent in the blend of solutions of shellac and the synthetic resin. This precipitate was dried and investigated by D.S.C. In this case also, the characteristic peaks of shellac were absent in the temperature range 53-80°C. Acid and saponification values of shellac, the synthetic resin and the precipitated mass were examined which are given Fig. 8.

Both the acid and saponification values of the precipitated mass were

Fig. 8 Chemical constants of shellac (S), synthetic resin (SR) and the precipitated mass (S+SR)



found to be in between the values of the individual resins. The above results from the D.S.C. and chemical constants confirm that a chemical combination between OH and COOH groups of shellac and the synthetic resin has taken place.

Shelf-life: The varnish stored under normal room temperature conditions upto 22 months retained all the desired good properties e.g., dielectric strength, drying schedule, finish, flexibility, resistance to tracking and thermal resistance upto 230°C.

Evaluation: The varnish was supplied to M/s Tajna Shellac Pvt. Ltd. The proprietor of the firm, who is also a member of the Institute's RAC, has informed that the varnish is fit for commercialization as he got the varnish evaluated through his contact in Germany.

Table 16 Characteristis of two high thermal resistant baking type insulating varnishes based on shellac and two different synthetic resins (Tested as per IS : 10026-1982)

Characteristics	Composition I (Sh AKDB)	Composition II (Sh 05 X B)	Shellac
Density	0.88	0.92	
Viscosity (Gardner Bubble Viscometer)	1.2 st	6.8 st	
Drying in thin film (Baking schedule)	0.5 h at 90°C and 1.5 h at 150°C	2.5 h at 100°C or 1.5 h at 150°C or 1 h at 175°C	30 min (in air)
Non-volatile matter (%)	38	24	
Finish	Non-tacky, hard film	Non-tacky, smooth and hard film	Smooth, Non-tacky
Dilution ability or compatibility with thinner (%)	100	100	100
Effect of varnish on enamelled wire (pencil hardness)	>16 (>6H)	>16 (>6H)	
Flexibility Test (3 mm mandrel)	Passes	Passes	Fails
Dielectric strength (kV/mm) of films			
* in air at room temp.	63-73	95-100	40
* in air after immersion in water for 24 h	27-30	75-80	5-6
Resistance to tracking (50 drops) both at 135 and 200V	Passes	Passes	Passes
Resistance to transformer oil (visual)	Passes	Passes	Passes
Reaction of varnish with copper	Passes, No greening	Passes, No greening	Passes, No greening
Scratch hardness	>2000g	>2000g	600g
Thermal resistance (°C)	230	230	65-70
Shelf-life	No gelling upto 22 months, films retained all the desired properties	No gelling upto 6 months in air-tight container	

During the period under report, another composition (Comp. II) of insulating varnish was developed based on shellac, another synthetic resin and commonly used solvents. Different characteristics of this varnish have been shown in the Table 16 along with those of the Comp. I. Comp. II was found to be superior to Comp. I in respect of finish, drying schedule, dielectric strength, resistance to water/humidity. Films of the Comp. II yielded a very high value of dielectric strength (76 kV/mm) even after immersion in water for 24h, indicating increased resistance towards water/humidity. Such high value of dielectric strength, in water immersion test, has so far not been reported for films of any shellac based insulating varnish composition. The corresponding value of unmodified shellac is less than 6 kV/mm. Films of

the Comp. II were flexible and possessed thermal resistance (tested) upto 230°C. Thus, all the three weaknesses of shellac, viz., brittleness of films, low thermal resistance (65-75°C) and low resistance towards humidity/water have been overcome in Comp. II.

Evaluation : The sample of Comp. II was supplied to a local consumer, M/s Om Electric Power Pvt. Ltd., Hatia, Ranchi. The varnish was applied on the coils of a 3.3 kV 400 H.P. electric motor. The performance of the varnish has been reported to be best of their satisfaction.

Fibre glass reinforced sheets (GRP)

Taking advantage of shellac's superb adhesion on a variety of substrates and in order to diversify the uses of shellac, an exploratory study was made on the use of shellac based varnishes in the preparation of fibre glass reinforced sheets. Since, different types of fibre glass mats are not available in the local market, loosely woven fibre glass mats (CSM) could only be procured. These mats were utilised and four types of GRP sheets were prepared by using (I) shellac cladded with epoxy resin, (2) shellac alone, (3) Comp. II plus epoxy and (4) Comp. II. alone by hand lay-up technique and baking in an oven at elevated temperature. Fourteen sheets of 3 mm thickness and size of 10x10" were prepared and were sent for testing of mechanical properties to CIPET, Lucknow. These have been shown in the Table 17. A few electrical properties were also studied and these have also been shown in the Table 17. Tensile strength values of compositions 2,3 and 4 were found to be in the range of polyester resin bonded GRP sheets prepared by hand lay-up technique reported in the literature. Tensile strength of Comp. 4 was found to be in the range of aluminium metal. Since the varnishes, which have been used for the preparation of GRP sheets, produce flexible films, the tensile modulus, flexural strength and flexural modulus were found to be lower compared to those available in the literature. Arc resistance values of the sheets were found to be similar to the values reported in the literature for epoxy, PS, SAN, PP and PPS based laminates (Encyl. Polym. Sci. Technol. 5,560; Hand Book of Plastic Testing Technol., V. Shah, Appendix). Dielectric strength values were found to be similar to the value obtained for the commercially available epoxy/based fibre glass sheets. Values of Izod impact resistance were found in the range reported in the literature (4-6 ftlb./in) for polyester, epoxy based GRPs.

Since, both mechanical and electrical poperties of GRPs depend on the texture of mats, resin used and method of preparation and recently GRP/FRPs are being manufactured with very high values of mechanical properties, fresh attempts will be made to prepare GRP sheets using fibre glass cloth and modified shellac varnish.

Table 17 Characteristics of shellac and modified shellac bonded fibre glass (CSM) reinforced sheets

Properties	Epoxy cladded Shellac	Uncladed Shellac	Comp. II Plus epoxy	Comp II alone	Hand lay up mat laminate based on polyster	Epoxy glass cloth laminate	Aluminium metal
	(1)	(2)	(3)	(4)	(a)	(b)	(c)
Tensile strength kgf/cm²	390.5	832.5	745.5	950.1			
(MPa)	(38.3)	(81.7)	(74)	(93.2)	(55-117)		(80-430)
Tensile modulus kgf/cm²	6036	11010	7529.5	13485			
(GPa)	(0.6)	(1.1)	(0.74)	(1.32)			(70)
Flexural strength kgf/cm²	343	448	527	-			
(MPa)	(33.65)	(43.95)	(51.7)		(69-138)		
Flexural modulus kgf/cm²	12090	19670	30640	-			
(GPa)	(1.2)	(1.93)	(3.0)		(3.4)		
Arc resistance (sec)	68	76	78	70			
Izod Impact Resistance (kg cm/cm of notch)	-	92.32	76.66	53.74			
Dielectric strength (kV/mm)		4	9-14		3.9-9.7	9.0	
Dissipation factor	0.0006	0.0005	0.0008				
Thermal Resistance (°C)	200	130	240	230			

Note : First six properties of Comp. 1 to 4 were evaluated at CIPET, Lucknow and last three properties were determined at this Institute

(a) and (c) have been quoted from litreature

(b) has been determined at lab and material was purchased from market

REVOLVING FUND SCHEME

Quality Broodlac Production on *Kusum* and *Palas*

BALANCE SHEET 1999-2000

Fund Received from ICAR in Nov. 1996 : **Rs. 6,70,000**

Opening Balance (Cash) on 1st April 1999: **Rs. 6,49,335**

EXPENDITURE (Rs.)		INCOME (Rs.)	
HEAD		**HEAD**	
Broodlac	40,700.00	Broodlac/(+Syn.) sold	1,95,940.00
Contractual (Labour)	55,200.00	Arrear cost of broodlac	8,000.00
Insecticides	17,781.00	Sticklac	8,008.00
T.A.	2,478.00	Broodlac used for next year	30,000.00
P.O.L.	373.00		
Total	1,16,532		2,41,948.00

HEAD	Up to MARCH 2000
Gross Profit (+) / Loss (-)	+1,25,416.00
Minus 10% of Worker's Share	−12,500.00
Establishment Charges	− 01,000.00
Depreciation	− 01,694.00
Net Profit	1,10,222.00

Cash Reserve as on 31st March 2000 as per cash book including interest amount of Rs. 22,984 of short term bank deposit	= Rs. 7,74,235.00
NR assets	= Rs. 11,675.00
Broodlac used for future crop	= Rs. 30,000.00
Total	= Rs. 8,15,910.00

TECHNOLOGY TRANSFERRED

Entrepreneur Development Programme

Ten entrepreneurs were trained on lac-based products/processes and lac quality control. The institute earned a revenue of Rs. 0.45 lakh through training charges under this programe.

Product/Process	No.trained	Beneficiary	Period
Aleuritic acid	1	Ashish G.Agarwal M/s Vijaya Shellac & Chemicals, Balghat Road, Gondia	5 - 13.4.99
Determination of life. flow & impurity	1	-do-	8 - 13.4.99
Sealing wax	6(in one group)	Persons sponsored by ITDA	4 - 10.5.99
		Nilgiri, Balasore, Orissa	16.8 - 12.9.99
Analysis & Testing of lac	1	Surendra Pandey, BISCOLAMF, Ranchi	
Lac Processing	1	Ashok Kumar Yadav	4 - 14.10.99
Lac Dye	1	Ashok Kumar Yadav	14 - 24.10.99

DISTRIBUTION OF BROODLAC TO FARMERS

Farmer receiving brood lac, under the sponsorship of SEPC

Under the sponsorship of SEPC, Calcutta and Trifed, Ranchi, *rangeeni* brood lac, for raising *baisakhi-cum-katki* 1999-2000 crop was distributed to around 200 farmers from several villages in Angara, Khunti, Arki and Silli blocks of Ranchi district and Tonto block of Singbhum district as well as to those from West Bengal.

Farmer receiving brood lac, under the sponsorship of TRIFED

EDUCATION & TRAINING

Four-month certificate course on "Modern Methods of Lac Culture"

Four Lac Supervisors, 3 Statistical Supervisors, 1 Junior Economic Investigator and 1 Lac Inspector from Institute of Forest Productivity, Ranchi and 23 unemployed rural youth (total 32 nos.) successfully completed the course.

One-week training on lac for farmers

The institute also conducted one-week training programme, with special emphasis on lac culture. The programme mainly aims at educating the lac cultivators and others on the "Improved lac cultivation techniques." A summary of one week programme conducted during the period is furnished in Table 18.

Table 18 Details of one-week training programme on lac conducted for farmers and others

Sponsoring/ Nominating organisation	Period	No. of participants
Farmers Training		
Adim Jati Sewa Mandal Kharsidag, Ranchi	1st to 6th Feb.	20
	13th to 18th Dec.	10
Forest Dept., Ranchi	22nd to 27th Feb.	28
	8th to 12th March	31
	15th to 20th March	35
	12th to 17th April	24
TRIFED, Ranchi	3rd to 7th May	20
	10th to 15th May	13
	17th 22nd May	29
Jagriti Vikas Kendra, Kurdeg	-do-	3
TRIFED, Ranchi	24th to 29th May	3
	31st May to 5th June	27
	7th to 11th June	27
	21st to 26th June	5
Bihar Samaj Kalyan Sangthan, Ranchi	27th Sept. to 1st Oct.	29
CASA, Ranchi	11th to 16th Oct.	22
SRI, Ranchi	25th to 30th Oct.	17
World Vision, Ranchi	1st to 6th Nov.	12
	29th Nov. to 4th Dec.	10
	Total	365

Sponsoring/ Nominating organisation	Period	No. of participants
Special One-week Training Programme		
Forest Dept., Ranchi	10th to 15th May	20
BHU (B.Sc. Ag) Students	21st to 26th June	3
Allahabad Agric. Inst. (B.Sc. Ag.) students	17th to 24th Dec.	8
	Total	31
	Grand Total	427

One day education programme

One day programme on lac cultivation was organised for 30 batches of Farmers, Post Graduate / Graduate Students as detailed in Table 19.

