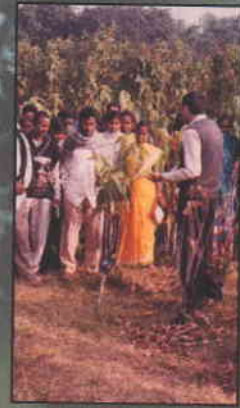


वार्षिक प्रतिवेदन 1998-99 ANNUAL REPORT



भारतीय लाख अनुसंधान संस्थान, राँची  
Indian Lac Research Institute, Ranchi

वार्षिक प्रतिवेदन 1998-99

Annual Report 1998-99

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preparation of the manuscript is thankfully acknowledged.

Cover photos (from top to bottom) : inoculation of lac host using broodlac placement tool;  
*Kusmi* lac on *ber*; farmers being explained about the cultivation operations.

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## PREFACE



Research is an endless effort, the more you perfect a technology, the more you feel that it needs improvement; more the areas you explore, more you uncover yet newer ones which may need attention. But, an applied research institution, like ILRI, should be very discerning in picking up the important areas for its research programme and prioritizing them in view of the fast changes in the consumer needs especially in lac application areas. It should also monitor the progress of ongoing research projects, for their reorientation, based on the

lessons learnt. Quinquennial review of research programme is one such exercise which is done on a regular basis in all ICAR institutes. The Quinquennial Review Team of ILRI submitted its recommendations for developing a short-term research programme for the institute based on the progress made during the past five years and after carefully considering the research needs of the institute. These recommendations have also been approved by the ICAR and will thus form the basis for research during the next half decade.

Recent years witnessed again, turbulence in the lac market, exposing the dependency of Indian lac on overseas market. This led us to organize a two-day National Symposium on "Strategies for Promotion of Lac Consumption" at this institute, mainly to evolve measures for creating a healthy and stable market for Indian lac. One of the major recommendations that emerged out of the deliberations of this seminar was to reduce the dependency on foreign buyers of lac by increasing the domestic consumption.

As a result of another important recommendation of this seminar, a 'Steering Committee on Lac' was constituted under the Chairmanship of the Managing Director, Ranchi Industrial Area Development Authority. The foremost recommendations of this committee, after its first meeting were that (i) the mandate of the Shellac Export Promotion Council should be redefined to include promotion of domestic consumption of lac as well, in order to create a healthy market for lac and (ii) this Council should also buy all the lac produced in the country and store in the form of seedlac and suitably channelize the lac as per prevailing marketing environment. This would ultimately help in the stabilization of the price for lac.

(Dr. S. C. Agarwal)

Director

## EXECUTIVE SUMMARY

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

### Research

The research programmes of the Institute are organized under two divisions : Lac Production and Lac Processing and Product Development. The major contributions made in the above areas have been listed below :

#### Lac Production

- A trivoltine lac insect collected from Sarat, Mayurbhanj, Orissa, which thrives well on *kusum*, is expected to make a breakthrough in the promotion of lac production.
- *Adansonia digitata* (Fam.: Bombacaceae), an exotic plant species of African origin, has been recorded as a new lac host and the thriving insects have been identified as *Kerria fici*.
- Fungal mortality is one of the important factors affecting lac crops. Three new species of fungi: *Aspergillus avamori*, *A. terricola* and *Penicillium citrinum* have been found associated with lac insect.
- An efficient simple indigenous device for lac pest management has been upgraded to separate predators, beneficial and inimical parasitoids, of lac insect.
- A method has been developed to estimate the total available shoot length of *ber* tree, based on easily measureable parameters such as cross-sectional area of the tree base.
- A negative correlation has been found between the brood rate used and the coverage on the *ber* tree, using *kusmi* broodlac.
- Five egg parasitoids were bred in the lab. and evaluated for their parasitizing efficiency against two major lepidopterus lac insect predators for the first time.
- Screening of certain insecticides and fungicides against one-month-old



*Trichocard* fixed on kusum for biological control of lac predators

*kusmi* lac insects of *aghani* crop revealed that three commercial fungicide formulations (up to 0.01%) were safe.

- Eggs of *Chrysopa sp.* have been successfully parasitized by the egg parasitoid *Telenomus remus*, under laboratory condition.
- Evaluation of *Flemingia semialata* and *F. macrophylla* using early variety *kusmi* lac insect under lac-based agroforestry crop model, showed better performance of *F. semialata* producing 189 g sticklac/bush compared *F. macrophylla*. Sponge gourd gave better returns compared to other crops tried in the system.
- Study on the management of *akashmani* for lac cultivation showed better performance of *jethwi* 1998 crop, at higher plant density.



Jethwi 1998 (*kusmi*) lac crop on *akashmani* at higher plant density



Lac-based cropping model for upland (Tanr I) Okra and kusmi lac on *Flemingia semialata*

- Comparison of different lac insect germplasm stocks revealed significant differences in the relative resin dye level, resin productivity per female, fecundity etc.
- Significant correlations have been obtained between certain plant and lac insect attributes in different *Flemingia* species.

#### Lac Processing and Product Development

- The conditions have been standardized for isolation of aleuritic acid directly from seedlac (fresh as well as old), *kiri* and sticklac, on commercial scale.
- A varnish composition, based on dewaxed lac has been developed for polishing wood which is a cheaper substitute for Melfolac.
- A composition of metal lacquer for food packaging has also been developed which satisfies most of the tests as per IS:5818 (1988).
- Insect sex pheromone components,



which are effectively used in pest management programme, have been synthesized from aleuritic acid adopting simplified reaction sequences.

- Provisional patent applications have been submitted to the Council for six lac processes/products, under IPR system.

### **Transfer of Technology**

#### **Extension Research**

A survey has been completed in a cluster of four villages in the Ranchi district on the availability and exploitation of lac hosts by the farmers and the income from lac and other agricultural crops. Lac was found to contribute 27% of the agricultural income, second only to paddy. Out of the three major hosts, *palas* contributed 47% of the income from lac. The level of exploitation of these hosts varied from 51 to 70%.

#### **Training and Special Programmes**

The Transfer of Technology Division conducted a number of training programmes for farmers, students, trainees, probationers and entrepreneurs on various aspects of lac. Seven persons successfully completed the Certificate Course on Lac Cultivation. Under one-day orientation/exposure programmes, 1,533 farmers, students and trainees were benefited. Thirty-two farmers were also trained on modern methods

of lac cultivation, under one-week programme. More than 1,800 farmers participated in the on-farm training camps organized in different villages. Seven entrepreneurs were given process know-how for aleuritic acid/bleached lac; three persons from lac processing units were trained on testing and analysis of lac.

#### **Success Story**

A farmer, adopted by the Institute in Jiravar village, Ormanjhee, Ranchi dist. has started lac cultivation on *palas* trees. He has produced lac worth Rs 21,275 from four lac crops, putting about 450 trees in operation under a coupe system.

#### **Publicity Activities**

A two-day National Symposium on "Strategies for Promotion of Lac Consumption" was organised by the institute on May 14 - 15, 1998 in commemoration of Golden Jubilee of India's Independence.



Dr. M. A. Mohsin, VC, BAU inaugurating the exhibition stalls put up on the occasion of Kisan Mela organised by the Institute



Dr. A. Alam, DDG (Engg.) at the stall of the institute in the India's Science Vision Exhibition, New Delhi (Mr. Ratan Prakash, Chief PRO, ICAR on right)

The Institute organized a *kisan mela* on January 17, 1998. It also participated in twelve exhibitions (which included putting up stalls at India's Science Vision Exhibition at India Gate Lawns and at India International Trade Fair, Pragati Maidan, New Delhi) and *kisan melas*. Publicity of lac cultivation technologies was also done through AIR and DD (seven programmes).

## The Institute Publications

The Institute published three books, eleven folders/leaflets and two newsletters, during the period, besides Annual Report.

## QRT Report

The QRT of ILRI finalized and submitted its report, which has been approved by the ICAR. The RAC also held its annual meeting to review the on-going research programmes. Both RAC and IMC have also been reconstituted w.e.f. this year.

## Training-cum-Demonstration Centre on Lac

An MoU was signed on 12.02.98 between ILRI and Directorate of Cottage and Small Scale Industries, Govt. of West Bengal for establishing a Training - cum - demonstration Centre on Lac at Balarampur. The Institute has been provided with a

Dr. R. S. Paroda, DG, ICAR releasing "Safari of ILRI through Seven Decades" published to commemorate golden jubilee of India's independence (Dr. S. C. Agarwal, Director, ILRI on right)





*Signing of MoU between ILRI and West Bengal Government at Purulia, W.B.*

free office accommodation and a farm consisting of 4,600 *palas* trees at Berada, Purulia.

### Infrastructure Development

*Internet connectivity* : Internet connectivity through National Informatics Centre has been established and the facility extended to all the research divisions and important sections through LAN.

*Copyprinting facility* : The publicity wing of the TOT Division has

been equipped with a Gestetner Copyprinter 5385 system with computer interface for fast production of large number of copies of publications from a computer.

### Ad hoc Project

An Ad hoc Research Scheme entitled "Polyblends of shellac with synthetic resins/polymers-formulation, characterisation and application studies" has been approved by the Council, starting 01.12.98.



*Shri Praloy Talukdar, Hon'ble Minister of Cottage and Small Scale Industries, Govt. of W.B. inaugurating an awareness programme organised at RFRS for Lac, Balarampur, Purulia, West Bengal*

## INTRODUCTION

### Historical

The foundation of the Indian Lac Research Institute (ILRI) was laid on Sept. 20, 1924. 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 Institute 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 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**

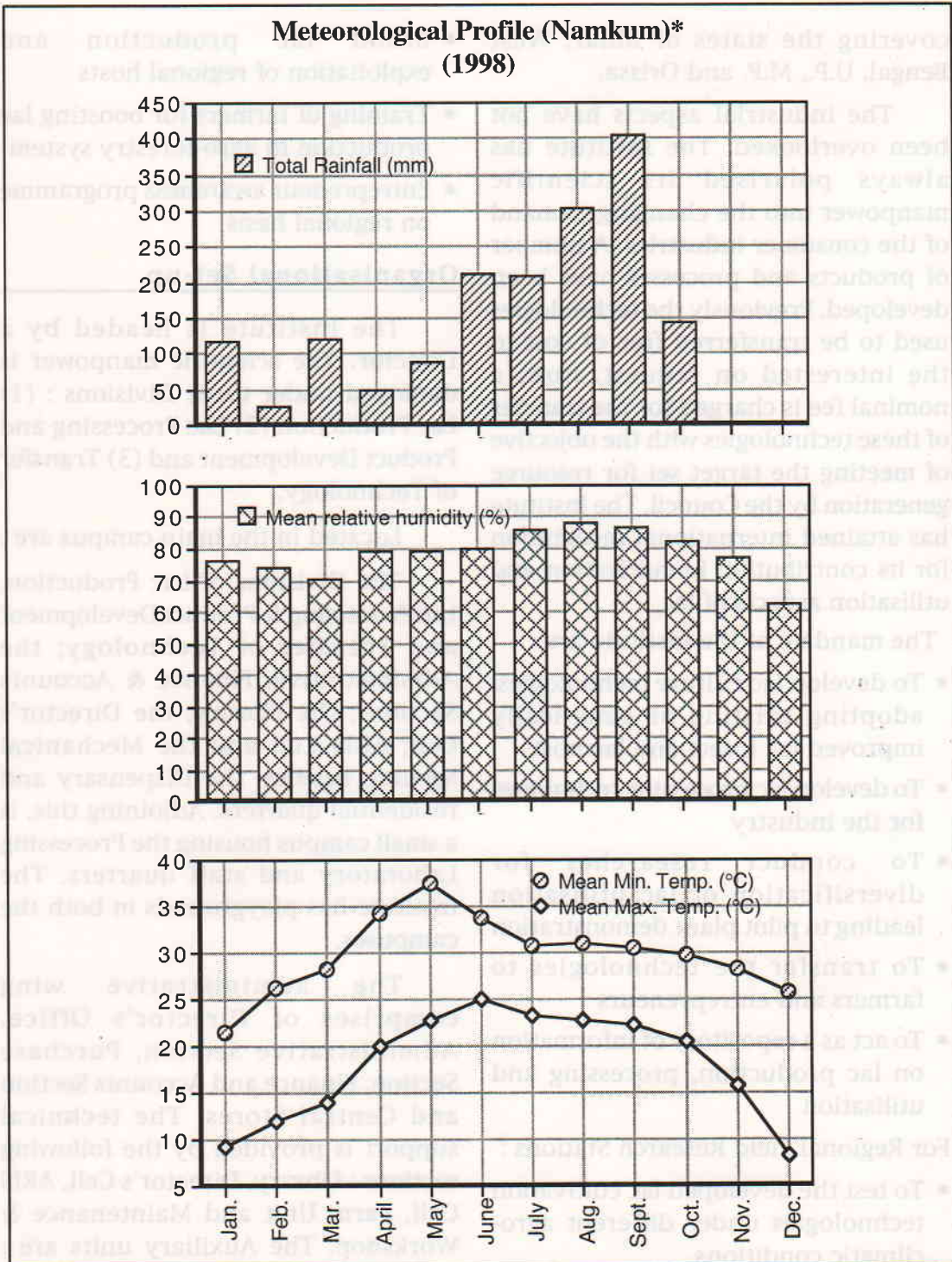
The ILRI is situated in the peaceful suburbs, nine kilometers east of Ranchi town, on the Ranchi-Tatanagar Highway, at an altitude of about 650 m above sea level at 23°23' N latitude and 85°23'E longitude. The soils of the Institute are developed on granite gneiss showing advance stage of weathering. 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 varying between 8.3°C in December and 25°C in June and mean maximum temperature varying between 21.45° in January and 37.54°C in May. The total rainfall during the period was 1679 mm of which the monsoon rainfall was 1129.5 mm.