Table 19 One day Orientation Programme on Lac

Beneficiary	Sponsored by	No. of batches	No. of participants
	Orientation Programme		
Farmers	• IFFCO, Ranchi	1	40
	• R.K.Mission, Ranchi	7	376
	• Nav Bharat Jagriti Manch, Murhu, Khunti, Ranchi	3	107
	• Forest Dept., Gaya	4	123
	• Vidhyapati Vikas Kendra, Hazaribag	1	9
	• Bihar Kalyan Sangathan	1	29
	• Munda Dev. Action Comm.	1	30
	• Catholic Christian Jan Vikas Kendra, Jamshedpur	1	24
	Total		**738**
Students	• Midnapur College, Midnapur W.B.	1	14
	• XISS, Ranchi	1	63
	• Ranchi Womens College, Ranchi	2	66
	• Gossner College, Ranchi	1	30
	• Nirmala College, Ranchi	1	70
	Total		**243**
	Exposure Programme		
Farmers	• R. K. Mission, Ranchi	4	354
	• West Bengal Agric. Dept. Khatna Division, Purulia (W.B.)	1	21
	Total		**375**
	Grand Total		**1356**

Keeping in mind the demand from the farmers for extension education, training programmes were organised on Lac Culture in association with various NGOs as given in Table 20.

Table 20 Field education training conducted on lac cultivation

Venue/Location	District/State	Collaborating organisation	No. of participants
Off-campus training			
Bardih	Gumla (Bihar)	Social Development Centre	199
Pakur	Pakur (Bihar)	MESO Project	800
Dava FPC	Balrampur (W.B.)	R.K.Mission, Lok Shiksha Parishad	53
Karra High School	Ranchi (Bihar)	Karra rural Dev. Society	35
Rajrappa	Hazaribah (Bihar)	IPDP	26
Garebih	Silli, Ranchi (Bihar)	Parvatiya Durgam Vikas	150
Raidih	Gumla (Bihar)	Raidih Samagra Vikas Parisad	200
		Total	**1463**
On-farm training programme			
Makadpada	Orissa	ITDA, Orissa	70
Ichadih	Balrampur (W.B.)	On farmers' request	15
Limha	Bilaspur (M.P.)	Forest Department, Ranchi	25
Latehar	Palamau (Bihar)	Vedic society	29
Kisan Gosthi			
S.S.School, Silli	Ranchi (Bihar)	INDAL, Muri	1000
Getalsud	Ranchi (Bihar)	R.K.Mission	400
		Total	**1539**

Technical information service

Technical information, in respect of lac cultivation, processing, product development and other general information related to lac, were provided to interested persons through correspondence and personal discussion. More than 70 queries were attended to during the period.

Lac culture samples received from lac growers and other organisations were examined for forecast of larval emergence.

PUBLICITY

Participation in Exhibitions and *Kisan Melas*

The institute participated in a number of exhibitions/*kisan melas* as shown in Table 21.

A large number of visitors were benefited from the exhibits of the stall. Literature on lac was also distributed among the interested persons.

Sale Counter

The TOT Division operates a sale counter for promotion of lac-based products. Various products, such as melfolac, water-soluble lac, lac handicrafts, sealing wax were sold amounting to Rs 1,08,178 during the period.

Table 21 Details of participation in exhibitions and *kisan melas*

Date	Name and location of the exhibition	Organized by
Exhibition		
10-11.1.1999	Workshop-cum-exhibition at Kishore Chandrapur, Balasore dist., Orissa	Kishore Chandrapur Lac Industrial Co-op. Soc. Ltd, Kishore Chandrapur
2-4.2.1999	Gumla Mahotsav-cum-Vikas Mela, Paramvir Albert Ekka Stadium, Gumla	Deputy Commissioner, Gumla
11.4.1999	Patrahatu, Silli Block, Ranchi	Gramin Vikas Kendra, Silli
16-17.7.1999	Training-cum-exhibition, CCL Community Hall, Rajrappa	CCL, Rajrappa, Hazaribag
28-29.8.1999	Training-cum-exhibition, Dept. of Zoology, St. Columba's College, Hazaribag	Dept. of Zoology, St. Columba's College, Hazaribag
22-23.9.1999	Seminar-cum-exhibition, Khadi Grama Udyog Kendra, Tuderma, Gumla	Rangadeh Samagra Vikas Parisad, Tudurma
15.10.1999	Training-cum-exhibition, Chamghati, Angara block, Ranchi	Society for Rural Industrialization, Ranchi
14-27.10.1999	India International Trade Fair, Pragati Maidan, New Delhi	Trade Fair Authority of India, Govt. of India
17.12.1999	Seminar-cum-exhibition, Khunti, Ranchi district	Nav Bharat Jagriti Kendra, Murhu
Kisan Mela		
19 Jan., 1999	Resham Krishi Mela RSRS, Hehal, Ranchi	Regional Sericultural Research Station, Hehal, Ranchi
24-26 Jan., 1999	Kisan Mela Jaipal Singh Stadium, Ranchi	Regional Development Commissioner, Ranchi
5-6 Feb., 1999	Kisan Mela Getalsud, Angara Block, Ranchi dist.	R.K. Mission Ashrama, Divyayan KVK, Morabadi, Ranchi
10 Feb. 1999	Kisan Mela High School, Chotamuri, Ranchi dist.	INDALCO, Chotamuri

Video Films on Lac

As a result of a maiden attempt of the Institute, a video film on lac has been produced in two parts. Both Hindi and English versions are avialbale.

Part I of the film entitled *"Thou Springeth from Blest Trees"* covers lac production, while

Part II, entitled *"Resource of the New Millennium"* covers lac processing and utilization.

The film has been made for educational purpose and each part is of approximately 18 min. duration. Copies of this film have been made available as VHS Cassettes and as VCDs.

Release of VHS cassetes by Ms. Rosaline Lakra, Station Director, AIR Ranchi

The Premiere of this film was held at a well-attended function on 12th Oct., 1999. Dr Anwar Alam, DDG (Engg.) inaugurated the Premiere. Copies of the films were also sold through the Sale Counter of the Institute.

A draft script has been prepared for preparation of two audio cassettes on lac cultivation.

A video camera with accessories has been procured for in-house production of short video films on the activities of ILRI and on different aspects of lac. Filming has been done covering the activities of the institute. It will be compiled into short duration cassettes for showing to the visitors.

Publicity through Mass Media

Radio Talk/T.V. Programme

1. '*Lak keet palan ke poshak vriksh evam unke dekh rekh.*' Broadcast from AIR, Ranchi on 13.3.99 by Dr. B. P. Singh
2. '*Chhotanagpur ke vikas mein lah ki bhumika.*' Telecast from DDK, Ranchi on 10.6.99
3. '*Lah keet palan ka vaigyanik tareeka.*' Broadcast from AIR, Ranchi on 10.7.99
4. '*Poshak vrikshon par adal-badal kar lakh ki kheti.*' Telecast from DDK, Ranchi on 25.8.99
5. '*Kusmi lah ki vaigyanik kheti.*' Telecast from DDK, Ranchi on 25.11.99

PUBLICATIONS

Research papers

Agarwal, S.C., Jaiswal, A. K. and Sharma, K.K. (1998) Problem and prospects of lac culture in India. J. Non-timber Forest Prod., **5** (3 & 4), 127

Bhattacharya, A., Mishra, Y.D., Sharma, K. K. and Sushil, S. N. (1999) Effect of different pesticide combinations on crop yield under intensive lac cultivation on *Flemingia macrophylla*, J. Appl. Zool. Res., **10**(1), 59.

Bhattacharya, A., Jaiswal, A. K., Mishra, Y.D. and Chaudhary, S.G. (1999) A method for estimation of shoot length of *Schleichera oleosa* (Lours) Oken for lac crop inoculation, J. Appl. Zool. Res., **10** (1), 62

Jaiswal, A. K., Sharma, K. K. and Agarwal, S.C. (1999) A modified and upgraded version of insect separating device used in pest management, Natl. Acad. Sci. letters, **22** (5&6), 106.

Jaiswal, A. K., Sharma, K. K., Kumar, K. K., Agarwal, S.C. (1999) Growth and instability analysis of domestic consumption and supply of lac in India, J. Non-timber Forest Prod., **6** (1&2), 44.

Majee, R. N., Rao, V. K., Saha, S. K. and Agarwal, S.C. (1999) Simplified synthesis of (Z) - 9-hexadecen-1-yl-acetate, J. Inst. Chem. (India), **71** (Part2), 137.

Mishra, Y.D., Kumar, S., Sushil, S.N., Bhattacharya, A and Singh B. P. (1999) Development of *kusmi* lac insect, *Kerria nagoliensis* (Mahdihassan) on different hosts, Insect Environment, **5** (3), 130.

Rajendran, I., Majee, R. N. and Agarwal, S.C.(1999) Synthesis of plant growth regulator analogues from aleuritic acid J. Inst. Chem. (India), **71** (Part 2), 75.

Rao, V. K. Majee, R. N., Saha, S. K. and Agarwal, S. C. (1999) Synthesis of 9, 11- dodecadien - 1-yl acetate from aleuritic acid, J. Indian, Chem. Soc., **76**, 503.

Sharma, K. K. and Ramani, R. (1999) An update on synoptic catalogue of lac insects (Homoptera: Coccoidea : Tachardiidae), J. Bombay Natural Hist. Soc., **96** (3), 438.

Sharma, K. K., Bhattacharya, A and Sushil, S. N. (1999) Indian Lac insect, *Kerria lacca*, as an important source of honey dew, Bee World, **80** (3), 115.

Srivastava, B.C. and Jaiswal, A.K. (1999) Evaluation of lac based slow-release pesticidal formulation for cockroach control, Natl. Acad. Sci. letters, **22** (7&8), 142.

Papers presented in Seminars

Agarwal, S.C., Mishra, Y.D., Kumar, P., Singh, B.P. and Bhattacharya, A.

(1999) Lac culture as a tool for joint forest management, in Seminar-cum-workshop on 'Role of sericulture and lac culture on sustenance of JFM, R.K.Mission, Lok Shiksha Parisad, Narendrapur, West Bengal.

Singh, B.P., Mishra, Y.D., Kumar, K.K., Kumar, P. and Agarwal, S.C.(1999) Integration of lac cultivation in Agro-Horticultural system in Chhotanagpur region, in National Seminar on Sustainable Horticultural Production in Tribal regions, at CHES, Ranchi, July 25-26.

Bhattacharya, A., Mishra, Y.D., Sushil, S.N. and Kumar, K.K. (1999) Lac culture - an overview in Zoological Seminar held on the occasion of Centenary Celebration of St. Columbas College, Hazaribagh, August 28-29.

Kumar, K. K. , Jaiswal, A. K. and Sharma, K.K. (1999). Scope of lac cultivation in employment and income generation for tribals in Seminar-cum-workshop on Augmentation of Collection and Processing of Minor Forest Produce organised by Gramya (a NGO) during 23-25 August at Srikrishna Administrative Training Institute, Ranchi.

Goswami, D.N., Mahto, K., Jha, P.C. and Agarwal, S.C. (1999) Shellac based insulating varnishes in Buyers' Meet organised by Indian Lac Research Institute on the occasion of Platinum Jubilee Celebration of ILRI's foundation sponsored by SIDBI, Patna on 13th Oct. at ILRI, Ranchi.

Gupta, P.C. and Sarkar, P.C. (1999) Some recent applications of lac in wood varnishing and packaging industry in Buyers' Meet organised by Indian Lac Research Institute on the occasion of Platinum Jubiliee Celebration of ILRI's foundation sponsored by SIDBI, Patna, on 13th Oct. 1999 at ILRI, Ranchi.

Prasad, N. and Agarwal, S.C. (1999) Technology of Processing of lac, in Buyer's Meet organised by Indian Lac Research Institute, Namkum, Ranchi on the occasion of Platinum Jubilee Celebration of ILRI's foundation, sponsored by SIDBI, Patna on 13th October.

Ramani, R. and Sharma, K. K. (1999) Holistic review of import and export of beneficial organisms in Brain Storming Seminar at Project Directorate of Biological control, Bangalore, on 27th October.

Prasad, N. (1999) Mechanisation of lac cultivation - a Challenge in XXXIV Annual Convention of ISAE at CCS HAU, Hisar during 16-18 December.

Prasad, N., Agarwal, S.C. and Kumar, K.K. (1999) Status of mechanisation, scope of improvement in making seedlac. In XXXIV Annual Convention of ISAE held at CCS HAU, Hisar during 16-18 Dec.

Popular Articles

Prasad, N. and Kumar, K.K. (1999) *Deep sinchai - Chhotanagpur ke pathari khestra ke liye bardan* (in

Hindi) Chhotanagpur Horticulture, 14 (1-4), 30

Kumar, K.K. and Bhagat, M.L. (1999) *Lakh utpadan mein mahilaon ka yogdan, Krishi vistar Sameeksha* (in Hindi), Jan - Feb., Min. of Agric., Govt. of India, New Delhi.

Tehnical bulletins/pamphlets/ folders/leaflets published by the Institute

Technical bulletins

Kumar, P., Kumar, K.K., Mishra, Y.D., Bhattacharya, A. and Sushil, S.N. (1999) Project profile for lac cultivation in north-east hill region, Indian Lac Research Institute, Ranchi, 7p.

Mishra, Y.D., Bhattacharya, A., Chaudhary, S.G. and Kumar, P. (1999) Advanced broodlac production technology on *kusum*, Bulletin No. 1, Indian Lac Research Institute, Ranchi.

Folders and Pamphlets

- Heat and Water-proof Shellac Varnishes for Wooden Furniture, a leaflet. 1p.
- Shellac-based Tyre-glazing Varnish, a leaflet, 1p.
- Technologies on Aleuritic Acid and Isoambrettolide from Lac, a leaflet, 2pp.
- Shellac-based Insulating Varnishes, a leaflet, 2pp.
- Fibre glass Reinforced Sheets Based on Shellac and Epoxy Resin, a leaflet, 1p.

Books/Booklets

- Press Clippings on I.L.R.I. Activities, a book, 66 pp
- *Kaise karen kusum vriksh par lakh ki kheti*, a booklet, 8 pp
- Package of Practices for Lac Cultivation on *Akashmani* (*Acacia auriculaeformis*), a booklet. 8pp.
- Advanced Broodlac Production Technology on *Kusum*, a booklet, 8 pp.

Newsletters

- ILRI Newsletter, Jul - Dec 1998, 4 pp
- ILRI Newsletter, Jan - June 1999, 4 pp

Compilation of lac bibliography has been done. Material for creation of a website for ILRI has been prepared and forwarded to the Council.

In addition to the distribution of publicity literature printed earlier, about 8,900 copies of different publicity materials were reprinted and distributed during various training programmes, exhibitions etc. Besides, more than 26,000 copies comprising of 160 copies pages of different proforma of office, division etc. were also produced with the copyprinting facility.

LIST OF APPROVED ON-GOING PROJECTS

Core Programmes

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

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 insect and host plant 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. Utilization of by-products (lac dye, wax, refuse lac) of lac industry for food grade lac dye, varnishes/lacquers and bonding for particle board

- Varnish composition based on aleuritic acid-free gummy mass
- Development of lac wax based formulations
- Use of refuse lac/by-products/modified lac for making particle board/ composites from various agro-wastes

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

Sponsored Projects/Schemes

Approved Ad hoc Projects

- Lac productivity rating of different lac insect on conventional and promising lac host
- 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

PROMOTION OF LAC CULTIVATION IN NEH REGION

Inspection of inoculated lac host by Trifed, Guwahati officials

North Eastern Hill states, particularly Assam and Meghalaya used to produce substantial quantity of lac a few decades back, but it has declined over the years to a negligible quantity. The institute has made a modest but determined effort to revive lac cultivation in the region. Over the past two years, scientists of the Institute have visited the area a few times to conduct surveys regarding availability of lac insect and their hosts and to assess the potentiality of the area in lac production through systematic cultivation.

A number of organizations in the region have come forward to join hands with ILRI in this effort :

- Defence Research Laboratory, Tezpur, Assam.
- TRIFED, Guwahati, Assam
- State Forest Research Institute, Itanagar, Arunachal Pradesh
- North Eastern Council, Shillong, Meghalaya
- State Forest Department, Guwahati, Assam
- Arunachal Vikas Parishad (an NGO), Itanagar, Arunachal Pradesh

Survey of the region has revealed that lac is still being collected by the local people from the forests in small quantities but its cultivation has been abandoned. Large number of different lac host plats occurring in the region, such as *Samanea saman, Acacia auriculaeformis, Ziziphus mauritiana, Butea monosperma, Albizzia sp., Ficus spp., Grewia sp.* and *Cajanus cajan* have been found to hold potential for initiating lac cultivation. To start with, *kusmi* broodlac was distributed among tribals and inoculated on *ber,* rain tree etc. at Tezpur, Itanagar and Nawgaon (Karbi Anglong District). Literature on lac cultivation was also supplied to the collaborating agencies for distribution among farmers and for apprising them with the modern° scientific methods of lac cultivation.

IMPORTANT COMMITTEES

Research Advisory Committee

The fifth meeting of the Research Advisory Committee was held on 28-29 January at the Institute. This was the first meeting of new committee, constituted last year. The following members were present :

Dr B. L. Amla, Former-Director, CFTRI, Mysore	Chairman
Dr R. P. Kachru, ADG(PE) ICAR, New Delhi	Member
Dr S. C. Agarwal, Director ILRI, Ranchi	Member
Prof. D.R.C. Bakhetia, Head, Dept. of Entomology, PAU, Ludhiana, Punjab	Member
Dr M. Yaseen, Dy. Director & Head (Retd.), Indian Institute of Chemical Technology, Hyderabad	Member
Sri R. L. Sharma, Managing Director, Tajna Shellac (P) Ltd., Khunti, Ranchi	Member
Sri Madhu Agarwal, Secretary, Maharashtra Rajya Lah Utpadak & Chapra Nirmata Sangh, Gondia, Maharashtra	Member
Shri R. Ramani, Sr. Scientist TOT Division, ILRI, Ranchi	Member-Secretary

Dr S.C. Agarwal, Dirctor welcomed the Chairman and members of the newly constituted committee. He

Fifth Meeting of the Research Advisory Committee

presented the highlights of achievements and important events. Dr R.P. Kachru, ADG(PE) explained the objectives and functions of RAC. Mr. R. Ramani Member-Secretary presented the guidelines on powers and modalities of the functioning of the committee.

Action taken on the recommendations of the previous RAC meeting was reviewed in detail and specific suggestions were given. The Chairman released booklet entitled "Press Clippings on ILRI Activities."

The committee observed that Indian lac faces competition on two fronts: one from other countries which produce lac and the other from synthetic substitutes. We have to carefully analyze the situation and make an asset out of lac.

The committee then reviewed the progress made under current research projects. Two new projects proposed were also considered and the study entitled 'Mechanization of *Bhatta* process for production of button lac/ shellac, was approved to be taken up as an exploratory study. The committee also gave a number of suggestions for bringing about overall improvement in the functioning of the institute. Some of them were :

- A compilation must be made on the industrial scenario of lac, based on a meeting with the industrial agencies/organizations and a strategy paper along with the recommendations should be prepared.
- Possibilities for setting up net-work research project on lac cultivation and utilization involving SAUs in different states known for lac growing, should also be explored expeditiously at appropriate level.
- The TOT unit should work like a 'salesman' and approach the industry for selling technologies developed at ILRI.
- Emphasis must be made on the development of prototype facility for pilot plant.
- Some spending must be made on anticipatory research with some specific items indentified through collective wisdom. Althouh it would involve a calculated risk, but will go a long way to meet the future challenges is lac cultivation and its utilization.

Institute Management Committee

XXVII Meeting

The 27th meeting of the IMC was held on May 13, under the chairmanship of the Dr S.C. Agarwal, Director. The following members were present :

1. Dr R. P. Kachru, ADG(PE), ICAR, New Delhi
2. Dr J. B. Tomar, In-charge, NBPGR, Ranchi

Institute Management Committee reviewing the progress

3. Dr P. C. Gupta, Head, LP&PD Div., ILRI
4. Dr K. K. Kumar, Head, TOT Div., ILRI
5. Sri G. Singh, Sr. Scientist, ILRI
6. Sri R. K. Singh, F&AO, ILRI
7. Sri Ashish Rastogi, Admin. Officer, ILRI

The Director apprised the members of the salient achievements and development in the institute since the previous meting. The committee reviewed the action taken on the recommendations of the 26th meeting and also the progress made under various research projects of the institute, ad-hoc projects, revolving fund scheme and the work in NEH region. the committee also examined and approved various proposals relating to infrastructural development of the institute and the newly reconstitued Grievance Cell of Institute.

XXVIII Meeting

The 28th meeting of the IMC was held during October 28-29 under the Chairmanship of Dr S.C. Agarwal, Director and the following members were present :

1. Dr G. S. Dubey, Dean (PG), BAU, Ranchi
2. Dr J.B Tomar, In-charge, NBPGR, Ranchi
3. Dr P. C. Gupta, Head, LP&PD Div., ILRI
4. Dr K. K. Kumar, Head, Div. of TOT, ILRI
5. Sri G. Singh, Sr. Scientist, ILRI
6. Sri R. K. Singh, F&AO, ILRI
7. Sri S. K. Bose, F&AO, CIFRI, Barrackpore, West Bengal

8. Sri Ashish Rastogi, Admin. Officer, ILRI

The Proceedings of the previous meeting was confirmed after the Chairman presented the achievements of the Institute. The action taken on the recommendations of the previous meeting was discussed in detail. It also approved the condemnation of two old vehicles of the institute, payment of sponsarship fee to ITRC, Lucknow for conducting toxicity tests on lac dye and lac wax. The progress of the work done under the research projects, ad-hoc schemes, revolving fund scheme and NEH Region Development was then reviewed. It also approved some of the proposals, after careful consideration.

Staff Research Council (SRC)

The meeting of Staff Research Council was held on 2-3 & 22 May 2000 under the Chairmanship of Dr. K. K. Kumar, Acting Director, to review the progress of research and to finalise the research programme for the year 2000-01.

The new research projects approved for the year 2000-01

1. Nutrient Management in soil for maximising lac yield - Sri G. Singh, Sri S. K. Yadav and Sri S. Ghosal.
2. Management of *Flemingia semialata* for sustainable lac production under different crop geometry and irrigation - Sri S. K. Yadav, Sri Y. D. Mishra and Sri Arvind Kumar.
3. Mechanisation of *Bhatta process* - Sri S. K. Pandey and Dr. N. Prasad

The SRC also considered the project "Development of food grade lac dye" to be taken under NATP at the cost of Rs. 19.80 lakh presented by Dr. N. Prasad, Sr Scientist and recommended for forwarding to the Council for its approval.

PARTICIPATION OF SCIENTISTS IN TRAINING, MEETINGS, SYMPOSIA ETC.

Dr. P. Kumar, P.S. and Head, Division of Lac Production, Dr. B. P. Singh, Senior Scientist and Mr. Y. D. Mishra, Senior Scientist participated in National Seminar on Sustainable Horticulture production in Tribal Regions, on 25-26 July at CHES, Ranchi.

Dr. N. Prasad, Scientist, TOT Division attended XXXIV Annual convention of Indian Society of Agricultural Engineers held at CCS, HAU, Hisar during 16-18 December.