### **The Present Status**

The ILRI has responded to the opening up of economic policy, 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



\* See Appendix I for details.

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 insect 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.

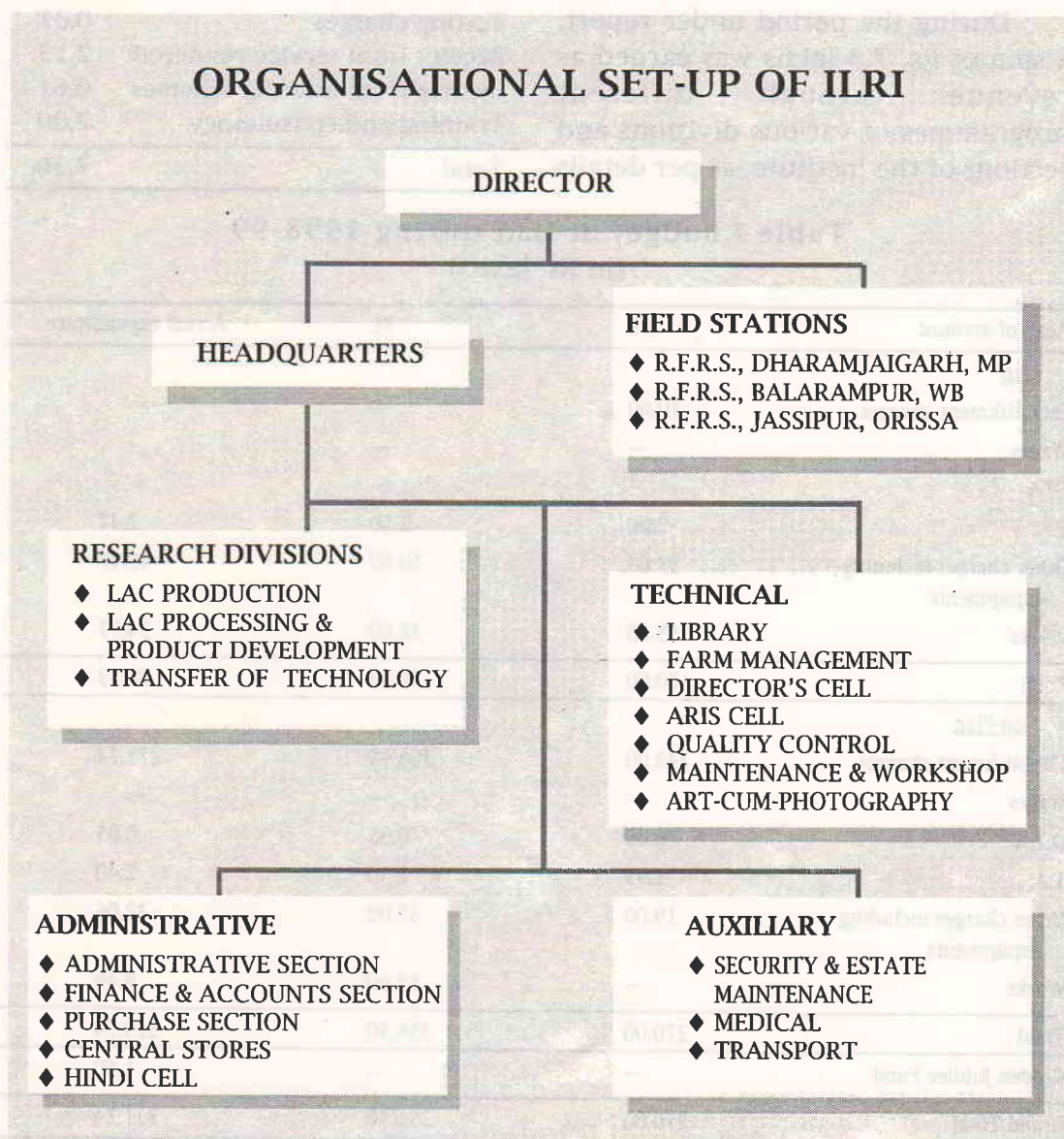
43 administrative and 112 supporting grade posts.

**Staff**

**Budget**

The Institute has a sanctioned strength of 56 scientific, 84 technical,

During 1998-99 the non-plan expenditure was Rs. 319.74 lakhs,





against a budget estimate of Rs. 356.50 lakhs, the plan expenditure was Rs. 86.73 lakhs against a budget estimate of Rs. 88.00 lakhs. The detailed figures are shown in the Table I.

### Revenue Generation

During the period under report, a sum of Rs. 7.3 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<br>(In lakhs) |
|-------------------------------|-----------------------|
| Sale of farm produce          | 0.72                  |
| Sale of publications          | 0.11                  |
| Licence fee                   | 1.11                  |
| Interest on loan and advances | 0.31                  |
| Testing charges               | 0.31                  |
| Receipt from service rendered | 2.13                  |
| Income from internal schemes  | 0.61                  |
| Training and consultancy      | 2.00                  |
| <b>Total</b>                  | <b>7.30</b>           |

**Table I Budget of ILRI during 1998-99**  
(in Rs. lakhs)

| Head of account                    | BE            | RE            | Actual expenditure |
|------------------------------------|---------------|---------------|--------------------|
| <u>Plan</u>                        |               |               |                    |
| Establishment charges              | 10.00         | —             | —                  |
| Wages                              | —             | —             | —                  |
| OTA                                | —             | —             | —                  |
| T.A.                               | 2.00          | 2.50          | 2.47               |
| Other charges including equipments | 53.00         | 50.50         | 49.49              |
| Works                              | 55.00         | 35.00         | 34.77              |
| <b>Total</b>                       | <b>120.00</b> | <b>88.00</b>  | <b>86.73</b>       |
| <u>Non-Plan</u>                    |               |               |                    |
| Establishment charges              | 249.00        | 306.95        | 275.74             |
| Wages                              | —             | —             | —                  |
| O.T.A.                             | 0.05          | 0.05          | 0.05               |
| T.A.                               | 1.95          | 2.50          | 2.40               |
| Other charges including equipments | 19.00         | 35.00         | 32.06              |
| Works                              | —             | 12.00         | 9.49               |
| <b>Total</b>                       | <b>270.00</b> | <b>356.50</b> | <b>319.74</b>      |
| Golden Jubilee Fund                | —             | —             | 1.50               |
| <b>Grand Total</b>                 | <b>270.00</b> | <b>356.50</b> | <b>321.24</b>      |

## 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

*Ber* bushes, under four treatments viz., 400 g, 200 g of urea as basal, in two splits, 1% foliar application and no urea (control) were inoculated with *kusmi* broodlac during February 1998. Data on density of nymphal settlement as well as percent initial mortality were

collected (Table 1) by random destructive sampling and yield data at the time of harvesting. The performance of foliar application of 1% urea was found best over remaining three treatments showing high density of settlement, low initial mortality and high broodlac yield, sticklac yield, brood used to yield ratio and sticklac used to yield ratio (Table 1).

Relatively good performance of *kusmi* lac insect on trees under control indicated congenial climatic conditions during the year. Repeated precipitation during winter and summer might have been one of the important factors for this result. The experiment, therefore, was modified to include life saving irrigation in the

Table 1 Effect of urea application on various productivity attributes of *jethwi* (*kusmi*) crop on *ber*

| Urea application rate | Shoot length (m) |                         |                        | Density of settlement (no./sq. cm) | Percent mortality | Broodlac* Yield (kg) | Yield ratio                 |  |
|-----------------------|------------------|-------------------------|------------------------|------------------------------------|-------------------|----------------------|-----------------------------|--|
|                       | Primaries        | Secondaries per primary | Tertiaries per primary |                                    |                   |                      | Brood yield/ brood lac used | Scraped lac yield/ scraped lac from brood used |
| 400 g (soil)          | 1.833            | 6.201                   | 41.257                 | 54.75                              | 56.42             | 0.85 (0.215)         | 3.09                        | 1.56   |
| 200 g (soil)          | 1.703            | 6.453                   | 35.314                 | 91.314                             | 52.85             | 0.39 (0.095)         | 2.41                        | 2.33   |
| 1% foliar             | 2.127            | 6.110                   | 23.586                 | 113.82                             | 37.55             | 0.933 (0.230)        | 3.55                        | 2.29   |
| Control               | 1.446            | 4.806                   | 19.071                 | 87.65                              | 34.23             | 0.233 (0.060)        | 2.33                        | 1.20   |

\* Figures within parentheses indicate sticklac yield.

Fig. 1a Relationship between brood rates and coverage of *ber* bushes per kg broodlac used

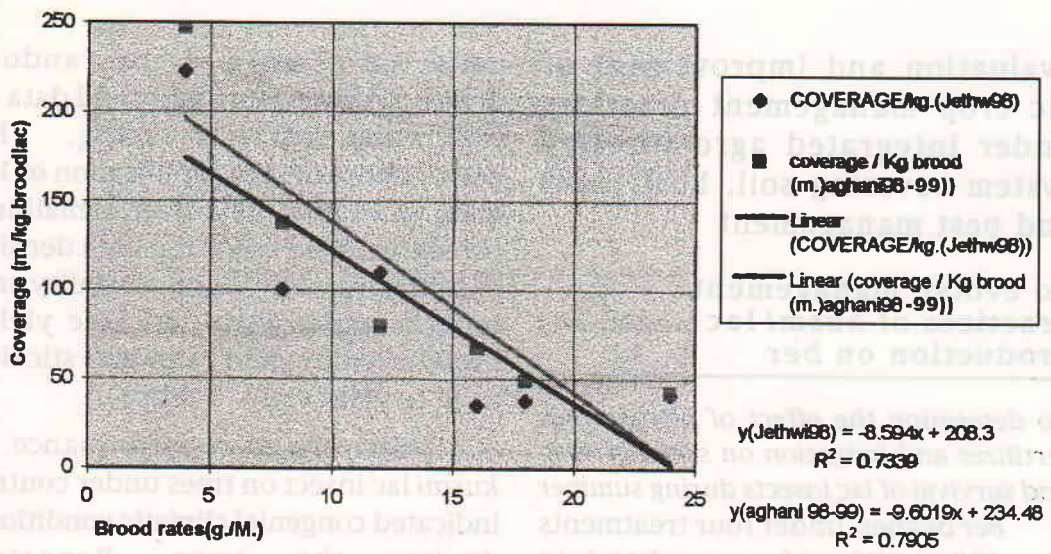


Fig. 1b Relationship between brood rates and yield ratio on *ber* bushes

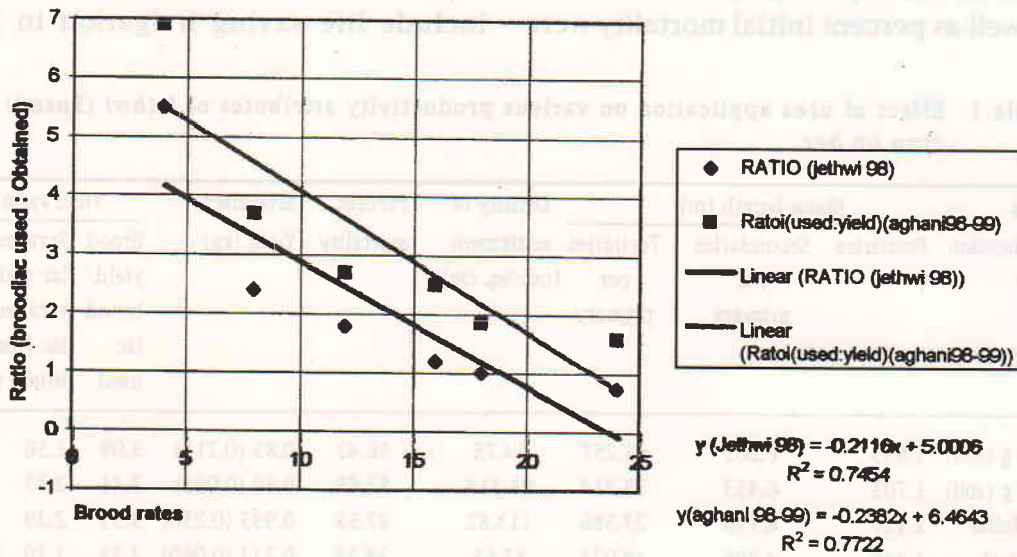


Table 2 Correlation between various parameters of *ber* (*Zizyphus mauritiana*)

| Parameters   | No. of Samples | Mean   | Range       | Correlation coefficient (r) |
|--|----------------|--------|-------------|-----------------------------|
| Number of primary shoots per tree ( $X_1$ )          | 32             | 6.15   | 2-20        |                             |
| Cross-sectional area of tree at base                 |                |        |             | 0.6675**                    |
| Average length of primary branches per tree          |                |        |             | - 0.2379                    |
| Total shoot length per tree                          |                |        |             | 0.7383                      |
| Cross-sectional area at the base (sq. cm.) ( $X_2$ ) | 32             | 90.41  | 13.4-254.5  |                             |
| Average length of primary branches per tree          |                |        |             | 0.1500                      |
| Total shoot length per tree (m)                      |                |        |             | 0.1615**                    |
| Average length of primary branches (m) ( $X_3$ )     | 32             | 191.75 | 117.8-340.4 |                             |
| Total shoot length per tree (m)                      |                |        |             | 0.1446                      |
| Total shoot length (m) (y)                           | 32             | 42.11  | 7.2-160.5   |                             |

\*\* Significant 1%.

main plot under S.P.D and fertilizer application in the sub plot in order to find out impact of irrigation and fertilizer alone and in combination.

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

(R.B.D. design, 3 treatments and 7 replications)

To determine optimum brood rate for *jethwi* and *aghani* crops, *ber* bushes were inoculated with *kusum* broodlac at different rates, during February and *kusmi ber* broodlac during July 1998. Correlation between brood rate used and percent coverage, broodlac yield

ratio, length of coverage per kg broodlac used and yield of sticklac per metre available shoot length was studied.

The coverage per kg broodlac used and yield ratio indicated significant negative linear correlation with increase in brood rate (Figs. 1a and 1b) whereas coverage of tree and sticklac yield per metre shoot length (Figs. 1a and 1b) have shown typical trends for *jethwi* and *aghani* crops. Keeping in view the economy of broodlac and lac yield, 5-10 g/m brood rate was found to be optimum for *jethwi* and 10-15 g/m shoot length for *aghani* crop inoculations. Pruning of 70 *ber* trees and 50 *ber* bushes has been done for further experimentation.

**Table 3** Regression between total shoot length (primary and secondary) and some parameters of *ber*

| Dependent variable (Y)                     | Parameters                                    | Intercept const. | Partial Regression co-efficient |                | r <sup>2</sup> | F-Value |
|--|---|------------------|---------------------------------|----------------|----------------|---------|
|  |   |                  | b <sub>1</sub>                  | b <sub>2</sub> |                |         |
| Length of primary and secondary shoots (m) | Number of primary branches (x <sup>1</sup> )  | 1.403            | 6.611**                         |                | 0.545**        | 35.994  |
|  | Cross - sectional area (cm) (x <sup>2</sup> ) | 7.757            |                                 | 0.379          | 0.398*         | 19.898  |
|  | x <sup>1</sup> & x <sup>2</sup>               | -2.997           | 5.116                           | 0.150          | 0.579**        | 20.004  |

\*\* Significant 1% ; \* Significant at 5%.

To determine inoculable shoot length, multiple regression analysis was conducted by finding out the correlation coefficient between easily accessible parameters of *ber* viz., cross-sectional area of the trunk at the base. No. of primary shoots, average length of primary shoots etc. and total inoculable shoot length (primary + secondary) on 32 *ber* trees. The former two characters were found to be highly significantly and positively correlated with inoculable shoot length, accounting for 58% variation in the total inoculable shoot length (Tables 2 and 3). They may thus be used for inoculable shoot length estimation.

#### **Bio-rational approaches for management of pests of lac insects and host plants**

##### *Screening of insecticides*

Acephate (0.00625, 0.0125 and 0.025%) and alphasmethrin (0.0025, 0.005 and 0.01%) caused heavy

mortality of one-month-old lac insects of *katki* crop raised on potted *bhalia* plants, within two weeks of application.

##### *Evaluation of insecticides and fungicides*

One-month-old *kusmi* lac insects of *aghani* crop raised on *bhalia* bushes were sprayed with alphasmethrin (0.0025, 0.005 and 0.01%), acephate (0.00625, 0.0125 and 0.025%), endosulfan (0.05%), carbendazim as Bengard 50 WP (0.01 and 0.005%), Metalaxyl 8% + mancozeb 64% as Krilaxyl 72 WP (0.01 and 0.005%), methyl thiophanate as ROKO 70 WP (0.01 and 0.005%).

Alphasmethrin caused heavy mortality within two weeks. The lowest concentration of acephate has been found comparatively safe to the lac insects. All the fungicide treatments and endosulfan proved to be safe for the lac insects. The crop is progressing

Table 2 Correlation between various parameters of *ber* (*Zizyphus mauritiana*)

| Parameters   | No. of Samples | Mean   | Range       | Correlation coefficient (r) |
|--|----------------|--------|-------------|-----------------------------|
| Number of primary shoots per tree ( $X_1$ )          | 32             | 6.15   | 2-20        |                             |
| Cross-sectional area of tree at base                 |                |        |             | 0.6675**                    |
| Average length of primary branches per tree          |                |        |             | - 0.2379                    |
| Total shoot length per tree                          |                |        |             | 0.7383                      |
| Cross-sectional area at the base (sq. cm.) ( $X_2$ ) | 32             | 90.41  | 13.4-254.5  |                             |
| Average length of primary branches per tree          |                |        |             | 0.1500                      |
| Total shoot length per tree (m)                      |                |        |             | 0.1615**                    |
| Average length of primary branches (m) ( $X_3$ )     | 32             | 191.75 | 117.8-340.4 |                             |
| Total shoot length per tree (m)                      |                |        |             | 0.1446                      |
| Total shoot length (m) (y)                           | 32             | 42.11  | 7.2-160.5   |                             |

\*\* Significant 1%.

main plot under S.P.D and fertilizer application in the sub plot in order to find out impact of irrigation and fertilizer alone and in combination.

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

(R.B.D. design, 3 treatments and 7 replications)

To determine optimum brood rate for *jethwi* and *aghani* crops, *ber* bushes were inoculated with *kusum* broodlac at different rates, during February and *kusmi ber* broodlac during July 1998. Correlation between brood rate used and percent coverage, broodlac yield

ratio, length of coverage per kg broodlac used and yield of sticklac per metre available shoot length was studied.

The coverage per kg broodlac used and yield ratio indicated significant negative linear correlation with increase in brood rate (Figs. 1a and 1b) whereas coverage of tree and sticklac yield per metre shoot length (Figs. 1a and 1b) have shown typical trends for *jethwi* and *aghani* crops. Keeping in view the economy of broodlac and lac yield, 5-10 g/m brood rate was found to be optimum for *jethwi* and 10-15 g/m shoot length for *aghani* crop inoculations. Pruning of 70 *ber* trees and 50 *ber* bushes has been done for further experimentation.

**Table 3 Regression between total shoot length (primary and secondary) and some parameters of *ber***

| Dependent variable (Y)                     | Parameters                                    | Intercept const. | Partial Regression co-efficient |                | r <sup>2</sup> | F-Value |
|--|---|------------------|---------------------------------|----------------|----------------|---------|
|  |   |                  | b <sub>1</sub>                  | b <sub>2</sub> |                |         |
| Length of primary and secondary shoots (m) | Number of primary branches (x <sup>1</sup> )  | 1.403            | 6.611**                         |                | 0.545**        | 35.994  |
|  | Cross - sectional area (cm) (x <sup>2</sup> ) | 7.757            |                                 | 0.379          | 0.398*         | 19.898  |
|  | x <sup>1</sup> & x <sup>2</sup>               | -2.997           | 5.116                           | 0.150          | 0.579**        | 20.004  |

\*\* Significant 1% ; \* Significant at 5%.

To determine inoculable shoot length, multiple regression analysis was conducted by finding out the correlation coefficient between easily accessible parameters of *ber* viz., cross-sectional area of the trunk at the base. No. of primary shoots, average length of primary shoots etc. and total inoculable shoot length (primary + secondary) on 32 *ber* trees. The former two characters were found to be highly significantly and positively correlated with inoculable shoot length, accounting for 58% variation in the total inoculable shoot length (Tables 2 and 3). They may thus be used for inoculable shoot length estimation.

#### **Bio-rational approaches for management of pests of lac insects and host plants**

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Alphasmethrin caused heavy mortality within two weeks. The lowest concentration of acephate has been found comparatively safe to the lac insects. All the fungicide treatments and endosulfan proved to be safe for the lac insects. The crop is progressing

well and will be harvested during February, 1999.

#### Ovicidal activity of insecticides

*Eublemma amabilis* eggs were treated with five concentrations of acephate (0.0015, 0.0031, 0.0062, 0.0125 and 0.025%) and alphamethrin (0.0062, 0.0012, 0.0025, 0.005 and 0.01%) by dipping for five seconds, alongwith control (water treatment). Acephate exhibited strong ovicidal activity by inhibiting egg hatching from 1.1 to 39.8 percent, while alphamethrin did not affect significantly.

#### Evaluation of egg parasitoids against lac insect predators

*Chrysopa* eggs were exposed to *Telenomus remus*, an egg parasitoid, under laboratory conditions. Forty-nine percent parasitization was observed and emergence of the parasitoids was 28 percent.

Field release of the egg parasitoids viz., *Trichogramma chilonis*, *T. pretiosum* and *Telenomus remus* by means of trichocards at weekly intervals indicated presence of lesser predators at crop maturity compared to control when 500 g samples of mature lac crops were caged to record emergency of predators.

#### Monitoring of lac associated insect fauna

Lac samples collected at weekly intervals during *jethwi*, *aghani* and

*baisakhi* crops from the institute farm indicated that *Tetrastichus purpureus* and *Tachardiaephagus tachardiae* were the most prominent lac insect parasitoids. Presence of *P. pulverea* during *jethwi* was more in comparison to *E. amabilis*, among the predators.

Lac samples collected from 12 different lac growing areas of Bihar, West Bengal and Orissa have shown significant difference in relative abundance of predators and parasitoids (harmful and beneficial). Samples collected from Gumla region (Bihar) indicated relatively higher abundance of the beneficial parasitoids, viz., *Bracon hebetor* and *Apanteles fakhrulhajiae* whereas higher infestation of *P. pulverea* and *E. amabilis* was recorded at Puttidih (W. B.) and Sisai (Bihar) respectively.

#### New record of fungi associated with lac insect

Lac insect culture, particularly in rainy season, is prone to fungal attack. Samples of lac sticks were collected randomly during the rainy season from population cultured on *kusum* (*Schleichera oleosa*) and *bhalia* (*Flemingia macrophylla*). Fungal infected lac cells were utilised to prepare pure and sporulating slants in Potato Dextrose Agar medium. Three species of fungi belonging to the family Eurotiaceae/Aspergillaceae viz., *Aspergillus awamori* Nakazawa, *A. terricola* Marchal and *Penicillium*



*citrinum* Thom (Syn. *P. auriflorum* Biourge) were found associated with lac insect.

### **Improvement in the device for separation of predators, beneficial and inimical parasitoids of lac insect**

The indigenous device for automatic separation of lac predators, reported last year, was further modified and upgraded. The original device (*Ann. Rep. 1997-98*) worked efficiently when broodlac (*phunki*) sticks were kept inside but when fresh scraped lac (without host sticks) was kept, the moisture could not escape from the container resulting into lump formation of scraped lac and growth of fungi, thereby reducing the efficiency of the device substantially. Hence, the device was modified (i) to overcome the problem of moisture collection in the container, (ii) to make it more efficient in terms of percentage of parasitoids retrieved and (iii) to retrieve predators also, if desired.

An 'L' shaped plastic pipe bend, has been fitted to the upper portion of two side walls of the container facing each other. Both open ends were covered with fine nylon mesh, so as to allow air circulation and prevent escape of parasitoids. One end of the bend, which opens inside the container, faces upwards, so that water can not enter inside the device during rainy season. A 5 cm diameter circular

hole was made at the centre of bottom of the container and 10 cm long perforated plastic pipe covered at top with fine nylon net was fitted for air circulation inside. The bottom surface was lifted 3 cm above the ground to facilitate air circulation from bottom. When retrieval of predators is desired, another plastic pipe fitted with nylon mosquito net is put between the black pipe and chamber.

The upgraded device, retrieved more parasitoids of lac predators (biological control agents) compared to the earlier one. Scraped lac kept in a container and the meshed side unit made up of plastic pipes, retrieve parasitoids of lac predators. *Agathis coryphe*, *Brachymeria tachardiae*, *Elasmus claripennis*, and *Pristomerus sulci* to the extent of cent percent while *Bracon greeni* and *Apanteles tachardiae* to the extent of 82 and 96% respectively.

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

Lac based cropping model for upland (Tanr I) was laid out to integrate lac cultivation with general agriculture for higher biomass and return per unit area. Four lac hosts of different canopy spread and height viz., *ber* (*Zizyphus mauritiana*), *galwang* (*Albizzia lucida*), *Bhalia* (*Flemingia macrophylla*) and

*Flemingia semialata* were raised along the boundary of the plot (0.1 ha) under model, *ber* and *galwang* were planted at 3 m apart whereas *Flemingia* spp. at 1.2 m and the spacing adopted between *ber* or *galwang* to *Flemingia* spp. was 1.5 m. During the period under report, two *Flemingia* spp. were brought under lac culture after one year of planting for raising *aghani* 1998 lac crop using early *kusmi* variety. Data recorded on plant growth attributes before lac inoculation of *Flemingia* spp. have been given in Table 4 and lac yield in Table 5. Perusal of Table 4 indicated that almost all the growth attributes were better in *F. macrophylla* as compared to *F. semialata*. Despite better growth, *F.*

*macrophylla* showed inferior lac yield potential compared *F. semialata*. *F. semialata* produced on an average 188.9 g stick lac/bush as compared to *bhalia* (*F. macrophylla*), 70.5 g/bush.