Mr. R. Ramani, Sr. Sc., Dr. K. K. Sharma, Sc(SS) attended, as resource persons, the brainstorming seminar on Holistic review of import and export of beneficial organisms held on 27.10.99 at Project Directorate of Biological Control, Bangalore

Dr. D. N. Goswami and Dr. A. Bhattacharya attended the coordination committee meeting of AICRP on Post Harvest Technology from 27 to 29 December, 1999 at UAS, Bangalore and presented the Progress of the on going Ad-hoc research projects.

Dr. A Bhattacharya attended the brain storming session on 'Holistic review of import and export of beneficial organisms for presentation of guidelines at Project Directorate of Biological control, Bangalore on 29.12.99.

Dr. A Bhattacharya and Dr. S. N. Sushil visited Entomology Department of PAU, Ludhiana from 25 - 27.11.99 and held discussion with scientists and experts on studies related to pesticide residue analysis and biological control.

SEMINAR, SYMPOSIUM ETC. ORGANISED

NGOs' Meet with ILRI

A one-day NGOs' Meet with ILRI was organized at the institute on June 16, 1999. The objectives of the meet were :

- To establish more linkages between ILRI and NGOs for promotion of lac cultivation and related activities
- To apprise the NGOs about the activities of ILRI
- To work out modalities for working together

A total of forty representatives from 30 NGOs participated in the meet, which included invited representatives from other organizations such as NABARD, TRIFED, BAU and IFP.

Inaugural ceremony

In his welcome address, Dr. S. C. Agarwal hoped that this meet would serve as a launching pad for establishing new relationship with a number of NGOs so that they can work together with the institute for the upliftment of economically weak persons through lac cultivation. Elaborating the status of lac, Director told that it is an important commodity of our country and this region as well, because India is the principal producer of lac, contributing 20,000 metric tons, of which 60% comes from Chhotanagpur region alone. Dr. Agarwal lauded the role of NGOs and

Inaugural Session of NGO's Meet

asserted that they can play a very important role especially, in the area of lac. He emphasized that the main purpose of this meet is to develop linkages with more and more NGOs for promotion of lac cultivation and related aspects.

Dr K. K. Kumar, Head, Transfer of Technology Division of the Institute, gave details about the transfer of technology activities of the Institute. He told that the Institute is operating regular training programmes for farmers, students, entrepreneurs, Govt. and non-Govt. personnels. He informed that the Institute organizes extension and publicity programmes to disseminate the technologies developed. He said that the institute has brought out several publications for cultivators and persons engaged in this field.

The Meet was inaugurated by Shri S.S. Verma, IAS, Commissioner, South Chotanagpur Division and Chief Guest.

Dr. Anwar Alam, DDG (Engg.) addressing the participants of Buyers' Meet

Delivering his inaugural address Shri Verma commended the efforts of the Institute and said that the NGOs can play an important role to propagate the achievements of the Institute to rural masses and areas. He informed that the administration has made contacts with Ranchi based Institutions and consequently exhibitions and melas were organized, which have created a favourable atmosphere. Shri Verma expressed his desire to take advantage of the situation. He emphasized the need to establish coordination between lac, sericulture, horticulture and forest deptt. to promote them. He made an appeal to the participating NGOs to disseminate the outcome of this meeting to the farmers.

On this occasion, latest issue of ILRI Newsletter was also released by the Chief Guest.

Pre-lunch Session

During this session, Director, Institute of Forest Productivity, Ranchi, Dr Ghosh elaborated on the initiatives taken by IFP for lac host improvement and their mass multiplication for distribution. He pointed out the immense potential for enhancing lac production in the region and the global interest and demand for natural products like lac. Mr K. K. Sinha, District Development Manager, NABARD, Ranchi told various schemes available to NGOs which can be used for promotion of lac cultivation. Mr Alexander Minz, Lead District Manager, Bank of India, Ranchi, stressed the need of financial support for lac development and elaborated on the role of Self-help Groups in lac cultivation and how these should operate. Mr S.S. Choudhary, FRO, Forest Department described the recent initiatives taken up by the Forest Department for supporting lac cultivation. They included raising and distribution of lac hosts plants in large numbers, training of lac growers at ILRI, bringing out publications on lac culture and efforts made for making *akashmani* trees available to the farmers for lac culture. Mr H.P.S. Chauhan, Regional Manager, TRIFED, Ranchi informed the audience about their programme for training growers on lac culture and further support by free supply of broodlac to the trained farmers. He invited the NGOs to select eligible farmers from the areas in which they are active and communicate to Trifed so that they can sponsor them for training on improved methods of

lac cultivation. Shri R. Ramani, Sr. Scientist of the Institute conducted the proceedings of the Meet, also proposed a vote of thanks.

Post-lunch Session

In the post-lunch session, interaction was held between the representatives of NGOs and Scientists of the Institute. During this session, representatives from each NGO presented their activities in lac cultivation. They also put forward queries regarding various TOT programmes and some of the problems faced by them in promoting lac production. Suitable replies to their queries and problems were given by the representatives of ILRI. The modalities of working together were also discussed during the interaction.

Some of the important points which emerged out of the meet were :

- The NGOs who were not working in area of lac cultivation expressed their determination to take it up with the support of ILRI.
- All the NGOs were extremely satisfied with the very useful information provided during the meet, on the kind of support available for lac production from not only ILRI but other related government organizations which in their view would greatly help in strengthening their activites in the area of lac.
- Many NGOs expressed their desire to send their workers and farmers from their operational areas for training at ILRI on lac cultivation techniques.
- The NGOs also expressed their desire to sign MoU with ILRI for cooperation in promoting lac production and semiprocessing of lac and lac-based cottage industries.
- Efforts will also be made for training the rural women to increase their role in the field of lac.
- An appeal was made to the NGOs to regularly provide material to the Institute on their activities in the area of lac which can be used to publish a Lac Newsletter. Similarly, material can be collected from other govt. agencies as well. This newsletter will serve as a powerful medium for dissemination of information including availability and demand of brood lac etc.
- Efforts will be made to make this kind of meet a regular one to enable constant monitoring and strenghthening of the co-operation between NGOs and ILRI.

The meeting ended with a vote of thanks by the Chairman of the session Dr S.C. Agarwal, Director, ILRI.

Buyers' Meet

The Buyers' Meet has organized by the institute with the sponsorship of SIDBI, Patna, on Oct 13. The main focus of the meet was to boost domestic lac consumption by motivating the industries to take up lac-based

enterprises and also by projecting about the advantange of lac for its application is various areas.

Inaugural session

The Meet began with the welcome address by Dr S. C. Agarwal who outlined the activities and achievements of the Indian Lac research Institute. He elaborated on some of the technologies of lac developed by the institute, especially, in lac processing and utilization. He expressed ILRI's commitment for developing technologies to boost the domestic lac consumption. He outlined how the institute could help the entrepreneurs to set up lac-based enterprises.

Subsequently, Mr S. L. Choudhury, GM, SIDBI, Patna explained the participants about the objectives of SIDBI, Patna. He informed that SIDBI can give direct assistance to SSI units up to Rs. 1.5 crores. He also explained about some relevant programmes of SIDBI, including microcredit scheme, Skill-cum-Technology Upgradation Programme, rural industrialization, ISO 9000 certification, modernization of industries etc.

Dr Anwar Alam, DDG (Engg.), Chief Guest, expressed his desire for increased partnership between ILRI and the industry. He said that lac is an importnat source of income of tribals and the lac-based industries have a responsible role to play. He called upon the industrialists and entrepreneurs to adopt the technologies developed by ILRI. He felt that the lac cultivation technologies developed by ILRI should be promoted and SIDBI should come forward for financing such ventures.

Mr R.L. Sharma, a veteran lac industrialist, spoke about the scenario of lac-based raw materials in the country. He felt that lac processing units should concentrate on the quality of processed lac produced in the country. He said that if the manufacturers can assure good quality they can get good price for their lac. If we can properly exploit the potential for internal consumption of lac, probably there may not be any shellac left for exports; such is the scope of lac utilization. At present, there is high degree of dependency on overseas market. He felt that we should do something to come out of this dependency.

Mr Lalit Kedia, President, Chhotanagpur Chamber of Commerce, expressed that he was also not aware of certain of the applications of lac mentioned in the talks. He stressed the need for the industrialists of region coming closer to ILRI for reaping the benefits of the technolgies developed by them.

Mr. Prabhat Mahesh, President, Giants Group at Ranchi, expressed the desire of Chhotanagpur Chamber of Commerce and ILRI jointly holding of symposium on lac.

Presentations

Dr P.C. Sarkar, Scientist, ILRI apprised the participants about some recent applications of lac in wood varnishing and packaging industry.

Dr Niranjan Prasad, Sr. Scientist, ILRI presented an overview of the advances in lac processing and value addition of chemicals.

Dr D. N. Goswami, Sr Scientist, ILRI presented the recent achievements made in the development of superior shellac-based insulating varnishes.

Interaction Session

The participants put forth queries regarding various technologies outlined in the lectures, which were replied to by the experts. The questions mostly pertained to mode of technology transfer, transfer costs, economics and marketing of the products.

Some of the important points that were discussed are summarised below:

- There was consensus on conducting more such awareness programmes to achieve wider publicity of the lac-based technolgies available with ILRI.
- There was considerable interest on the lac-based insulating varnishes. The entrepreneurs desired that charges of transfer of technology should be reduced for the tribals. There was a suggestion that the local entrepreneurs should be given the technolgoy at concessional rates.
- The participants also desired that potential buyers of the lac-based products should also be included in the project profile.
- The entrepreneurs who were interested in obtaining samples of the products for evaluation were requested to provide the requirement of samples to the institute. They were also requested to give evaluation report to the institute after testing the products.
- The availability and the cost of the basic material, viz., shellac was discussed. It was pointed out that there is huge potential for increasing the production of Indian lac in our country. It was felt that any gradual increase in demand can be met within short time-frame through extension programmes.
- The entrepreneurs were promised maximum possible support from the Indian Lac Research Institute for setting up lac-based industries. There was a general optimism and interest among the participants for taking up new enterprises based on lac.

The meet was conducted by Mr R. Ramani, Sr. Scientist and Convenor of the Meet.

The Buyers' Meet ended with a vote of thanks by Dr K. K. Kumar, Head Division of Transfer of Technology, ILRI.