Two vegetable crops, viz., sponge gourd (*Luffa cylindrica*) and okra (*Abelmoschus esculantus*) and cereal crop maize (*Zea mays*) were raised in the main plot in equal plot size (13.0 x 11.5 m). Overall performance of sponge gourd was found to be quite satisfactory with an yield of 112 kg/plot (75q/ha) followed by okra, 77.7 kg/plot (52q/ha) and maize 74.7 kg cobs/plot (50q. cobs/ha). Mustard raised after harvest of the above crops in the previous year (1997-98) in winter season under rain fed condition,

Table 4 Plant growth attributes of two *Flemingia* spp. recorded before lac inoculation (Aghani 1998)

| Host                  | Plant height (cm) | Basal girth (cm) | Tillers/bush (Nos.) | Canopy spread |       | Total shoot length (m) | Inoculable shoot length (m) | Harvested biomass (Dry wt.) (kg/plant) |
|-----------------------|-------------------|------------------|---------------------|---------------|-------|------------------------|-----------------------------|--|
|                       |                   |                  |                     | N - S         | E - W |                        |                             |  |
| <i>F. semialata</i>   | 132.5             | 6.6              | 7.4                 | 68.5          | 66.8  | 9.87                   | 6.48                        | 0.75                                   |
| <i>F. macrophylla</i> | 223.0             | 15.3             | 13.2                | 147.5         | 153.1 | 31.98                  | 18.85                       | 2.85                                   |

Table 5 Lac yield potential (Aghani 1998) of two *Flemingia* spp.

| Host                  | Broodlac used (g) |             | Yield obtained/bush (g) |                     |                   | Yield ratio                |   |
|-----------------------|-------------------|-------------|-------------------------|---------------------|-------------------|----------------------------|---|
|                       | Brood lac         | Scraped lac | Broodlac sticks         | Rejected lac sticks | Total scraped lac | Brood obtained/ Brood used | Total scrap lac yield/ scraped lac of brood |
| <i>F. semialata</i>   | 100               | 43.83       | 550.6                   | 145.2               | 188.86            | 5.51                       | 4.31  |
| <i>F. macrophylla</i> | 100               | 40.17       | 286.0                   | 142.8               | 70.47             | 2.86                       | 1.78  |

yielded on an average 6q/ha.

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

The objective of the study is to develop a suitable technique for rapid raising of *akashmani* (*Acacia auriculaeformis*) plantation through agronomic manipulation for *kusmi* lac cultivation under rainfed condition. Two experiments were laid out to study the effect of plant densities and height of coppicing on plant growth as well as lac yield coupled with fertilizer applications.

#### *Effect of plant densities and fertilizers*

The experiment was laid out in a split-plot design, having three plant spacings (2.0 x 1.8, 3.0 x 2.7 and 4.0 x 3.6 m) in the main plot and different fertilizer levels as sub-plot treatment (Table 6).

During the period under report, lac crop (*Jethwi* 1998) raised on *akashmani* was harvested in July, 1998. The details of the yield and harvested biomass obtained are presented in Table 6. Perusal of data indicated that yield ratios were maximum with higher plant densities. Though the lac crop was affected by severe summer, however, effects of treatment were observed to be significant.

Data on plant attributes before raising winter lac crop (*Aghani* 1998-

99) are presented in Table 7. The plant attributes did not differ significantly with the three plant densities. However, application of fertilizers affected the plant growth significantly (Table 7).

#### *Effect of height of coppicing and fertilizers*

The experiment was also laid out in split-plot design consisting of four coppicing treatments (No coppicing and coppicing at 30, 60 and 90 cm above the ground level) in the main plot and four fertilizer levels (0+0+0+, 30+40+20, 60+80+40 and 120+160+80 g/plant of N+P<sub>2</sub>O<sub>5</sub>+K<sub>2</sub>O) in the sub-plot with four replications.

*Aghani* 1998-99 lac crop was raised on *akashmani* using early variety of lac insect. Although initial settlement of lac insect was satisfactory, the crop yield was not satisfactory. Coppicing at different heights above ground level did not yield significant differences in the plant growth attributes.

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

Out of different stocks being maintained, eight were evaluated for their economic parameters, viz., life period, fecundity, size of mature female cell, weight of cell, weight of resin produced and relative resin dye level.

**Table 6 Effect of plant densities and fertilizers on yield of lac (*Jethwi 1998*) from *akashmani***

| Treatment   | No. of plants/ha | Brood lac used/ plant (g) |             | Yield Obtained/Plant (g) |                     |                   | Yield ratio     |                    | Stick lac yield (q/ha) | Harvested biomass (Dry wt., t/ha) |
|---|------------------|---------------------------|-------------|--------------------------|---------------------|-------------------|-----------------|--------------------|------------------------|-----------------------------------|
|   |                  | Broodlac                  | Scraped lac | Brood lac sticks         | Rejected lac sticks | Total scraped lac | Broodlac used : | Scraped lac used : |                        |                                   |
| Planting spacing (m)                              |                  |                           |             |                          |                     |                   |                 |                    |                        |                                   |
| 2.0 x 1.8   | 2778             | 305.3                     | 122.10      | 278.3                    | 261.7               | 86.2              | 1:0.91          | 1:0.70             | 2.39                   | 14.43                             |
| 3.0 x 2.7   | 1235             | 369.3                     | 147.70      | 183.3                    | 322.1               | 71.6              | 1:0.50          | 1:0.48             | 0.88                   | 6.18                              |
| 4.0 x 3.6   | 694              | 300.0                     | 120.00      | 178.1                    | 331.2               | 73.5              | 1:0.59          | 1:0.61             | 0.51                   | 4.37                              |
| Fertilizer levels (g/plant)                       |                  |                           |             |                          |                     |                   |                 |                    |                        |                                   |
| N+P <sub>2</sub> O <sub>5</sub> +K <sub>2</sub> O |                  |                           |             |                          |                     |                   |                 |                    |                        |                                   |
| 0+0+0   |                  | 245.9                     | 98.28       | 128.1                    | 206.5               | 55.4              | 1:0.52          | 1:0.56             | 1.00                   | 5.78                              |
| 25+50+10  |                  | 337.7                     | 135.08      | 191.4                    | 336.6               | 74.5              | 1:0.57          | 1:0.55             | 1.25                   | 9.22                              |
| 50+100+20   |                  | 352.8                     | 141.10      | 274.2                    | 345.4               | 89.9              | 1:0.78          | 1:0.64             | 1.39                   | 9.22                              |
| 75+150+30   |                  | 362.9                     | 145.18      | 259.1                    | 330.5               | 87.6              | 1:0.71          | 1:0.60             | 1.40                   | 9.41                              |

**Table 7 Effect of plant densities and fertilizers on plant growth recorded before lac inoculation *aghani 1998-99***

| Treatment   | No. of plants/ha | Plant height (m) | Basal girth (cm) | Number of primary branches | Canopy spread (m) |       | Total shoot length (m) | Total inoculable space (m) |
|---|------------------|------------------|------------------|----------------------------|-------------------|-------|------------------------|----------------------------|
|   |                  |                  |                  |                            | N-S               | E-W   |                        |                            |
| Planting spacing (m)                              |                  |                  |                  |                            |                   |       |                        |                            |
| 2.0 x 1.8   | 2778             | 4.01             | 23.50            | 14.50                      | 2.65              | 2.68  | 38.14                  | 20.54                      |
| 3.0 x 2.7   | 1235             | 3.84             | 21.79            | 13.75                      | 2.67              | 2.60  | 40.39                  | 20.42                      |
| 4.0 x 3.6   | 694              | 3.60             | 24.71            | 15.96                      | 2.78              | 2.87  | 37.88                  | 18.74                      |
| CD at 5%  |                  | NS               | NS               | NS                         | NS                | NS    | NS                     | NS                         |
| Fertilizer levels (g/plant)                       |                  |                  |                  |                            |                   |       |                        |                            |
| N+P <sub>2</sub> O <sub>5</sub> +K <sub>2</sub> O |                  |                  |                  |                            |                   |       |                        |                            |
| 0+0+0   |                  | 3.60             | 20.56            | 12.50                      | 2.53              | 2.54  | 31.20                  | 16.92                      |
| 25+50+10  |                  | 3.68             | 22.22            | 13.56                      | 2.67              | 2.67  | 33.29                  | 18.37                      |
| 50+100+20   |                  | 4.01             | 24.17            | 16.94                      | 2.69              | 2.80  | 44.43                  | 21.63                      |
| 75+150+30   |                  | 3.98             | 26.39            | 15.94                      | 2.91              | 2.84  | 46.29                  | 22.68                      |
| CD at 5%  |                  | 2.05             | 1.525            | 1.525                      | NS                | 0.154 | 5.521                  | NS                         |

Five replications of each stock were maintained on potted *bhalia* (*Flemingia macrophylla*). Ten females from each replicate of individual stock were collected at crop maturity and stored in glass vials. Different biological parameters were scored, a month after collection and analysed. For recording resin dye level, 1% solution in methanol was prepared and absorbance was recorded at 440 nm. Results obtained are furnished in Table 8.

*Evaluation of Flemingia spp. for rangeeni strains of lac insects during summer crop*

Four *Flemingia* spp. viz., *F. macrophylla*, *F. semialata*, *F. stricta* and *F. bracteata*, planted in R.B.D., replicated six times, were evaluated for *rangeeni* lac production during *katki* 1998 season. Six plant and seven lac insect productivity attributes were studied (Table 9).

Highly significant variation was noted between all the treatments (*Flemingia* spp.) (Table 9) for all the thirteen characters. *F. semialata* showed superior performance with regard to scraped lac yield per bush, no. of surviving female cells, weight of

Table 8 Various economic parameters of different lac insect stocks

| Lac Insect stock             | Crop period | Life (days) | Fecundity (No.) | Cell size (mm) | Cell wt. (mg) | Resin wt. (mg) | Resin dye (Absorbance at 440 nm) |
|------------------------------|-------------|-------------|-----------------|----------------|---------------|----------------|----------------------------------|
| Trivoltine                   | 8/97-1/98   | 158.7       | 276.2           | 2.95           | 11.991        | 8.881          | 0.7942                           |
| Trivoltine                   | 4/97-8/97   | 108.2       | 313.8           | 2.86           | 8.821         | 6.846          | 1.0964                           |
| Meghalaya                    | 5/97-10/97  | 152.9       | 526.3           | 3.65           | 19.507        | 16.995         | 1.0770                           |
| Local <i>rangeeni</i> yellow | 5/97-9/97   | 122.1       | 369.2           | 3.13           | 10.385        | 8.570          | 0.6396                           |
| Orissa kusmi yellow          | 6/97-12/97  | 163.7       | 357.2           | 3.42           | 22.848        | 19.386         | 0.5264                           |
| <i>Rangeeni</i> crimson      | 9/97-10/97  | 112.1       | 383.9           | 3.02           | 10.364        | 7.315          | 0.6104                           |
| <i>Kusmi</i> early           | 7/97-12/97  | 159.4       | 383.9           | 3.31           | 17.971        | 15.223         | 0.4828                           |
| <i>Kusmi</i> late            | 8/97-3/98   | 220.3       | 4.86            | 3.70           | 24.140        | 20.941         | 0.6054                           |
| Inbred <i>rangeeni</i>       | 7/97-10/97  | 111.4       | 520.8           | 3.17           | 8.937         | 7.053          | 0.7312                           |
| Mean                         |             | 145.4       | 401.8           | 3.2            | 15.0          | 12.4           | 0.7293                           |
| S. Em±                       |             | 1.9769      | 24.0            | 0.0854         | 1.0294        | 0.9013         | 0.0521                           |
| CV%                          |             | 3.0397      | 13.3362         | 5.8842         | 15.3491       | 16.3095        | 15.9708                          |
| CD at 5%                     |             | 5.6751      | 68.7995         | 0.2451         | 2.9551        | 2.5874         | 0.1449                           |

**Table 9** Comparative performance of *Flemingia* spp. with regards to various plant and lac insect attributes

| Parameters                                   | <i>F. macrophylla</i> | <i>F. semialata</i> | <i>F. stricta</i> | <i>F. bracteata</i> | C.D. 5% | C.D. 1% |
|--|-----------------------|---------------------|-------------------|---------------------|---------|---------|
| No. of Branches/tiller                       | 5.283                 | 1.467               | 2.867             | 5.867               | 1.425   | 1.971   |
| Length of initial lac coverage/tiller (cm)   | 92.917                | 86.200              | 109.950           | 81.117              | 17.915  | 24.775  |
| Length of inoculable tiller (cm)             | 205.300               | 140.917             | 129.017           | 119.467             | 13.861  | 19.169  |
| No. leaves/tiller                            | 41.33                 | 8.767               | 29.983            | 65.100              | 8.319   | 11.505  |
| Length of internode (cm)                     | 6.675                 | 7.717               | 5.733             | 5.117               | 0.756   | 1.045   |
| Diameter of tiller (cm)                      | 0.882                 | 0.802               | 0.570             | 0.642               | 0.079   | 0.109   |
| Weight of scraped lac/ metre SI (g)          | 17.800                | 30.000              | 15.250            | 12.050              | 5.76    | 7.297   |
| Weight of broodlac/ metre SI* (g)            | 198.167               | 105.1250            | 83.433            | 256.267             | 92.421  | 127.810 |
| Biomass weight/fresh bush (kg)               | 1.393                 | 0.773               | 0.638             | 0.835               | 0.341   | 0.472   |
| Weight of lac sticks/ bush (g)               | 578.867               | 327.767             | 292.767           | 206.117             | 109.632 | 151.612 |
| Weight of 100 (live) mature female cells (g) | 1.262                 | 1.564               | 1.553             | 1.324               | 0.191   | 0.265   |
| Survival (%) at maturing                     | 13.583                | 18.967              | 9.567             | 8.783               | 3.709   | 5.129   |
| Scraped lac yield/ bush (g)                  | 53.000                | 89.167              | 43.817            | 39.600              | 18.825  | 26.032  |

\* SI = Shoot length.

100 mature female cells, weight of lac sticks/bush, weight of scraped lac/ metre shoot length, diameter of tiller, length of internode and length of inoculable tiller; whereas, the no. of branches/tiller, length of initial lac coverage, no. of leaves/tiller and weight of biomass/bush were significantly low compared to other species.

Genetic co-efficient of variance

varied from 9.9 to 64.2 and heritability estimates, from 0.36 to 0.96 (Table 10). These provided a basis for improvement of *Flemingia* spp.

After partitioning, values of genotypic, phenotypic and environmental correlation coefficients have indicated that no. of branches/tiller, length of initial lac coverage/tiller, no. of leaves/tiller, weight of brood lac/ metre shoot length were

negatively correlated with scraped lac yield/bush whereas length of internode, diameter of tiller, weight of scraped lac per metre shoot length and no. of surviving female cells have shown significant positive correlation with scraped lac yield/bush and may be taken for characterization of *Flemingia* spp. for *rangeeni* lac production point of view. It is, therefore, expected that any selection strategy planned for increasing *rangeeni* lac production on *Flemingia*

spp. shall have positive impact on positively correlated characters and vice versa.

### Mechanisation of lac cultivation operations

The project aims at mechanisation of pruning, brood lac placement, *phunki* removal and harvesting operations involved in lac production. It also aims at development of suitable brood lac carrier for its safe transportation.

Table 10 Coefficient of variance and estimates of heritability as well as genetic advance for different characters in *Flemingia* spp.

| Parameters   | CV%   | Coefficient of phenotypic variance | Coefficient of genetic variance | Heritability | Genetic variance |
|--|-------|------------------------------------|---------------------------------|--------------|------------------|
| X <sub>1</sub> No. of branch/tiller                      | 30.01 | 59.92                              | 51.87                           | 0.75         | 11.95            |
| X <sub>2</sub> Length of initial lac coverage/tiller     | 15.78 | 19.80                              | 11.96                           | 0.36         | 3.34             |
| X <sub>3</sub> Length of inoculable tiller               | 7.60  | 26.98                              | 25.88                           | 0.92         | 9.85             |
| X <sub>4</sub> No. leaves/tiller                         | 18.68 | 66.88                              | 64.22                           | 0.923        | 15.53            |
| X <sub>5</sub> Length of internode                       | 9.76  | 20.08                              | 17.55                           | 0.76         | 7.05             |
| X <sub>6</sub> Diameter of tiller                        | 8.85  | 21.35                              | 19.43                           | 0.83         | 7.88             |
| X <sub>7</sub> Weight of scraped lac/ metre shoot length | 22.91 | 46.72                              | 40.72                           | 0.76         | 10.70            |
| X <sub>8</sub> Weight of broodlac/ metre shoot length    | 46.86 | 65.99                              | 46.47                           | 0.50         | 8.30             |
| X <sub>9</sub> Weight of biomass/bush                    | 30.56 | 45.97                              | 34.35                           | 0.56         | 7.80             |
| X <sub>10</sub> Weight of broodlac/bush                  | 25.44 | 51.12                              | 44.35                           | 0.75         | 11.08            |
| X <sub>11</sub> Weight of 100 (live) mature female cells | 10.95 | 14.77                              | 9.92                            | 0.45         | 3.57             |
| X <sub>12</sub> Number of surviving female cells         | 23.76 | 42.58                              | 35.33                           | 0.69         | 9.26             |
| X <sub>13</sub> Scraped lac yield/bush                   | 27.21 | 47.08                              | 38.41                           | 0.67         | 9.41             |

As a first step, existing level of mechanisation in lac cultivation was studied. It was found that locally manufactured hand tools are mostly used in different lac cultivation operations.

The work has been divided in two parts. In the first part, attempt is being made to improve upon the design of existing equipments for eliminating the problems associated with them. Under this part, modifications in the designs and development of tree pruner and *phunki* hook are in progress.

In the second part, work has been initiated to develop equipments for operations for which tools/equipments are not available. A model of brood lac placement-cum-*phunki* removal tool has been developed and its detailed testing has been planned in the year 1999.

## Extension Research

### Survey of lac growing areas

Four students of post-graduate diploma course on Rural Development of Xavier Institute of Social Services, Ranchi, were sent to this institute for two months, under summer placement programme. After educating them on the methodology, they were sent to conduct a survey in six villages of Ranchi dist., viz., Kantadih, Sundil, Kocho and Modidih of Silli block and Perka, Gingira village of Khunti block in Ranchi district. A total of 177

households were surveyed in the above villages with special emphasis on lac culture.

Out of this, the salient findings of the survey of 122 households of only four villages namely, Kantadih, Sundil, Modidih and Kocho on the availability and exploitation of lac hosts; income per annum from lac and other agricultural crops are given in Tables 1 1 and 1 2 respectively.

### *Families owning major lac host trees*

All the families except one in Modidih village, owned at least one of the major lac hosts namely, *kusum*, *ber* and *palas*. The picture is similar in all villages except Kocho where 96% of the families owned *palas* trees.

### *Average holdings of lac host trees*

Average number of major hosts owned per family is highest for *palas* (117.3) followed by *ber* (12.5) and *kusum* (2.3) in all the four villages. The average no. of *palas* tree holding per family was higher in Kantadih (134) and Kocho (196) villages than in Sundil (63) and Modidih (76). Likewise, in respect of *ber* trees it is substantially higher in Kantadih village (31) compared to other villages (5-8).

### *Utilisation of host trees for lac cultivation*

*Ber* has been found to be the most favoured host tree in terms of its exploitation for lac cultivation. This is because (i) *ber* trees are more productive



Table 11 Availability and exploitation of lac hosts in four villages of Ranchi district

| Village  | Lac host     | Families<br>owning lac<br>host trees | Lac host<br>trees<br>available in<br>area | Average<br>holdings of<br>lac host per<br>family | Host trees<br>utilised for<br>lac cultivation | Average<br>income per<br>family per<br>annum | Share<br>of income<br>from each<br>host |
|----------|--------------|--------------------------------------|---|--|---|--|---|
|          |              | (%)                                  | (%)                                       |  | (%)   | (Rs.)  |   |
| Kantadih | <i>kusum</i> | 58                                   | 0.78                                      | 2  | 67  | 1687   | 15.6                                    |
|          | <i>ber</i>   | 100                                  | 19.00                                     | 31   | 74  | 3152   | 29.2                                    |
|          | <i>palas</i> | 97                                   | 80.20                                     | 134  | 62  | 5951   | 55.1                                    |
| Sundil   | <i>kusum</i> | 47                                   | 2.51                                      | 2  | 94  | 1370   | 36.2                                    |
|          | <i>ber</i>   | 83                                   | 11.37                                     | 6  | 76  | 921  | 24.4                                    |
|          | <i>palas</i> | 60                                   | 86.12                                     | 63   | 33  | 1489   | 39.4                                    |
| Modidih  | <i>kusum</i> | 20                                   | 2.77                                      | 2  | 57  | 1875   | 53.1                                    |
|          | <i>ber</i>   | 88                                   | 37.72                                     | 5  | 70  | 603  | 17.1                                    |
|          | <i>palas</i> | 76                                   | 59.17                                     | 76   | 50  | 1050   | 29.8                                    |
| Kocho    | <i>kusum</i> | 82                                   | 1.32                                      | 3  | 30  | 4391   | 24.2                                    |
|          | <i>ber</i>   | 89                                   | 2.62                                      | 8  | 60  | 2250   | 12.4                                    |
|          | <i>palas</i> | 96                                   | 95.16                                     | 196  | 60  | 11,500                                       | 63.4                                    |
| Average  | <i>kusum</i> | 52                                   | 1.85                                      | 2.3  | 62  | 2331   | 32.3                                    |
|          | <i>ber</i>   | 90                                   | 17.68                                     | 12.5   | 70  | 1732   | 20.8                                    |
|          | <i>palas</i> | 82                                   | 80.16                                     | 117.3  | 51  | 4998   | 46.9                                    |

than *palas* for *rangeeni* lac, and villagers are not able to utilise all the large no. of *palas* trees available, due to resource constraints. In Sundil, however, *kusum* is the most favourite host.

#### Gross income generation through cultivation of lac on various trees

The main source of income from lac in this area comes from *palas* as it yields about Rs. 5000 per family per annum (market price of sticklac Rs. 30 per kg). This is because *palas* trees are the most abundant among the major hosts, although the percentage of trees

exploited for lac cultivation is less. In spite of low holding size of *kusum* tree, the average annual income is about Rs. 2330 (market price Rs. 40 per kg). Thus, *kusmi* lac contributes 32.3% of the total earning from lac whereas, *palas* and *ber* contribute to 49.9% and 20.8% respectively of income. In spite of higher holding size of *ber* tree per family in comparison to *kusum*, the annual income from this host is less. This is because *kusum* trees are very big and yield of lac per tree is approximately 25 kg per tree whereas *ber* trees are relatively smaller and

Table 12 Annual gross income from lac and other agricultural crops

| Crop       | Kantadih                                   |                                |                   | Sundil                                     |                                |                   | Modidih                                    |                                |                   | Kocho                                      |                                |                   | Average                                    |                                |                   |
|------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|
|            | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income |
| Lac        | 100  | 10790                          | 37.5              | 100  | 3780                           | 19.7              | 96   | 3528                           | 20.7              | 100  | 11059                          | 30.3              | 99   | 7289                           | 28.2              |
| Paddy      | 100  | 8287                           | 28.8              | 100  | 7512                           | 39.1              | 100  | 9032                           | 53.1              | 100  | 20555                          | 56.3              | 100  | 11347                          | 43.9              |
| Wheat      | 58   | 2750                           | 9.6               | 23   | 1986                           | 10.3              | 12   | 3226                           | 18.9              | 25   | 1994                           | 5.5               | 29.5                                       | 2489                           | 9.6               |
| Vegetables | 79   | 1817                           | 6.3               | 100  | 1982                           | 10.3              | 24   | 916                            | 5.4               | 68   | 1705                           | 4.7               | 67.8                                       | 1605                           | 6.2               |
| Black Gram | 53   | 695                            | 2.4               | 27   | 1100                           | 5.7               | 28   | 307                            | 1.8               | 25   | 800                            | 2.1               | 33.3                                       | 726                            | 2.8               |
| Maize      | 53   | 655                            | 2.8               | 20   | 907                            | 4.7               | -  | -                              | -                 | 25   | 415                            | 1.1               | 32.7                                       | 659                            | 2.5               |
| Niger      | 11   | 2325                           | 8.1               | 7  | 1200                           | 6.2               | -  | -                              | -                 | -  | -                              | -                 | 9.0  | 1763                           | 6.0               |
| Pigeon Pea | 8  | 1433                           | 5.0               | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 |
| Horse Gram | -  | -                              | -                 | 7  | 763                            | 4                 | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 |

average yield of lac is around 6-7 kg per tree.

#### Gross income from lac vis-a-vis other agricultural crops

All families under study, grow paddy and it has been found that besides paddy, 99% of the households are involved in lac cultivation (Table 12). Cent per cent families are involved in lac cultivation in Kantadih, Sundil and Kocho village and 96% in Modidih village. Wheat (29.5%), black gram (33.3%) and vegetable (67.8%) are grown in all the villages. About 32.7% of the households also grow maize mainly in Kantadih, Sundil and Kocho village. Niger (*Sarguja*) is grown in Kantadih and Sundil and only 9% families are involved in this. Horse gram

(*Kulthi*) is another crop grown by 7% families in Sundil village only.