DISTINGUISHED VISITORS

The Lac Museum at the Institute was visited by 881 persons from all walks of life. Besides, 1356 farmers sponsored by various GOs and NGOs also visited the Museum. The following were some of the distinguished visitors who visited the Museum during the period under report :

- Sri Ram Karan Pal, Mukhya Sachetak Satharurh Dal, Bihar Vidhan Parishad, Patna
- Sri Man Raj, IFS, General Manager, Bihar State Forest Development Corp. Ltd., Ranchi
- Sri S. Mediratta, Brigadier, H.Q.21, Corps, C/o 56 APO
- Sri S. K. Sarkar, Chief Conservator of Forests (R&D), W.B., Calcutta
- Dr. S. C. Goel, HOD, ECF Deptt., BIT, Mesra, Ranchi
- Mr. P. C. Mishra, Conservator of Forests, Working Plan & Research Circle, Van Bhawan, Doranda, Ranchi
- Mr. S. L. Choudhary, Deputy General Manager, SIDBI, Patna
- Dr. Bahadur Singh, President, Cambridge School, Tatisilwai, Ranchi
- Sri H. L. Jhaml, Sr. DGM, HEC, Ranchi
- Sri A. Som, Sr. Manufacturer, HEC, Ranchi
- Mr. B. K. Sinha, IPS, Commandant, BMP, Doranda, Ranchi
- Dr. K. R. Koandal, NRC, Plant Bio.Tech, IARI, Pusa, New Delhi - 110 002
- Mr. S. S. Verma, Commissioner, South Chhotanagpur Division, Ranchi
- Mr. Khem Raj, Director (Agric.), Govt. of Rajasthan, Jaipur
- Mr. J. Ram, Acting Secretary, SEPC, 14/1B, Ezra Street, Calcutta, W.B.
- Dr. J. L. Karibaloo, Project Director, NRC, NBPGR, New Delhi
- Dr. Anwar Alam, DDG (Engg.), ICAR, Krishi Bhawan, New Delhi
- Mr. S. C. S. Pathania, Colonel, SM, VSM, 99 APO
- Mr. Deepak Jindal, Lieutenant 99 APO
- Dr. B. B. Singh, PS & OSD on NATP Biodiversity Conservation & Monitoring, NBPGR, New Delhi
- Dr. G.L. Sharma, V. R. Singh and Subramanium Swami, ICAR, H.Q. New Delhi - 110 0001
- Mr. M. Ahrens, CE Roeper Gamb, Hamburg, Germany
- Mr. Ramesh Chandan, New Brighton, MN 95112, USA

PERSONNEL

(As on 31.12.1999)*

Name	Designation
Dr. S. C. Agarwal	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
R.F.R.S, Dharamjaigarh, M.P.	
Dr. S. K. Jaipuriar	Senior Scientist (Agric. Entomol.) I/c
R.F.R.S., Balarampur, W.B.	
Dr. A Bhattacharya	Senior Scientist (Agric. Entomol.) I/c
Administrative Section	
Sri A. Rastogi	Administrative Officer
Sri R. K. Singh	Finance & Accounts Officer
Director's Cell	
Sri Ramesh Prasad	Technical Officer (T-6) Lab.
Library	
Sri R. P. Tewari	Technical Officer (T-5)
Quality Control (Testing Lab.)	
Sri D. Ghosh	Technical Officer (T-5) Lab.
Farm Unit	
Dr. B. P. Singh	Senior Scientist (Agronomy), I/c
Maintenance and Workshop Unit	
Sri S. K. Srivastava	Technical Officer (T-5)
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

Farm Unit

Management and upkeep of farm plantation and office campus, including maintenance of roads, paths, channels, hedges and edges were continued. Hoeing, weeding, mulching, removal of termitarium and spraying of insecticides to the lac host plants to control termites were done in different plots. Unwanted and obnoxious weeds were eradicated from *ber, khair, kusum, putri, plas, sisam* and *Akashmani. Akashmani* plants were uprooted from plot no. 64 and 65 for allotment to the scientists. Seedlings of various species such as *kusum, ber, galwang, palas, akashmani* and *khair* were raised in polyethylene bags as well as in nursery beds for filling up the vacant space in the respective plots, utilization in research experiments and for distribution amongst the desirous trainees/farmers. At the onset of the monsoon, seedlings of different lac host plants were transplanted in respective plots. Irrigation was also provided as and when required. After monsoon, application of lime to lac host plants in the farm and avenue trees of the Institute campus under landscaping area was also done.

For beautifying the landscaping area, the seasonal flowers, shrubs and ornamental foliage specially, Tuberose and Gladiolus plants were planted at various places in the office campus.

Developmental Activities :

A. Seedlings of paddy cv, mansuri, IR36 and basmati 1310 were raised and transplanted in the plot nos. 17, 22 and 61 and satisfactory yield was obtained.

Soyabean and maize in plot no. 30 and turmeric in mixed plantation of *bhalia* (*Flemingia macrophylla*) and *galwang* (*Albizzia lucida*) were raised in plot no. 29 as Gora *paddy* and ragi - were raised in upland plot-0, 54A and 61A with satisfactory yields.

Dr. Anwar Alam, DDG (Engg.) examining kusmi *lac crop on* Flemingia semialata *at the farm*

B. Seedlings of *kusum* (30) *ber* (100) *palas* (5) *Khair* (50) *akashmani* (7) and *galwang* (25) were planted in their respective plots under gap filling programme.

C. Approximately 650 trainees/ farmers/students, from different corners of the country, received short and long term trainings organized by the Institute. The Institute earned a revenue of Rs. 78,822 through sale of different farm produce, viz., vegetables, paddy, soyabean, maize, seeds of bushy lac hosts, seedlings of seasonal flowers and ornamental plants, ragi, straw, fire wood and monthly contract for grass cutting.

Library & Documentation Centre

Institute Library has been partially computerized and facilities for scanning of CD-ROM Discs of AGRIS - 1995-98) as well as DIALOG Discs (for WSCA) have been developed.

The Library has the following resources

Document holdings	Additions during the year	Total
Books & Journals (Bound)	237	23751
Annual Reports	214	3695
Reprint / Photocopies	7	300
Bulletin / Research Notes	6	511
CD-ROMs	17	17

The scientists of the institute and research scholars from BIT, Mesra, Ranchi University, RIT, Jamshedpur and IIT - Kharagpur constitute the clientele of the library. A sum of Rs. 11.3 lacs was spent for the purchase of various kinds of library resources during the year under report.

Library continued to maintain exchange of ILRI publications with the scientific institutions within and outside the country.

Total No. of periodicals received during the year in the library is us under :

Particulars	National	International
No. of Journals subscribed	60	25
No. of Journals received on exchange or *on gratis*	49	27

Mechanical Section

The unit undertakes electrical maintenance work of entire office, laboratory buildings, residential quarters, street light, pump houses (situated about 2.5 km. away from the institute), HT/LT sub-stations and also electric supply through generator set.

The unit also maintains liaison with Bihar State Electricity Board for maintenance of 11 kVA feeder and certification/settlement of HT/LT energy bills/fuel surcharges etc. The unit also under takes monthly record of electricity consumption and billing of all residential quarters. It under took jobs for minor repair of instruments/ equipments.

This unit maintains water pipe line from the pumping station situated about 2.5 km. away from Institute at Subarnrekha river bed site, and also the pipe line within the various establishments/residential quarters of the institute.

Apart from the above a "Hand operated lac scraping machine" was fabricated in the section under research project entitled Mechanization of Lac Cultivation Operations.

Different Jobs undertaken by the section are given below :

Job description	No. of jobs carried out
• Electrical maintenance	
a) Electrical maintenance of office campus, including street lights etc.	710
b) Electrical maintenance-residential	318
c) Instruments/equipments repair	391
• Mechanical maintenance/ repair work	
a) Repair/overhauling work for engines, pumps, motors and other small machines.	—
b) Machine shop (lathe, drilling, grinding and steel fabrication) work	332
c) Electrical welding, M.S. Fabrication, repair of farm equipments and implements	245
• Civil maintenance	
a) Laying/repair of water pipe line for residential and office and laboratories.	—
b) Carpentry work viz. repair/fabrication of door, windows,furnitures and related to research work.	415
• Other activities	
Monitoring of maintenance work for solar light unit, generator set etc. under AMC.	—

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 and all the working days. He is assisted by one stockman-cum-Compounder and an attendant. During the period under report, 6460 patients were attended to and 90 patients were referred to different specialists of RMCH and authorised hospitals

SUMMARY REPORT IN HINDI

कार्यकारी सारांश

भारतीय लाख अनुसंधान संस्थान लाख के क्षेत्र में अनुसंधान एवं विकास के लिए समर्पित एक अग्रणि संस्थान है। संस्थान द्वारा उत्पादन एवं औद्योगिक क्षेत्र की बदलती जरूरतों के अनुरूप अपने कार्यक्रमों की समीक्षा की जाती है क्योंकि प्रौद्योगिकी का विकास एवं इसका इस्तेमाल सीधे इन्हीं से जुड़ा होता है। संस्थान द्वारा लाख उत्पादन एवं इसके उपयोग के क्षेत्र में अनुसंधान संबंधी सहायता प्रदान करने के लिए सतत् प्रयास किये जा रहे हैं। रिपोर्ट की अवधि में संस्थान द्वारा विभिन्न क्षेत्रों में हुई प्रगति के विवरण का सारांश निम्नवत् है।

अनुसंधान

संस्थान की अनुसंधान परियोजनाएं अनुसंधान के दो विभागों, लाख उत्पादन विभाग तथा लाख संसाधन एवं उत्पाद विकास विभाग द्वारा चार मुख्य कार्यक्रमों के अन्तर्गत चलाई जाती है। इन अनुसंधान कार्यक्रमों के अन्तर्गत प्राप्त उपलब्धियों का सारांश अधोलिखित है।

लाख उत्पादन

- किये गए प्रयोग से ज्ञात हुआ कि गर्मी में छद्म प्यूपा चरण के दौरान कुसमी लाख कीट के नर का निर्जलीकरण मुख्य व्यवरोध है एवं गर्मी के दैरान नई पत्तियों के उगने के कारण सितम्बर/अक्टूबर में संचारण के 2-4 माहपूर्व आंशिक छंटाई से नए कीट के संरक्षण में सहायता मिलती है।
- भालिया, फ्लेमेंजिया मैक्रोफाझला झाड़ियों एवं पलाश वृक्षों पर कतकी 99 फसल की अवधि में क्रमशः ट्राइकोग्राम प्रेटीओसम एवं टी. चीलोनीस के अण्ड परजीवी छोड़े गए। टी. प्रेटीओसम के छोड़े जाने के कारण नियंत्रण के फलस्वरूप ई.एमाबिलीस की संख्या में 82 से 87 प्रतिशत श्यूडोहाइपाटोपा पल्वेरिया की संख्या में 89 से 92.5 प्रतिशत कमी के संकेत मिले हैं। टी. चीलोनीस छोड़े जाने की स्थिति में नियंत्रण के फलस्वरुप ई.एमाविलीस की संख्या में 65 से 59 प्रतिशत कमी तथा पी. पल्वेरिया छोड़े जाने की स्थिति स्थिति में 57 से 74 प्रतिशत कमी देखी गयी। बीहन लाख के प्रयोग की दृष्टि से उपज अनुपात देखने पर नियंत्रण की तुलना में बीहन की प्राप्ति 100% ज्यादा पायी गई। अध्ययन से संकेत मिलते है कि लाख की खेती में नाशीकीट प्रबन्धन के लिए ये परजीवी आशाजनक हैं।
- शरदकालीन लाख की फसल (अगहनी) में प्लेमेंजिया मैक्रोफाझला एवं एफ. सेमिएलाटा पर लाख कीट स्थापना के लिए उपलब्ध दौजी। नई टहनियों की कुल लम्बाई पर क्रमशः 22.1 एवं 21.3 प्रतिशत कीट स्थापना देखी गई जिसमें संबंधित परिपालकों पर लाख का पपड़ीकरण काफी अच्छा देखा गया। इन परिपालकों पर कीट स्थापन के लिए उपयुक्त टहनी का घेरा क्रमशः 3.37 से 2.39 एवं 3.45 से 2.50 से.मी. रिकार्ड किया गया।
- पौधे के बीच की दूरी के विभिन्न स्थितियों पर प्रयोग से उपज की मात्रा (कि.ग्रा./पौधा) में कोई उल्लेखनीय प्रभाव नहीं देखा गया। जैसे कटाई की गयी जैव मात्रा, बीहन लाख, छांटी गई लाख डंडियां एवं यष्टिलाख (छिली लाख) जबकि पौधों का घनत्व उच्चतर उपज के लिए महत्वपूर्ण कारक के रुप में देखा गया। उर्वरकों के प्रयोग को बढ़ाने से उपज सूचकांक में महत्वपूर्ण परिवर्तन देखे गए।
- केरल, कर्नाटक एवं असम से सर्वे कर नई लाख कीट की टहनियाँ एकत्र की गई।

- हाथ से चलाने वाला एक छीलने की मशीन अभिकल्पित की गई एवं बनाई गई। यह अलग करने की 97% क्षमता के साथ एक घंटे में लगभग छः किलोग्राम लाख की डंटियों की छिलाई करता है।