Maximum income per annum is generated from paddy crop (Rs. 11,347) followed by lac (Rs. 7289), wheat (Rs. 2489), vegetable (Rs. 1605) and black gram (Rs. 726). The percentage share of income from these crops was 44.4, 27.1, 11.1, 6.7 and 3.0 respectively. Maize contributes 2.7% of the total income in three villages. It was also found that income from lac exceeds Rs. 10,000 per family per annum in Kantadih and Kocho village, which is about 38% and 30% respectively of the total agricultural income. The average income from lac is around Rs. 3500 and Rs. 3800 per household per annum in Modidih and Sundil villages, which are

Table 12 Annual gross income from lac and other agricultural crops

| Crop       | Kantadih                                   |                                |                   | Sundil                                     |                                |                   | Modidih                                    |                                |                   | Kocho                                      |                                |                   | Average                                    |                                |                   |
|------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|--|--------------------------------|-------------------|
|            | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income | % households involved in agric. activities | Av. income per household (Rs.) | % share of income |
| Lac        | 100  | 10790                          | 37.5              | 100  | 3780                           | 19.7              | 96   | 3528                           | 20.7              | 100  | 11059                          | 30.3              | 99   | 7289                           | 28.2              |
| Paddy      | 100  | 8287                           | 28.8              | 100  | 7512                           | 39.1              | 100  | 9032                           | 53.1              | 100  | 20555                          | 56.3              | 100  | 11347                          | 43.9              |
| Wheat      | 58   | 2750                           | 9.6               | 23   | 1986                           | 10.3              | 12   | 3226                           | 18.9              | 25   | 1994                           | 5.5               | 29.5                                       | 2489                           | 9.6               |
| Vegetables | 79   | 1817                           | 6.3               | 100  | 1982                           | 10.3              | 24   | 916                            | 5.4               | 68   | 1705                           | 4.7               | 67.8                                       | 1605                           | 6.2               |
| Black Gram | 53   | 695                            | 2.4               | 27   | 1100                           | 5.7               | 28   | 307                            | 1.8               | 25   | 800                            | 2.1               | 33.3                                       | 726                            | 2.8               |
| Maize      | 53   | 655                            | 2.8               | 20   | 907                            | 4.7               | -  | -                              | -                 | 25   | 415                            | 1.1               | 32.7                                       | 659                            | 2.5               |
| Niger      | 11   | 2325                           | 8.1               | 7  | 1200                           | 6.2               | -  | -                              | -                 | -  | -                              | -                 | 9.0  | 1763                           | 6.0               |
| Pigeon Pea | 8  | 1433                           | 5.0               | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 |
| Horse Gram | -  | -                              | -                 | 7  | 763                            | 4                 | -  | -                              | -                 | -  | -                              | -                 | -  | -                              | -                 |

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#### Gross income from lac vis-a-vis other agricultural crops

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about 20-21% of the total agricultural income respectively. Relatively higher income from lac in Kantadih and Kocho villages is due to larger average holding of *palas* trees per family and also higher number of host tree utilisation for the purpose of lac cultivation.

### Ad hoc Research Scheme

#### Productivity rating of different lac insect stocks on conventional hosts

Naturally occurring thirteen lac insect stocks, seven of *Kerria nagoliensis* (LR-5312, 5313, 5314, 5315, 5316, 5317, 5318), one of *K. sharada* sp.n, (LR-5331) from *Scheleichera oleosa* and five of *K. lacca*, out of which three were from *palas* (*Butea monosperma*), (LR-5101, 5102, 5111), one from *ber* (*Zizyphus mauritiana* (LR-5205) and one from Rain tree (LR-5712) were collected at maturity from different localities. The broodlac from each stock was inoculated on four trees of each of *ber*, *kusum* and *palas* in the Institute Farm during July 1998, at the rate of 10 g/metre shoot length available on the trees. The density of settlement and percent mortality were scored by destructive random sampling (3% shoots per tree) after three weeks of inoculation. Sex ratio and female population at sexual maturity were also scored in the same manner. At crop maturity, five samples of 10 cm for lacstick were collected from each tree

for determining the mean live cell weight and the number of females per square centimetre. Similarly Dry cell weight and sticklac production per metre were calculated from another set of samples, allowed to Dry after emergence of young ones. Productivity was calculated by dividing sticklac production per metre with mean life period of females (crop duration). Data obtained only for surviving stocks on each of the host plant species were subjected to analysis of variance in RBD taking stocks as treatment replicated four times. Multiple regression analysis was also conducted for calculating regression model for sticklac productivity by taking mean productivity of stocks as dependent variable and seven parameters as independent variables.

Data on performance of various stocks of lac insects on conventional hosts with regard to ten productivity linked parameters during winter/rainy season have been shown in Tables 13, 14 and 15. It can be seen that out of thirteen stocks studied, only 11 could survive on *ber*, 8 on *kusum* and 5 on *palas*.

The following stocks showed superior performance with respect to productivity of lac per metre per day :

| Host         | Stocks                 |
|--------------|------------------------|
| <i>Kusum</i> | LR - 5313, 5312 & 5318 |
| <i>Ber</i>   | LR - 5316, 5314 & 5315 |
| <i>Palas</i> | LR - 5712 & 5101       |

The stock LR-5312, tested at three different localities viz., Chakidih (Orissa), Hesal broodlac farm and Institute plantation, was found to be the best with a yield ratio 1:6 as compared to 1:2 to 1:4 in case of other stocks.

Table 13 Performance of different stocks of lac insects on *palas* (*Butea monosperma*)

| Stocks         | X <sub>1</sub><br>Density<br>of<br>settlement<br>(no./sq. cm) | X <sub>2</sub><br>Mortality<br>% | X <sub>3</sub><br>Male<br>% | X <sub>4</sub><br>Survival<br>after<br>sexual<br>maturity<br>(no./cm <sup>2</sup> ) | X <sub>5</sub><br>Live cell<br>wt. (mg) | X <sub>6</sub><br>Dry cell<br>wt. (mg) | X <sub>7</sub><br>Resin/<br>female<br>(mg) | X <sub>8</sub><br>Females<br>(no./cm <sup>2</sup> ) | X <sub>9</sub><br>Life<br>period<br>(days) | X <sub>10</sub><br>Lac<br>productivity<br>(g/day/m) |
|----------------|---|----------------------------------|-----------------------------|---|---|--|--|---|--|---|
| LR-5101        | 79.783  | 44.028                           | 15.663                      | 39.900  | 23.250                                  | 11.250                                 | 9.710                                      | 11.950  | 10.363<br>(106.392)*                       | 0.251   |
| LR-5712        | 94.728  | 43.070                           | 17.625                      | 51.225  | 23.500                                  | 10.500                                 | 8.925                                      | 15.293  | 10.365<br>(106.433)                        | 0.277   |
| LR-5111        | 72.763  | 45.960                           | 24.125                      | 34.225  | 19.500                                  | 10.000                                 | 8.500                                      | 10.353  | 10.215<br>(103.346)                        | 0.201   |
| LR-5205        | 56.175  | 41.120                           | 26.000                      | 25.475  | 23.000                                  | 11.250                                 | 9.563                                      | 7.692   | 10.265<br>(104.37)                         | 0.164   |
| LR-5102        | 66.925  | 42.388                           | 19.700                      | 33.000  | 17.500                                  | 9.250                                  | 7.588                                      | 10.000  | 10.265<br>(104.37)                         | 0.176   |
| C.V.           | 17.9047   | 7.6551                           | 5.5472                      | 11.8970   | 7.4550                                  | 9.0362                                 | 9.2720                                     | 12.1153   | 0.5620                                     | 10.3638   |
| C.D. 5%        | 18.38   | 4.60                             | 1.59                        | 6.06  | 2.21                                    | 1.31                                   | 1.14                                       | 1.86  | 0.08                                       | 0.03  |
| P.C.V.         | 24.89   | 7.85                             | 21.62                       | 28.02   | 14.21                                   | 11.32                                  | 12.61                                      | 27.53   | 0.81                                       | 24.40   |
| G.C.V.         | 17.29   | 1.73                             | 20.90                       | 25.37   | 12.09                                   | 6.82                                   | 8.55                                       | 24.72   | 0.59                                       | 22.09   |
| h <sup>2</sup> | 0.48  | 0.05                             | 0.93                        | 0.82  | 0.72                                    | 0.36                                   | 0.46                                       | 0.81  | 0.52                                       | 0.82  |
| G.A.           | 4.96  | 0.28                             | 8.95                        | 8.94  | 5.63                                    | 2.52                                   | 3.36                                       | 8.71  | 0.97                                       | 8.34  |

\* Figures in parentheses are original values.

Table 14 Performance of different stocks of lac insects on ber (*Zizyphus mauritiana*)

| Stocks         | X <sub>1</sub><br>Density<br>of<br>settlement<br>(no./sq. cm) | X <sub>2</sub><br>Mortality<br>% | X <sub>3</sub><br>Males<br>% | X <sub>4</sub><br>Survival<br>after<br>sexual<br>maturity<br>(no./cm <sup>2</sup> ) | X <sub>5</sub><br>Live cell<br>wt. (mg) | X <sub>6</sub><br>Dry cell<br>wt. (mg) | X <sub>7</sub><br>Resin/<br>female<br>(mg) | X <sub>8</sub><br>Females<br>(no./cm <sup>2</sup> ) | X <sub>9</sub><br>Life<br>period<br>(days) | X <sub>10</sub><br>Lac<br>productivity<br>(g/day/m) |
|----------------|---|----------------------------------|------------------------------|---|---|--|--|---|--|---|
| LR-5312        | 117.675   | 27.145                           | 26.265                       | 18.882  | 41.185                                  | 31.027                                 | 26.997                                     | 13.562  | 15.075<br>(226.25)                         | 0.354   |
| LR-5313        | 112.175   | 33.117                           | 27.342                       | 20.202  | 34.692                                  | 27.960                                 | 23.475                                     | 15.117  | 15.182<br>(229.49)                         | 0.339   |
| LR-5314        | 108.905   | 35.532                           | 26.895                       | 22.880  | 38.815                                  | 33.085                                 | 28.267                                     | 20.985  | 15.307<br>(233.30)                         | 0.581   |
| LR-5315        | 112.300   | 48.020                           | 18.137                       | 26.025  | 42.345                                  | 35.742                                 | 30.577                                     | 17.610  | 15.307<br>(233.30)                         | 0.530   |
| LR-5316        | 130.85  | 32.712                           | 27.120                       | 51.162  | 43.692                                  | 37.545                                 | 32.500                                     | 19.515  | 14.802<br>(218.09)                         | 0.670   |
| LR-5317        | 127.325   | 25.490                           | 17.147                       | 52.532  | 29.872                                  | 23.695                                 | 19.510                                     | 20.150  | 15.307<br>(233.30)                         | 0.403   |
| LR-5205        | 47.650  | 29.965                           | 19.375                       | 27.800  | 16.250                                  | 8.250                                  | 7.012                                      | 12.922  | 10.790<br>(115.42)                         | 0.267   |
| LR-5101        | 59.025  | 46.192                           | 16.850                       | 20.450  | 21.000                                  | 9.500                                  | 8.062                                      | 10.175  | 10.790<br>(115.42)                         | 0.214   |
| LR-5712        | 60.875  | 48.077                           | 27.900                       | 17.975  | 19.250                                  | 9.500                                  | 8.075                                      | 8.987   | 10.115<br>(101.31)                         | 0.219   |
| LR-5102        | 70.875  | 48.180                           | 33.700                       | 23.300  | 16.750                                  | 8.500                                  | 7.225                                      | 11.650  | 10.720<br>(113.91)                         | 0.239   |
| LR-5111        | 51.800  | 30.417                           | 22.450                       | 24.725  | 17.750                                  | 7.750                                  | 6.587                                      | 12.362  | 10.630<br>(111.99)                         | 0.225   |
| G.M            | 90.85   | 36.80                            | 23.9                         | 27.81   | 29.32                                   | 21.15                                  | 18.02                                      | 14.82   | 13.09                                      | 0.36  |
| C.V.           | 17.52   | 14.032                           | 18.300                       | 19.659  | 12.371                                  | 15.284                                 | 16.968                                     | 27.012  | 0.558                                      | 30.820  |
| C.D. 5%        | 22.917  | 7.435                            | 6.303                        | 7.871   | 5.207                                   | 4.653                                  | 4.403                                      | 5.763   | 0.105                                      | 0.163   |
| C.D. 1%        | 30.862  | 10.013                           | 8.488                        | 10.600  | 7.012                                   | 6.268                                  | 5.930                                      | 7.762   | 0.141                                      | 0.219   |
| P.C.V.         | 38.90   | 27.32                            | 27.84                        | 47.25   | 40.00                                   | 60.41                                  | 61.31                                      | 36.55   | 18.26                                      | 51.24   |
| G.C.V.         | 34.73   | 23.45                            | 20.98                        | 42.96   | 38.04                                   | 58.44                                  | 58.92                                      | 24.62   | 18.00                                      | 40.94   |
| h <sup>2</sup> | 0.82  | 0.74                             | 0.57                         | 0.83  | 0.90                                    | 0.94                                   | 0.92                                       | 0.45  | 0.99                                       | 0.64  |
| G.A.           | 10.24   | 7.93                             | 6.17                         | 11.71   | 11.78                                   | 14.99                                  | 14.89                                      | 5.65  | 8.79                                       | 9.41  |

\* Figures in parentheses are original values.