लाख संसाधन एवं उत्पाद विकास विभाग

- श्रीओ-एल्यूरिटिक अम्ल से पहली बार हेल्कोवर्पा आर्मीगेरा एवं कई अन्य कीट के नाशीकीटों का एक फीरोमोन अवयव (जेड)-9- हेकसाडेकेन-1- अल संश्लेषित किया गया। सामान्य प्रतिक्रिया का क्रम अपनाते हुए पहली बार श्रीओ एल्यूरिटीक अम्ल से, मटर में पाया जाने वाला एक पौध वृद्धि उद्दीपक हाइड्रौक्सी-डी^{9} डोडेसीनइक अम्ल संश्लेषित किया गया।
- लाख से विकसित किया गया हॉट मेल्ट आसंजक अज्वलशील, विषविहिन पाया गया तथा यह एक घण्टे के अन्दर मजबूत बंधन बनाता है। यह देखा गया कि इसे किताबों की जिल्द बनाने, कागज साटने, पैकिंग बनाने, जूता उद्योग, सेरामिक्स को साटने तथा प्लाइउड बक्से बनाने में इस्तेमाल किया जा सकता है। इसे चौबीस घण्टे पानी से डूबाने पर बंधन की मजबूती पानी के लिए अप्रवेश्य बनी रही।
- गमी भास एवं कृत्रिम रेजीन पर आधारित भर्जित संयोजन विकसित किया गया जिसमें उच्च परावैद्युत तथा 240^{0}सी तक (परीक्षण किया हुआ) ताप प्रतिरोधक गुण है। आई.एस. : 10026-1982 के अनुरुप परीक्षण करने पर इन वार्निशों में अधिक प्रतिरेखन अवरोधक गुण भी पाये गए।
- उच्च ताप अवरोधक (230^{0}सी) वार्निश का एक अन्य संयोजन (कॉम्प - II) विकसित किया गया जिसकी फिल्म हवा में उच्च परावैद्युत शक्ति रखती है तथा 24 घण्टे इसे पानी में डूबाए रखने के बाद भी परीक्षण करने पर इनके गुणों में ज्यादा ह्रास नहीं देखा गया। इस संयोजन से चपड़े की तीन कमजोरियां जैसे फिल्म की भंगुरता, पानी तथा ताप से अवरोध क्षमता की न्यूनता से छूटकारा पाया जा सकता है। एक स्थानीय उपभोक्ता ने इसका उपयोग 3.3 के.वी. 400 एच.पी. विद्युत मोटर पर किया है तथा इस वार्निश को संतोष जनक पाया है।

पिछले वर्ष रिपोर्ट किया गया वार्निश कॉम्प - I को 22 महीने तक कमरे के सामान्य तापक्रम पर रखा गया तथा पाया गया कि इसके सभी अच्छे गुण मौजूद हैं। चपड़ा/रूपान्तरित चपड़ा बौंडेड फाइबर ग्लाश (सीएमएस) सुदृढ़ सीट तैयार करने के प्रयास किये गए।

प्रौद्योगिकी हस्तांतरण

प्रशिक्षण

लाख के विभिन्न पहलूओं पर प्रौद्योगिकी हस्तातंरण विभाग द्वारा किसानों, छात्रों, प्रशिक्षुओं, परीवीक्षा अधिकारियों तथा उद्यमियों को विभिन्न प्रशिक्षण कार्यक्रमों के अन्तर्गत प्रशिक्षण दिया गया जिसका सारांश निम्नवत् है

"लाख की खेती के आधुनिक तरीके" पर बत्तीस प्रतिभागियों ने चार माह का प्रमाणपत्र पाठ्यक्रम सफलतापूर्वक पूरा किया।

एक सप्ताह के बत्तीस प्रशिक्षण कार्यक्रम आयोजित किये गए जिसमें 365 किसानों एवं अन्य लोगों ने हिस्सा लिया। वन विभाग के अधिकारियों एवं छात्रों के लिए तीन बैचों में एक सप्ताह का विशेष प्रशिक्षण कार्यक्रम भी आयोजित किये गए। जिसमें 31 प्रतिभागियों ने भाग लिया।

लाख की खेती पर एक दिन का अभिविन्यास कार्यक्रम 30 बैचों में आयोजित किया गया जिसमें 1356 प्रतिभागियों ने लाभ उठाया।

बिहार एवं पश्चिम बंगाल के सात स्थलों पर ''परिसर से बाहर'' प्रशिक्षण कार्यक्रम आयोजित किये गए जिसमें 1463 प्रतिभागियों ने लाभ उठाया। विभिन्न राज्यों के चार ग्रामों में चार क्षेत्र प्रशिक्षण शिविर आयोजित किये गए जिसमें 139 किसानों ने हिस्सा लिया।

गैर सरकारी संगठनों का सम्मेलन

संस्थान में 16 जून 1999 को गैर-सरकारी संगठनों के साथ भा.ला. अनु.सं. का एक दिवसीय सम्मेलन आयोजित किया गया। इसका उद्घाटन श्री एस.एस. वर्मा, भा.प्र.से. आयुक्त, दक्षिण छोटानागपुर प्रमंडल ने किया। तीस गैर-सरकारी संगठनों के चालीस प्रतिनिधियों ने इसमें भाग लिया। इसके अतिरिक्त सरकारी संगठनों के बारह आमंत्रित अधिकारियों ने इसमें हिस्सा लिया। इस अवसर पर भा.ला.अनु.सं. की गतिविधियों का प्रस्तुतीकरण, वन उत्पादकता संस्थान, नवार्ड, ट्राईफेड, बैंक ऑफ इन्डिया तथा राज्य सरकार के वन विभाग के अधिकारियों ने लाख के क्षेत्र में उनकी सहयोगी भूमिका के संबंध में आमंत्रित व्याख्यान, गैर-सरकारी संगठनों के साथ कार्य करने के तरीकों तथा लाख के विकास में आने वाली समस्याओं पर चर्चा के लिए विचार विमर्श सत्र जैसे कार्यक्रम आयोजित किये गए। सम्मेलन की कार्यवाही को स्थानीय समाचार माध्यमों एवं आकाशवाणी पर प्रचारित किया गया।

क्रेता सम्मेलन

लाख एवं लाख आधारित प्रौद्योगिकी के बारे में जागरूकता पैदा करने तथा लाख की घरेलु खपत में तेजी लाने के मुख्य उद्देश्यों को लेकर 13 अक्तूबर 1999 को संस्थान द्वारा एक क्रेता सम्मेलन का आयोजन किया गया। लघु उद्योगों तथा अन्य संबंधित अभिकरणों के प्रतिनिधियों के अलावे इसमें 58 उद्यमियों ने भाग लिया।

इस सम्मेलन में विभिन्न लाख आधारित प्रौद्योगिकी के बारे में वैज्ञानिक द्वारा प्रस्तुतीकरण सत्र तथा उसके पश्चात् विचार विमर्श सत्र आयोजित किया गया। यह कार्यक्रम भारतीय लघु उद्योग विकास बैंक (सिडबी) पटना द्वारा प्रायोजित किया गया।

प्रचार

संस्थान के द्वारा विकसित लाख आधारित प्रौद्योगिकी एवं लाख के प्रसार के लिए संस्थान ने विभिन्न स्थानों पर 13 प्रदर्शनी, किसान मेला में हिस्सा लिया तथा स्टाल लगाए। पहली बार लाख के बारे में दो भाग में हिन्दी तथा अंग्रेजी में शैक्षणिक विडियो फिल्म बनाई गई। इसके प्रिमियर समारोह का उद्घाटन डॉ अनवर आलम, उप महानिदेशक (अभियांत्रिकी) ने किया।

प्रकाशन

लाख एवं लाख प्रौद्योगिकी के बारे में संस्थान द्वारा पुस्तक, पुस्तिकाएं, पत्रक इत्यादि कुल दस प्रकाशन जारी किये गए। भा.ला.अनु. सं. (अर्द्धवार्षिक) न्यूजलेटर भी नियमित रूप से प्रकाशित किया जाता है।

गुणवत्ता नियंत्रण

संस्थान द्वारा विभिन्न सराकरी संगठनों निजी उद्योगों इत्यादि से प्राप्त लाख एवं लाख उत्पादों की जाँच की सुविधा प्रदान की जाती है। इस अवधि में संस्थान द्वारा जाँच शुल्क के रूप में रू. 16595.00 अर्जित किये गए।

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 सुझांवों के आलोक में उस समय के लाख व्यापारी ''भारतीय लाख अनुसंधान संगठन'' नामक एक निजी पंजीकृत संस्था के अन्तर्गत संगठित हुए। इस संगठन को राज्य सरकार से भूमि प्राप्त हुई तथा संस्थापक निदेशक श्रीमती डोरोथी नॉरीस के अधीन संस्थान ने कार्य करना आरम्भ किया।

आरम्भ में कीट विज्ञान अनुभाग संस्थान की प्रमुख ईकाई थी तथा जैव रसायन अनुभाग 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 अगस्त

के बीच औसत न्यूनतम मासिक तापक्रम 6.7° सें. से 23.5° सें. के बीच तथा औसत अधिकतम मासिक तापक्रम जनवरी से अप्रैल के बीच 25.1° सें. से 40.1° सें. के बीच रहा। इस अवधि में कुल वर्षा 1593 मी.मी. हुई जिसमें मानसून की वर्षा 1391 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., प. बंगाल एवं उड़ीसा में तीन 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 के पुनः प्राप्ति हेतु सूचना भंडार तक वैज्ञानिकों की पहुँच बनाने के लिए कृषि अनुसंधान आसूचना तंत्र (एरीस सेल) प्रकोष्ठ 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 उद्देश्य 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 की गई आय निम्नवत है।

शीर्ष	राजस्व (लाख में)
फार्म उत्पादों इत्यादि की ब्रिकी	2.04
जाँच शुल्क	0.27
सेवा प्रदान करने से प्राप्ति	0.95
आंतरिक योजनाओं से आय	0.30
प्रशिक्षण एवं परामर्शदात्री सेवा	2.14
अन्य प्राप्ति	3.98
कुल	**9.67**

बजट

1999-2000 की अवधि में योजना एवं गैर योजना मद में खर्च का विवरण नीचे सारिणी में दिया गया है।

1998-99 के दौरान भा.ला.अनु.सं. का बजट

लेखा शीर्ष व्यय	बजट अनुमान 989-2000 (रु.लाख)	संशोधित अनुमान 99-2000 (रु . लाख)	वास्तविक व्यय (रु . लाख)
योजना			
स्थापना शुल्क	3.50	1.35	1.35
मजदूरी	–	–	–
समयोपरि भत्ता	–	–	–
यात्रा भत्ता	2.50	2.00	1.98
निर्माण सहित अन्य शुल्क	40.00	47.50	47.30
निर्माण	34.00	10.16	10.16
कैच अप अनुदान			
उपकरण	13.00	3.00	1.19
निर्माण	11.00	16.44	16.42
पुस्तकालय की किताबें एवं अन्य मद	16.00	4.55	4.53
कुल	120.00	85.00	82.93
योजनेत्तर			
स्थापना शुल्क	373.00	327.90	270.80
मजदूरी	–	–	–
समयोपरि भत्ता	0.05	0.05	0.05
यात्रा भत्ता	2.50	2.50	2.50
उपकरण समेत अन्य शुल्क	46.45	61.55	44.58
कुल	422.00	392.00	317.93

हिन्दी प्रकोष्ठ

भारत सरकार के राजभाषा विभाग (गृहमंत्रालय) द्वारा तैयार किये गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम तथा नियमों के संबंध में भारतीय कृषि अनुसंधान परिषद, नई दिल्ली से समय समय पर प्राप्त निर्देशों पर अनुवर्ती कार्रवाई तथा सरकारी कामकाज में राजभाषा हिन्दी के अधिकाधिक प्रयोग की पृष्ठभूमि तैयार करने तथा प्रोत्साहन योजना को कार्यान्वित करने के उद्देश्य से हिन्दी प्रकोष्ठ का गठन किया गया है। इसमें एक सहायक निदेशक (राजभाषा) तथा एक हिन्दी अनुवादक कार्यरत है।

संस्थान के दैनिक कार्यों में हिन्दी के प्रयोग में प्रगति, हिन्दी को सर्वग्राह्य बनाने के लक्ष्य की प्राप्ति एवं बहुआयामी उपयोग के लिए हिन्दी प्रकोष्ठ द्वारा निम्नलिखित कार्य संपादित किये जाते हैं।

- संस्थान राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन, कार्यसूची एवं कार्यवृत की तैयारी तथा लिये गए निर्णयों पर अनुवर्ती कार्रवाई।
- वार्षिक रिपोर्ट का सारांश, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा सूचना, कोटेशन एवं पत्राचार के विभिन्न सामग्रियों का अनुवाद।
- हिन्दीत्तर अधिकारियों / कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण कार्यक्रम में भेजने हेतु नामित करवाना।
- हिन्दी दिवस, हिन्दी पखवाड़ा एवं हिन्दी के विभिन्न प्रतियोगिताओं का आयोजन।
- संदर्भ साहित्य, हिन्दी पत्रिकाएँ, शब्दकोष एवं तकनीकी शब्दावलियों का उपार्जन।
- द्विभाषी मुहरों, नामपट्ट एवं साइनबोर्ड का निर्माण।
- प्रचार सामग्रियों, विवरणियों का अनुवाद। सूचना संकलन एवं समय-समय पर समाचार सामग्री तैयार करना।
- नगर राजभाषा कार्यान्वयन समिति की अनुशंसाओं का कार्यान्वयन।

उपरोक्त कार्यों के निष्पादन हेतु संस्थान राजभाषा कार्यान्वयन समिति कार्यरत रही। समिति के निम्नलिखित सदस्य थे:

डॉ. सतीश चन्द्र अग्रवाल निदेशक	अध्यक्ष
डॉ. प्रणय कुमार अध्यक्ष, लाख उत्पादन विभाग	सदस्य
डॉ. कौशल किशोर कुमार अध्यक्ष, प्रौद्योगिकी हस्तांतरण विभाग	सदस्य
डॉ. प्रेमचन्द गुप्ता अध्यक्ष, लाख संसाधन एवं उत्पाद विकास विभाग	सदस्य
डॉ. भरत प्रसाद सिंह प्रभारी अधिकारी, फार्म	सदस्य
श्री आशीष रस्तोगी प्रशासनिक अधिकारी	सदस्य
श्री रजनीश कुमार सिंह वित्त व लेखा अधिकारी	सदस्य
श्री राम प्रताप तिवारी पुस्तकालयाध्यक्ष	सदस्य
डॉ. अंजेश कुमार हिन्दी अनुवादक	सदस्य
श्री लक्ष्मी कान्त सहायक निदेशक (रा.भा.)	सदस्य सचिव

निदेशक महोदय की अध्यक्षता में संस्थान में दिनांक 31.7.99 को संस्थान राजभाषा कार्यान्वयन समिति की बैठक में निम्नलिखित निर्णय लिए गए।

- कम्प्यूटरों में हिन्दी सॉफ्टवेयर की व्यवस्था करना।
- नगर स्तरीय अंताक्षरी प्रतियोगिता का आयोजन।
- वैज्ञानिकों के लिए हिन्दी कार्यशाला का आयोजन।
- संचिकाओं पर हिन्दी एवं अंग्रेजी में प्रशासनिक वाक्यांशों का मुद्रण।
- हिन्दी प्रकाशनों का उपार्जन।

नगर राजभाषा कार्यान्वयन समिति, राँची की बैठक में सहभागिता :-

- दिनांक 19.02.99 को मेकन कम्यूनिटी हॉल में आयोजित बैठक में डॉ. सतीश चन्द्र अग्रवाल, निदेशक एवं श्री लक्ष्मीकान्त, स.निदेशक (रा.भा.) ने भाग लिया।
- दिनांक 27.08.99 को मेकन कम्यूनिटी हॉल में आयोजित बैठक में डॉ. कौशल किशोर कुमार, कार्यकारी निदेशक, श्री लक्ष्मीकान्त, स.निदेशक (रा.भा.), डॉ. अंजेश कुमार हिन्दी अनुवादक एवं श्री प्रह्लाद सिंह ने भाग लिया।

हिन्दी में वैज्ञानिक गोष्ठी

- हिन्दी में वैज्ञानिक गोष्ठी व्याख्यान माला के अन्तर्गत डॉ. कौशल किशोर कुमार, अध्यक्ष, प्रौद्योगिकी हस्तांतरण विभाग ने "कृषि में शोध तथा प्रसार के लिए द्रूत विश्रांत एवं ग्रामीण सहभागिता की महत्ता" विषय पर संस्थान के वैज्ञानिकों को संबोधित किया।

हिन्दी दिवस समारोह

संस्थान में दिनांक 30.09.99 को हिन्दी दिवस समारोह का आयोजन किया गया। समारोह का उद्घाटन मुख्य अतिथि श्रीमती रोजलिन लकड़ा, केन्द्र निदेशक, आकाशवाणी, रांची ने दीप प्रज्वलित कर किया। प्रारंभ

हिन्दी दिवस समारोह में बोलते हुए आकाशवाणी के निदेशक, श्रीमती रोजलिन लकड़ा

में संस्थान के निदेशक डॉ. सतीश चन्द्र अग्रवाल ने पुष्प गुच्छ दे कर मुख्य अतिथि का स्वागत किया। सभा का आरंभ सुश्री कृषा डे एवं पार्थ सारथी डे के स्वागत गान से हुआ। संस्थान के निदेशक, डॉ. अग्रवाल ने अपने स्वागत भाषण में कहा कि राजभाषा हिन्दी के लागू होने के इस स्वर्ण जयंती वर्ष तथा शताब्दी के अन्तिम हिन्दी दिवस का विशेष महत्त्व है। मुख्य अतिथि के प्रति आभार प्रकट करते हुए उन्होंने संस्थान की उपलब्धियों के प्रचार एवं प्रसार में आकाशवाणी के योगदान की चर्चा की। उन्होंने बताया कि राजभाषा अधिनियम के पारित होने के पूर्व से ही संस्थान द्वारा हिन्दी में अनुसंधान की उपलब्धियाँ प्रकाशित होती आ रही है। इस कार्य में हमें संस्थान के वैज्ञानिकों एवं अन्य सभी अधिकारियों/कर्मचारियों का सहयोग हमेशा मिलता रहा है। उन्होंने कहा कि हिन्दी के प्रचार/प्रसार

कार्यक्रम को बृहत रूप देने के लिए रांची स्थित केन्द्रीय सरकार के कार्यालयों के बीच संस्थान द्वारा पिछले दो वर्षों से हिन्दी अंताक्षरी प्रतियोगिता का आयोजन किया जा रहा है। डॉ. अग्रवाल ने कहा कि हिन्दी हम सब की मातृभाषा, राष्ट्रभाषा एवं संपर्कभाषा है। इसका प्रयोग हमें आत्म गौरव के साथ करना चाहिए। इस अवसर पर अपनी शुभ कामना प्रकट करते हुए उन्होंने कार्यालय के कार्यों में हिन्दी के अधिकाधिक प्रयोग हेतु अपील की।

मुख्य अतिथि श्रीमती रोजलिन लकड़ा ने संस्थान के अधिकारियों/कर्मचारियों एवं आमंत्रित अतिथियों को संबोधित करते हुए कहा कि हिन्दी ने कई भाषाओं के शब्दों को आत्मसांत किया है। यह एक सरल और सर्वग्राह्य भाषा है। उन्होंने कहा कि प्राय: पूरे देश में हिन्दी स्वीकार्य है तथा इसे अपने दैनिक कार्य में व्यवहार कर गौरवान्वित होना चाहिए।

उनहोंने सुझाव दिया कि हमें संचिकाओं में छोटी-छोटी टिप्पणियां लिख कर हिन्दी में काम की शुरूआत करनी चाहिए। खासकर कृषि अनुसंधान के संस्थानों में हिन्दी का विशेष महत्व है क्योंकि यह संस्थान एवं कृषकों के बीच कड़ी का कार्य करेगी।

इस अवसर पर कृषि अनुसंधान एवं शिक्षा विभाग, भारत सरकार के सचिव एवं भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के महानिदेशक डा. राजेन्द्र सिंह परोदा का संदेश संस्थान के वरीय वैज्ञानिक, श्री रंगनादन रमणी ने पढ़ा।

संस्थान के कार्यों में हिन्दी के प्रयोग संबंधी प्रगति प्रतिवेदन प्रस्तुत करते हुए श्री लक्ष्मी कान्त, सहायक निदेशक (राजभाषा) ने सूचित किया कि प्रशासनिक एवं तकनीकी कार्यों की भांति वैज्ञानिक क्षेत्र में भी हिन्दी का प्रयोग सहजता पूर्वक बढ़ रहा है। हिन्दी माध्यम में प्रशिक्षण, प्रदर्शन एवं किसान मेलों का आयोजन होता रहा है। कम्प्यूटरों में हिन्दी के सॉफ्टवेयर उपलब्ध हो जाने से हिन्दी के कार्य में आशातीत प्रगति हुई है।

इस समारोह में विभिन्न कार्यक्रम के अर्न्तगत सुश्री कृषा डे, पार्थ सारथी डे, श्री कवल किशोर प्रसाद, श्री बैजनाथ गोप, डॉ. अंजेश कुमार, श्री एच.पी.एस.चौहान ने गीत, कवितायें, भजन एवं हास्य व्यंग्य की सरस झलकियां प्रस्तुत की। श्री राम प्रताप तिवारी ने स्वर्ण जयंती वर्ष में हिन्दी की स्थिति विषय पर प्रकाश डाला।

इस अवसर पर केन्द्रीय सचिवालय हिन्दी परिषद, भारतीय कृषि अनुसंधान परिषद के साथ-साथ संस्थान द्वारा प्रकाशित हिन्दी पुस्तक पुस्तिकाओं की एक मनोरम प्रदर्शनी लगाई गई। हिन्दी अनुवादक, डॉ. अंजेश कुमार ने सभा का संचालन तथा श्री गनौरी सिंह, अध्यक्ष, हिन्दी दिवस आयोजन समिति, ने धन्यवाद ज्ञापन किया।

प्रतियोगिता का आयोजन

हिन्दी दिवस समारोह के उपलक्ष्य में संस्थान में हिन्दी की विभिन्न प्रतियोगिताएं दिनांक 24.8.99 को प्रौ.ह.विभाग के व्याख्यान कक्ष में आयोजित की गई तथा निम्नांकित विजेताओं को पुरस्कार प्रदान किये गये।

	विजयी दल
1. अंताक्षरी -	श्री विजय कुमार तिवारी
	श्री विनोद कुमार
	श्री हीरा लाल भक्त
	श्री वैजनाथ गोप
	श्री अर्जुन शर्मा
	श्री प्रह्लाद सिंह

2. व्याख्यान	श्री भक्ति प्रसाद बनर्जी	प्रथम पुरस्कार
	श्री अनिल कुमार सिन्हा	द्वितीय पुरस्कार
3. प्रारूप लेखन	श्री अमर कुमार सहाय	प्रथम पुरस्कार
	श्री शरत चन्द्र लाल	द्वितीय पुरस्कार
4. निबन्ध	श्री मदन मोहन	प्रथम पुरस्कार
	श्री बिहारी साहु	द्वितीय पुरस्कार
5. सुलेख	श्री ध्रुवदेव प्रसाद	प्रथम पुरस्कार
	श्री अनिल कुमार सिन्हा	द्वितीय पुरस्कार
6. टिप्पणी	श्री विनोद कुमार	प्रथम पुरस्कार
	श्री विजय कुमार तिवारी	द्वितीय पुरस्कार
7. हिन्दी पर्याय	श्री प्रह्लाद सिंह	प्रथम पुरस्कार
	श्री शरत चन्द्र लाल	द्वितीय पुरस्कार
	श्री अनिल कुमार शर्मा	सांत्वना पुरस्कार
	श्री लाखनराम	सांत्वना पुरस्कार