Table 15 Performance of different stocks of lac insects on kusum (*Schleichera oleosa*)

| Stocks         | X <sub>1</sub><br>Density<br>of<br>settlement<br>(no./sq. cm) | X <sub>2</sub><br>Mortality<br>% | X <sub>3</sub><br>Males<br>% | X <sub>4</sub><br>Survival<br>after<br>sexual<br>maturity<br>(no./cm <sup>2</sup> ) | X <sub>5</sub><br>Live cell<br>wt.<br>(mg) | X <sub>6</sub><br>Dry cell<br>wt. (mg) | X <sub>7</sub><br>Resin/<br>female<br>(mg) | X <sub>8</sub><br>Females<br>(no./cm <sup>2</sup> ) | X <sub>9</sub><br>Life<br>period<br>(days) | X <sub>10</sub><br>Lac<br>productivity<br>(g/day/m) |
|----------------|---|----------------------------------|------------------------------|---|--|--|--|---|--|---|
| LR-5312        | 122.985   | 25.195                           | 23.553                       | 24.273  | 33.843                                     | 30.443                                 | 26.305                                     | 20.825  | 14.910<br>(221.31)*                        | 0.708   |
| LR-5313        | 99.770  | 26.903                           | 14.470                       | 28.938  | 38.695                                     | 30.370                                 | 25.870                                     | 21.877  | 15.110<br>(227.312)                        | 0.730   |
| LR-5314        | 80.870  | 35.545                           | 24.713                       | 16.440  | 30.873                                     | 22.878                                 | 19.628                                     | 18.467  | 15.078<br>(226.346)                        | 0.463   |
| LR-5315        | 141.555   | 31.638                           | 17.908                       | 37.108  | 32.180                                     | 24.013                                 | 20.513                                     | 22.790  | 15.045<br>(225.352)                        | 0.602   |
| LR-5316        | 116.790   | 31.395                           | 11.498                       | 36.273  | 30.700                                     | 22.900                                 | 18.230                                     | 11.455  | 14.458<br>(208.034)                        | 0.285   |
| LR-5317        | 114.065   | 29.083                           | 18.920                       | 35.020  | 32.773                                     | 25.508                                 | 21.008                                     | 14.173  | 14.743<br>(216.356)                        | 0.365   |
| LR-5331        | 140.050   | 27.658                           | 34.843                       | 35.998  | 21.098                                     | 12.668                                 | 8.875                                      | 17.420  | 10.165<br>(102.327)                        | 0.410   |
| LR-5318        | 132.160   | 32.675                           | 21.430                       | 24.515  | 29.380                                     | 22.000                                 | 17.750                                     | 26.205  | 14.945<br>(222.353)                        | 0.625   |
| C.V.           | 15.12   | 9.73                             | 14.54                        | 9.77  | 16.06                                      | 17.52                                  | 21.56                                      | 33.21   | 0.75                                       | 34.21   |
| C.D. 5%        | 24.88   | 4.05                             | 4.21                         | 4.04  | 6.95                                       | 5.79                                   | 5.91                                       | 8.82  | 0.15                                       | 0.25  |
| P.C.V.         | 21.82   | 14.16                            | 36.47                        | 26.68   | 21.12                                      | 27.92                                  | 33.25                                      | 38.12   | 11.81                                      | 43.33   |
| G.C.V.         | 15.71   | 10.28                            | 33.45                        | 24.83   | 13.71                                      | 21.74                                  | 25.32                                      | 18.71   | 11.79                                      | 26.58   |
| h <sup>2</sup> | 0.52  | 0.53                             | 0.84                         | 0.87  | 0.42                                       | 0.61                                   | 0.58                                       | 0.24  | 1.00                                       | 0.38  |
| G.A.           | 4.99  | 4.09                             | 10.46                        | 9.21  | 3.99                                       | 6.60                                   | 6.89                                       | 3.07  | 7.05                                       | 5.10  |

\* Figures in parentheses are original values.

## LAC PROCESSING AND PRODUCT DEVELOPMENT

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

### Syntheses of some bioactive compounds from aleuritic acid

Pheromones are behaviour modifying chemicals released by insects to communicate between members of the same species. Synthetic pheromones are being widely used because of their considerable potential in integrated pest management. During the period under report, two pheromone components were synthesised from aleuritic acid.

#### *(Z)*-7-Hexadecen-1-yl acetate (hexalure)

This sex pheromone of *Heliothis subflexa* was synthesised from *threo*-aleuritic acid as the starting material. *threo*-Aleuritic acid was converted into its methyl ester, which on acetonation followed by  $\text{KMnO}_4$ /acetic acid oxidation and reduction of the resultant half-ester with LAH/THF afforded *threo*-isoaleuritic acid, which was converted into its *erythro*-isomer. Treatment of the *erythro*-isoaleuritic acid with  $\text{HC(OEt)}_3$ /benzoic acid followed by aq. alkaline KOH hydrolysis gave 16-hydroxy-(*Z*)-7-

hexadecenoic acid as a thick liquid. It was then esterified with MeOH/ $\text{FeCl}_3$  to afford methyl ester, which was mesylated with methane sulphonyl chloride. The mesyl derivative was reduced with LAH/THF to yield (*Z*)-7-hexadecen-1-ol as a thick liquid. The acetate derivative was prepared following pyridine-acetic anhydride method.

#### *9,11*-Dodecadien-1-yl acetate (sex pheromone of *Diparopsis castanea*)

*threo*-Aleuritic acid was subjected to periodate oxidation to obtain azelaic acid aldehyde as one of the products, which was esterified with diazomethane. The resultant methyl ester of azelaic acid aldehyde was condensed with triphenylallyl phosphonium bromide under Wittig conditions in a heterogeneous medium using  $\text{K}_2\text{CO}_3$ /toluene. The methyl ester of 9,11-dodecadienoic acid, formed after condensation, was reduced with LAH/THF to get 9,11-dodecadien-1-ol and its subsequent treatment with pyridine/ $\text{Ac}_2\text{O}$  yielded 9,11-dodecadien-1-yl acetate.

(*Z*)-9-Hexadecen-1-yl acetate, sex pheromone of rice green caterpillar has also been prepared in quantity (5 g) for evaluation and field trials.



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

#### Wood varnish

Some more properties of Melfolac such as gloss, solid content, shelf-life and surface coverage were studied *vis-a-vis* two commercial compositions and the results are presented in Table 16. Performance of Melfolac was found to be better compared to those of two commercial products.

An attempt was made to prepare varnish at par, using non-conventional solvent system which is cheap and easily available compared to spirit and a suitable accelerator in place of melamine resin. The characteristics of one such varnish composition developed, have been brought out in Table 17 alongwith those of Melfolac.

Its performance was found to be at par with Melfolac and cost of the varnish is significantly less. Addition of butylated melamine resin (5 to 15% on the weight of shellac) increases the gloss from 3 to 13%, if desired.

#### Metal lacquers for food packaging

The use of lac in the field of metal lacquering is limited due to the brittleness of its films. The present work was taken up with the objective of increasing domestic consumption of lac in the can coating industry. Earlier work of Potnis *et al.* and Kumar were repeated as per IS:5818 (1988) specifications to identify technological gaps, if any. It was observed that in the case of the first composition, pinholing occurred and the second composition did not pass the acid resistance test. However, improvement was observed by incorporating a synthetic resin and new

Table 16 Characteristics of Melfolac and two commercial compositions

| Sample                       | Gloss (%) of film applied by |       | Solid content (%) | Surface coverage (m <sup>2</sup> /kg) | Shelf-life   | Removal of varnish coating               |
|------------------------------|------------------------------|-------|-------------------|---------------------------------------|--|--|
|                              | brush                        | spray |                   |                                       |  |  |
| Melfolac                     | 40                           | 74    | 24                | 7.5                                   | No gelling up to 12 months                             | Coating can not be removed by sand paper |
| Commercial composition No. 1 | 53                           | 60    | 40                | 6.0                                   | Gelled after transferring to other vessel after 2 days | - do -                                   |
| Commercial composition No. 2 | 45                           | 46    | 50                | 5.0                                   | - do -   | - do -                                   |

Table 17 Comparative performance of Melfolac and spiritless varnish developed

| Characteristics                           | Melfolac                          | Spiritless varnish                |
|---|-----------------------------------|-----------------------------------|
| Clarity of varnish                        | Clear                             | Clear                             |
| Colour                                    | Dark brown                        | Dark brown                        |
| Drying time                               |                                   |                                   |
| (a) Touch Dry                             | 10 min                            | 10 min                            |
| (b) Hard Dry                              | 1 hr                              | 1 hr                              |
| Water resistance                          | No blushing (15 days)             | No blushing (15 days)             |
| Heat resistance (99°C)                    | No disfiguration<br>(up to 2 min) | No disfiguration<br>(up to 2 min) |
| Gloss (% standard black glass) applied by |                                   |                                   |
| (a) brush                                 |                                   | 40 55                             |
| (b) spray                                 |                                   | 74 71                             |
| Coverage (by brush, three coatings)       | 7.5 m <sup>2</sup> /per kg        | 7.5 m <sup>2</sup> /per kg        |
| Shelf-life                                | No gelling up to one year         | No gelling up to 1 year           |
| Production cost                           | Rs. 140/litre                     | Rs. 70/litre                      |
| Varnish coating                           | Can not be removed by sand paper  | Can be removed by sand paper      |

formulations were developed which passed most of the tests as per IS.

Gloss, flexibility, impact resistance, acid resistance, sulphur staining, scratch hardness and Dry film weight of the composition per m<sup>2</sup> were studied. The results are brought out in Table 18. Attempts are being made to get the formulation evaluated by user industries as well as Government organisations/labs.

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

**Varnish composition based on aleuritic acid free gummy mass**

The work in the project was initiated during the period under

report. Gummy mass is obtained during isolation of aleuritic acid from seedlac/shellac as by-product. A huge quantity of gummy mass gets accumulated in enterprises engaged in the manufacture of aleuritic acid, whose disposal poses great problem. The present study is aimed at to develop a suitable baking type insulating varnish composition based on aleuritic acid free gummy mass.

Experiments were carried out to prepare gummy mass in several lots from the water soluble portion left after separation of sodium aleuritate during the preparation of aleuritic acid from seedlac. Optimisation of the conditions involved in the acid decomposition of aq. alkaline solution and separation of acid free gummy mass were carried out to get standardised product.

Table 18 Characteristics of the metal lacquers developed for food packaging evaluated as per IS:5818-1988\*

| Test material                  | Gloss standard black (%) | Scratch Hardness, load on 1 mm ball (g) | Acid resistance |
|--------------------------------|--------------------------|---|-----------------|
| Modified dewaxed lac           | Extensive pin-holing     | -                                       | -               |
| Dewaxed lac + Resin A          | 80                       | 1400                                    | Fails           |
| Dewaxed lac + Resin B          | 100                      | 2000                                    | Passes          |
| Modified dewaxed lac + Resin A | 80                       | 1500                                    | Fails           |
| Modified dewaxed lac + Resin B | 100                      | 2000                                    | Passes          |

\* All the test compositions passed the tests for flexibility, impact resistance, sulphur resistance, acidified  $\text{CuSO}_4$  and Dry film weight/ $\text{m}^2$ .

Gummy mass was modified with shellac, a cellulose derivative and epoxy resin. Three compositions were prepared. Dielectric strength of these were found to be 80, 60 and 48 kV/mm (BIS requirement 50 kV/mm) which indicate that only two compositions show some promise. The unmodified composition possessed acid value of 165-170. No greening of copper was noticed for the modified coating compositions. Unmodified gummy mass did not produce tack-free films even after baking at 200°C for 60 min. One of the modified compositions gave tack-free films after baking at a lower temperature (150°C).

Although modified compositions yielded glossy, smooth and flexible films (3 mm manDrel), finish of the films required some improvement as pinholes were noticed due to traces of

water in the gummy mass. Water could be removed from gummy mass after prolonged heating on water bath. This, however, resulted in darkening of gummy mass and an increase in alcohol insolubles (5-6%). Further study is in progress.

#### **Development of lac wax based formulation**

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

Samples of commercial lac wax and some other raw materials were procured. A few experiments were carried out to recover lac wax directly from sticklac using solvent extraction method with an yield of nearly 2.5%.

Before undertaking modification reactions, lac wax obtained from sticklac was characterised for certain physico-chemical properties and compared with those of a commercial sample (Table 19).

Table 19 Characteristics of lac wax from two sources

| Properties        | Wax obtained from sticklac | Commercial lac wax |
|-------------------|----------------------------|--------------------|
| Melting point     | 71-76°C                    | 72-78°C            |
| Acid value        | 19.5                       | 16.5               |
| Penetration value | 8                          | 3                  |

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

Particle boards have become popular as wood substitutes for various applications such as false ceiling, partition wall, furniture, packaging materials etc. In the present work, stick particles of bushy hosts *bhalia* (*Flemingia macrophylla*) and *arhar* (*Cajanus cajan*) were produced with the help of a disintegrator. Experiments were carried out to prepare particle boards from the above particles under the combined action of heat and pressure using shellac,

hydrolysed lac obtained from refuse lac and aleuritic acid free gummy mass respectively as binders.