हिन्दी अन्ताक्षरी प्रतियोगिता

राँची नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में भारतीय लाख अनुसंधान संस्थान में राँची स्थित केन्द्रीय सरकार के कार्यालयों, उपक्रमों के अधिकारियों एवं कर्मचारियों के लिए दिनांक 3.8.99 को हिन्दी अंताक्षरी प्रतियोगिता का आयोजन किया गया जिसमें 20 (बीस) विभिन्न कार्यालयों के 47 (सैतालिस) अधिकारियों/कर्मचारियों ने भाग लिया।

हिन्दी अंताक्षरी प्रतियोगिता का एक दृश्य

इस अवसर पर प्रतिभागियों को संबोधित करते हुए संस्थान के निदेशक, डॉ. सतीश चन्द्र अग्रवाल ने कहा कि राजभाषा स्वर्ण जयन्ती वर्ष के अवसर पर राजभाषा के प्रचार-प्रसार की कड़ी में हिन्दी अंताक्षरी प्रतियोगिता एक बेहतर प्रयास है। उन्होंने प्रतिभागियों का स्वागत करते हुए निर्णायक मंडल के सदस्यों का परिचय कराया। निर्णायक मंडल में डॉ. कौशल किशोर कुमार, अध्यक्ष, प्रौद्योगिकी हस्तांतरण विभाग, डॉ. निरंजन प्रसाद, वरीय वैज्ञानिक तथा डॉ. केवल कृष्ण शर्मा, वैज्ञानिक वरीय वेतनमान शामिल थे।

प्रतियोगिता का संचालन डॉ. अंजेश कुमार ने तथा धन्यवाद ज्ञापन श्री लक्ष्मीकान्त ने किया।

प्रतियोगिता के परिणाम निम्नवत् है:-

क्रमांक	प्रतिभागियों के नाम	कार्यालय का नाम	हिन्दी/हिन्दीत्तर	स्थान
1.	डॉ. अश्विनी कुमार सिन्हा	केन्द्रीय तसर अनुसंधान संस्थान	हिन्दी	प्रथम
2.	श्रीमती कल्पना मित्रा	केन्द्रीय विद्यालय, एच.ई.सी.	हिन्दीत्तर	प्रथम
3.	श्रीमती तारा जायसवाल	केन्द्रीय विद्यालय, एच.ई.सी.	हिन्दी	द्वितीय
4.	श्री प्रह्लाद सिंह,	भारतीय लाख अनुसंधान संस्थान	हिन्दी	द्वितीय
5.	श्री एस.पी. चौधरी,	केन्द्रीय विद्यालय, दीपाटोली	हिन्दी	तृतीय

APPENDEX - I

Meteorological data recorded at Namkum, Ranchi during 1999

Month	Mean max. temp. °C	Mean min. temp. °C	Mean dry bulb temp. °C	Mean wet bulb temp. °C	Mean relative humidity	Total rain fall mm.	Highest max. temp. °C	Lowest min. temp. °C
Jan.	25.15	6.72	16.62	13.73	69.16	Nil	29.3	4.5
Feb.	29.94	12.92	23.97	21.09	76.71	0.5	32.2	3.0
Mar.	33.8	16.11	25.4	21.09	67.1	Nil	37.0	11.1
Apr.	40.09	21.02	30.92	26.27	68.73	Nil	43.7	18.0
May	36.66	22.30	29.6	26.29	76.03	77.5	43.5	17.7
June	33.08	22.06	27.05	24.74	82.1	272.0	40.1	20.3
July	29.5	22.58	27.45	24.68	79.29	469.0	35.5	20.2
Aug.	29.9	23.51	27.24	24.56	84.29	474.0	33.0	21.0
Sept.	28.62	21.35	27.2	24.06	76.23	176.0	32.0	19.2
Oct.	28.63	19.95	26.57	20.9	63.9	123.5	30.0	18.0
Nov.	27.06	15.05	23.42	19.29	67.0	0.5	29.0	9.4
Dec.	25.39	9.76	20.54	16.94	69.09	Nil	28.0	8.0

The highest temperature : 43.7 °C on 30th April

The lowest temperature : 4.5 °C on 9th January

Total rain fall : 1593 mm

Monsoon rain fall :1391 mm

Appendix - II

PERSONNEL

As on 31.12.99

Name	Designation
Dr. S. C. Agarwal	- Director (RMP)

Division of Lac Production

Dr. P. Kumar	- P. S. & Head of Division
Dr. B. P. Singh	- Sr. Scientist (Agron.)
Dr. A. Bhattacharya	- Sr. Scientist (Agric. Entomol.) & I/c, RFRS, Balrampur
Sri S. C. Srivastava	- Sr. Scientist (Plant Breeding)
Sri G. Singh	- Sr. Scientist (Soil Sc. & Agric. Chem.)
Dr. S. N. Sushil	- Scientist (Agric.Ento.)
Sri S. K. Yadav	- Scientist (Agron.)
Sri Arvind Kumar	- Scientist (SW&CS)
Sri D. Saha	- Scientist (Biotech.)
Sri M. L. Rabidas	- T-II-3
Sri S. S. Prasad	- T-II-3
Sri K. P. Gupta	- T-II-3
Sri D D. Prasad	- T-II-3
Sri R. K. Swansi	- T-I-3
Sri Mohan Singh	- T-I-3
Sri D. W. Runda	- T-2
Sri R. G. Singh	- T-1

Division of Lac Processing and Product Development

Dr. P. C. Gupta	- P.S. & Head of Division (Org. Chem.)
Dr. D. N. Goswami	- Sr. Scientist (Physics)
Dr. N. Prasad	- Sr. Scientist (Org. Chem.)
Dr. R. N. Majee	- Sr. Scientist (Org. Chem.)
Dr. K. P. Sao	- Sr. Scientist (Physics)
Dr. K. M. Prasad	- Sr. Scientist (Org. Chem.)
Sri P. M. Patil	- Scientist (Sr. Scale) (Phys. Chem.)
Dr. P. C. Sarkar	- Scientist (Org. Chem.)
Dr. V. K. Rao	- Scientist (Org. Chem.)
Sri S. K. Pandey	- Scientist (Mech. Engg.)
Sri S. K. Giri	- Scientist (AS&PE)
Sri S. K. S. Yadav	- Scientist (Org. Chem.)
Sri B. P. Banerjee	- T.O. (T-5)
Sri D. D. Singh	- T.O. (T-5)
Sri T. K. Saha	- T.O. (T-5)
Sri Bhola Ram	- Lab. Tech. T-II-3
Sri B. P. Ghosh	- Lab. Tech. T-II-3
Sri M. K. Singh	- Lab. Tech. T-II-3

Sri B. P. Keshri	- Lab. Tech. T-II-3
Sri Tulsi Ram	- Lab. Tech. T-II-3
Smt. Prabha Devi	- Lab. Tech. T-I-3
Sri H. Das	- Lab. Tech. T-I-3
Sri S. K. Tirkey	- Lab. Tech. T-I
Sri Vinod Kumar	- Lab. Tech. T-I

Division of Transfer of Technology

Dr. K. K. Kumar,	- Head of Division
Sri R. Ramani	- Sr. Scientist (Agric. Entomol.)
Sri Y. D. Mishra	- Sr. Scientist (Agric. Entomol.)
Sri R. Singh	- Scientist (Sr. Scale) (Phys.Chem.)
Sri M. L. Bhagat	- Scientist (Sr. Scale) (Agric. Entomol.)
Dr. A. K. Jaiswal	- Scientist (Sr. Scale) (Agric.Entomol.)
Dr. K. K. Sharma	- Scientist (Sr. Scale) (Agric. Entomol.)
Dr. N. Prasad	- Scientist (Farm Machine & Power)
Sri Lakhan Ram	- Publicity Officer (T-6)
Sri L. C. N. Shahdeo	- Tech. Officer- (T-5) Field Farm
Sri M. Ekka	- Tech. Officer- (T-5) Lab.
Sri K. K. Prasad	- Tech. Officer- (T-5) Lab.
Sri Jagdish Singh	- Tech. Officer- (T-5) Lab
Sri U. Sahay	- Lab. Technician (T-II-3)
Sri V. K. Tiwari	- Field/Farm Technician (T-II-3)
Sri A. K. Sinha	- Field/Farm Technician (T-II-3)
Sri D. K. Singh	- Field/Farm Technician (T-II-3)
Sri Vinod Kumar	- Field/Farm Technician (T-II-3)
Sri R. P. Srivastava	- Jr. Artist-cum-Photographer (T-II-3)
Smt. Ratna Dutta	- Museum Assistant, T-II-3
Sri P. A. Ansari	- Field/Farm Technician (T-2)
Sri S. B. Azad	- Field/Farm Technician (T-2)
Sri Madan Mohan	- Field/Farm Technician (T-1)

R.F.R.S., Dharmjaigarh, M.P.

Dr. S. K. Jaipuriar	- Sr. Scientist (Agric., Entomol.) I/c
Sri Jiwan Lal	- Field/Farm Technician (T-I-3)

R.F.R.S. Balrampur, W.B.

Dr. S. Ghosal	- Scientist (Agronomy)
Sri K. A. Nagruar	- T-II-3

Administrative Section

Sri A Rastogi	- Administrative Officer
Sri R. K. Singh	- Finance & Accounts. Officer

Sri Nagendra Mahto - Asstt. Admin. Officer
Sri Md. Samiullah - Asstt. Admin. Officer
Sri R. Rabidas - Sr. P.A. to Director
Sri A. K. Yadav - Security Officer
Smt. S. Prasad - Stenographer, Grade - II
Sri A. K. Sinha - Stenographer, Grade - II
Sri S. K. Yadav - Jr. Stenographer
Sri R. B. Singh - Assistant
Sri K. D. Pandey - Assistant
Sri Budhan Ram - Assistant
Sri K. N. Sinha - Assistant
Sri Ravi Shanker - Assistant
Sri Dudheshwar Ram - Assistant
Smt. Sati Guha - Assistant
Sri Sudarshan Ram - Assistant
Sri R. K. Upadhyay - Assistant
Sri N. Topno - Assistant
Sri Md. Mobarak - Assistant
Sri Vijay Ram - Assistant
Sri B. K. Rajak - Assistant
Sri K. L. Chowdhury - Sr. Clerk
Sri Emil Gari - Sr. Clerk
Sri Thibu Minz - Sr. Clerk
Sri Baijnath Gope - Sr. Clerk
Sri Anant Pandey - Sr. Clerk
Sri Prahalad Singh - Sr. Clerk
Sri Narayan Gope - 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. P. Oraon - Sr. Clerk
Sri Pranay Kumar - 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

Director's Cell

Sri Ramesh Prasad - T.O. (T-6) Lab
Sri A. K. Sahay - T.O. (T-5) F.F.T.
Sri D. Ganguli - T.O. (T-5) Lab
Sri R. K. Rai - T-I-lab

Quality Control (Testing Lab.)

Sri D. Ghosh - T.O. (T-5) Lab
Sri K. M. Sinha - T.O. (T-5) Lab
Sri J. K. Ambuj - T-2 Lab
Sri Ajay Kumar - T-1 - Lab
Sri Anup Kumar - T-1 - Lab
Sri B. K. Singh - T-1 - Lab

Farm Unit

Dr. B. P. Singh - Sr. Scientist I/C
Sri R. N. Vaidya - T.O. (T-5) F.F.
Sri R. L. Ram - T-II - 3 (F.F.T.)
Sri Satish Kumar - T-1 (F.F.T.)
Sri S. K. Tripathy - T-I (F.F.T.)
Sri M. Surin - T-I (F.F.T.)
Sri S. K. Mukherjee - T-1 (F.F.T.)