The impact bending strength of medium density (0.6 - 0.7 g/cm<sup>3</sup>) boards (20 x 18 x 1.5 cm) prepared from *bhalia* stick particles were studied using a pendulum type impact tester. It was observed that the impact strength (4.7 cm. kg) of particle board made using shellac as binder was comparable to that made by using phenol formaldehyde (PF) resin (4.6 cm. kg). However, the water absorption and thickness swelling values, after 24 hours submersion, were found to be higher compared to PF-based particle board. The particle boards made by using hydrolysed lac and aleuritic acid free gummy mass showed much lower impact strength values (2.3 cm. kg and 1.6 cm. kg respectively) and also very poor water resistance property. The impact strength and water resistance property of these particle boards were found to improve when shellac was mixed with the hydrolysed lac or the aleuritic acid free gummy mass. Hence, with the view to use hydrolysed lac and aleuritic acid-free gummy mass respectively in making particle board, a systematic study of impact strength was made by mixing them with various proportions of shellac. The proportion of hydrolysed lac as well as aleuritic acid free gummy mass with shellac in the binder composition, which gave optimum impact strength, was

determined. Further work to improve the water resistance property and surface finish of these particle boards is in progress.

### Ad hoc Research Scheme

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

Improvement in thermal resistance and flexibility of shellac is achieved only when shellac is reacted with linseed oil in the presence of lime and litharge. This is a cumbersome process and often leads to batch failure. In the present study, an attempt has been made to combine shellac with a synthetic resin in solvent medium. Since solubility parameter plays an important role for selection of the solvent system for a coating composition, a clear understanding of the solubility parameters of the component resins/polymers is necessary for designing of polyblends. Solubility parameters of shellac and the synthetic resin were determined employing Hansen's three dimensional approach and Bagley's two dimensional plots for the first time. Solubility parameter of shellac was found to be  $11.2 \text{ cal}^{0.5}/\text{cm}^{1.5}$  similar to those reported by previous workers employing other methods. The contributions due to dispersion ( $\delta_d$ ), polar ( $\delta_p$ ) and hydrogen bonding

forces ( $\delta_h$ ), were found to be 8.1, 4.5 and 6.3 respectively. The high value of  $\delta_h$  is suggestive of existence of hydrogen bonding in shellac molecule. Solubility parameter of the synthetic resin has been determined  $9.5 \text{ cal}^{0.5}/\text{cm}^{1.5}$ . The contributions due to dispersion, polar and hydrogen bonding forces were 8.75, 1.95 and 3.0 respectively.

A composition of baking-type insulating varnish has been developed based on shellac and the synthetic resin. The composition produces non-tacky, flexible films after baking. The characteristics of the varnish have been shown alongwith those of individual resins in the Table 20. An improvement in both flexibility and thermal resistance have been achieved over shellac films. The results of IR studies also indicated probable chemical reaction involving the hydroxyl and carboxyl groups of shellac. Samples of the varnish developed have been supplied to a few consumers for evaluation.

Attempts have been made, in the present work, to correlate solubility parameter ( $\delta$ ) with the physical properties of polymers like, glass-transition temperature ( $T_g$ ), dielectric constant ( $\epsilon$ ), thermal conductivity (K), specific heat ( $C_p$ ) and tensile strength (TS). The following empirical relations have been found out from the values of the above parameters for different

Table 20 Characteristics of the shellac-synthetic resin varnish

| Properties   | Shellac-synthetic resin        | Synthetic resin        | Shellac                         |
|--|--------------------------------|------------------------|---------------------------------|
| Drying characteristics<br>(in thin film)           | Step curing at<br>90 and 200°C | 1h at<br>200°C         | Air-Dry in<br>30 min            |
| Dielectric strength<br>(kV/mm)                     |                                |                        |                                 |
| in air at R.T.                                     | 63-73                          | 72-73                  | 40                              |
| in air, after conditioning<br>at 100% R.H. for 24h | 23-29                          | 63                     | 8-10                            |
| In air at 200°C                                    | 30                             | 19-20                  | 20                              |
| Flexibility (3 mm manDrel)                         | Passes                         | Passes                 | Fails                           |
| Resistance to tracking<br>(IS:10026-1982)          |                                |                        |                                 |
| at 135 V   | Passes                         | Fails                  | Passes                          |
| at 200 V   | Passes                         | Fails                  | Passes                          |
| Greening of copper                                 | No                             | No                     | No                              |
| Resistance to transformer oil                      | Passes                         | Passes                 | Passes                          |
| Thermal resistance of films                        | More than 220°C                | More than 220°C        | 65-75°C                         |
| Thermal profile by DSC                             | No peak<br>up to 230°C         | No peak<br>up to 230°C | Two peaks<br>at 55.57 & 72-74°C |
| Scratch hardness                                   | More than<br>2000 g            | More than<br>2000 g    | 600-800 g                       |
| Noticeable change in IR                            | Reduced OH peak                | Pronounced OH peak     | Pronounced OH peak              |

polymers available in the literature.

$$T_g = 26.3 \delta \quad \dots (1)$$

$$\epsilon = 0.31 \delta \quad \dots (2)$$

$$\log (1/K) = 3+0.033 \delta \quad \dots (3)$$

$$C_p = 0.0377 \delta \quad \dots (4)$$

$$(\log TS)^{0.5} = 1.3 + 0.029 \delta \quad \dots (5)$$

The above relationships may be used for obtaining first hand idea about the stated physical properties of polymers/resins, including shellac, with certain errors.

## REVOLVING FUND SCHEME

### Quality broodlac production on *kusum* and *palas*

#### Balance Sheet (in Rs.)

| EXPENDITURE         |               | INCOME                               |               |
|---------------------|---------------|--------------------------------------|---------------|
| HEAD                | Rs.           | HEAD                                 | Rs.           |
| Broodlac            | 14,400        | Broodlac sold                        | 57,160        |
| Contractual Service | 23,100        | Sticklac                             | 16,484        |
| Insecticides        | 4,503         | Broodlac used for<br>succeeding year | 20,000        |
| T.A.                | 176           |                                      |               |
| POL                 | -             |                                      |               |
| <b>Total</b>        | <b>42,179</b> |                                      | <b>93,644</b> |

| HEAD                       | MARCH 1999       |
|----------------------------|------------------|
| Gross Profit (+) Loss (-)  | 51,465.00        |
| Less 10% of Workers' Share | -5,145.00        |
| Less Establishment charges | -1,000.00        |
| Less depreciation          | -1,694.00        |
| <b>Net Profit</b>          | <b>43,626.00</b> |

|  |          |                 |
|--|----------|-----------------|
| Reserve as on 31st March '98<br>(as per cash book) | =        | 6,49,335        |
| NR assets  | =        | 13,369          |
| Value Broodlac used for future crop                | =        | 20,000          |
| <b>Total</b>                                       | <b>=</b> | <b>6,82,704</b> |

## TECHNOLOGY TRANSFERRED

### Entrepreneur Development Programme

#### Process and Product Demonstration

Ten entrepreneurs were trained

on preparation of aleuritic acid, dewaxed bleached lac and on testing and analysis of lac (Table 21). The Institute earned a revenue of Rs. 0.78 lakh through training charges.

Table 21 Details of entrepreneur development programme on lac-based products/processes

| Products/Process            | No. Trained | Beneficiary   | Period             |
|-----------------------------|-------------|---|--------------------|
| Aleuritic acid              | 3           | • Sri P. Sreemany<br>17B, Sambhu Nath Das Lane, Calcutta - 700 050  | 19.2.98 to 28.2.98 |
|                             |             | • Sri A. Nagarajan<br>Sami Chemicals & Extracts Ltd.<br>H.O. : 1382, Southend Main Road<br>9th Block, Jayanagar, Eastend, Bangalore - 560 069 | 20.4.98 to 24.4.98 |
|                             |             | • Sri Uma Sankar Giri<br>Bardhan Brothers Pvt. Ltd., Murhu, Ranchi  | 27.7.98 to 22.8.98 |
| Dewaxed bleached lac        | 4           | • Sri Mohamed Aslam<br>70, Colootola Street, Calcutta - 700 073   | 2.2.98 to 12.2.98  |
|                             |             | • Sri P. Sreemany<br>17B, Sambhu Nath Das Lane, Calcutta - 700 050  | 19.2.98 to 28.2.98 |
|                             |             | • Sri Rajesh Gupta<br>Ganpati Traders, P. B. No. 63<br>Dhamtari - 493 773 (M.P.)  | 22.5.98 to 30.5.98 |
|                             |             | • Sri Uma Sankar Giri<br>Bardhan Brothers Pvt. Ltd., Murhu, Ranchi  | 28.7.98 to 17.8.98 |
| Testing and analysis of lac | 3           | • Sri P. Sreemany<br>17B, Sambhu Nath Das Lane, Calcutta - 700 050  | 19.2.98 to 28.2.98 |
|                             |             | • Sri Dipak Kumar Ray<br>Tajna Shellac Pvt. Ltd., Khunti, Ranchi - 835 210  | 1.4.98 to 23.4.98  |
|                             |             | • Sri Rajesh Kumar<br>Tajna River Industries Pvt. Ltd.<br>Khunti, Ranchi - 835 210  | 24.4.98 to 13.5.98 |



## EDUCATION AND TRAINING

Two unemployed youth successfully completed a four-month training programme on "Modern Methods of Lac Cultivation". A special programme of two and half month duration on "Modern Methods of Lac Cultivation" was organised for four Statistical Supervisors and two Junior Economic Investigators of the Institute of Forest Productivity, Ranchi. Five persons successfully completed the course.

Studies on impact of technologies already transferred to entrepreneurs are in progress.

### One-week Training on Lac

The Institute also conducts one-week training programme on lac, with special emphasis on lac culture. This mainly aims at educating the lac cultivators and trainees on the improved lac cultivation techniques and some basic information on other aspects of lac. A summary of one week programme conducted during the period is furnished in **Table 22**.

### One-day Education Programme

One-day programme on lac cultivation was organised by which

1533 farmers/forest officers/post-graduate students were benefited as detailed in **Table 23**.

Five "On-farm training" camps on lac culture were organised in association with various NGOs in which 1805 farmers participated (**Table 24**).



*Scientists explaining to farmers about lac culture on ber*

### Linkages

The institute has further established linkages with new NGOs.

INDAL, Chotamuri and Ranchi Human Resource Centre of CASA, Bichna (Khunti) helped the students of XISS for carrying out survey in their adopted villages.

### 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 190 queries were attended to during the period.

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

**Table 22 Details of one-week training programme on "Lac culture and other aspects"**

| Sponsoring organisation                               | Period               | Beneficiary | No. of participants |
|---|----------------------|-------------|---------------------|
| New Hope Leprosy Trust<br>Muniguda (Koraput), Orissa  | 11.5.98 to 16.5.98   | Farmers     | 9                   |
| AGRAGAMI, Kalahandi, Orissa                           | 6.10.98 to 9.10.98   | Trainers    | 2                   |
| Support for Sustainable Society<br>Bano, Gumla, Bihar | 26.10.98 to 31.10.98 | Farmers     | 12                  |
| KVK, Kalyan, Purulia (WB)                             | 2.11.98 to 7.11.98   | Trainers    | 2                   |
| HINDALCO, Lohardaga, Bihar                            | 14.12.98 to 19.12.98 | Farmers     | 7                   |
|   |                      | Total       | 32                  |

**Table 23 Details of one-day education programme on lac**

| Beneficiary                  | Sponsored by   | No. of batches                       | No. of participants                           |
|------------------------------|--|--------------------------------------|---|
| <u>Orientation Programme</u> |  |                                      |   |
| Farmers                      | <ul style="list-style-type: none"> <li>• KRIBHCO, Ranchi</li> <li>• R. K. Mission, Ranchi</li> <li>• Nav Bharat Jagriti Kendra, Murhu, Ranchi</li> <li>• Indian Aluminium Company, Silli, Ranchi</li> <li>• Action for Food Production (AFPRO), Ranchi</li> <li>• IFFCO, Ranchi</li> <li>• Agricultural Training Centre, Ranchi and Gumla</li> <li>• Forest Dept.</li> </ul> | 2<br>6<br>2<br>1<br>1<br>1<br>2<br>1 | 35<br>265<br>79<br>32<br>18<br>40<br>52<br>10 |
| Post Graduate Students       | • Xavier Institute of Social Services (XISS), Ranchi   | 1                                    | 76  |
| Forest Range Officers        | • Forest College, M.P.   | 1                                    | 48  |
| <u>Exposure Programme</u>    |  |                                      |   |
| Farmers                      | • R. K. Mission, Ranchi  | 11                                   | 878   |
| Total                        |  | 29                                   | 1533  |

*One-day orientation programme on lac in progress at lecture hall*



*Forest officers visiting the Institute's Museum*

**Table 24 Details of on-farm training conducted on improved techniques of lac cultivation**

| Village/Place            | Block               | Collaborating organisation      | No. of participants |
|--------------------------|---------------------|---------------------------------|---------------------|
| Gangtikuli               | Raghunathpur (W.B.) | On farmers' request             | 50                  |
| Antara and Antari        | Sahdol (M.P.)       | KVK                             | 25                  |
| Ukauli                   | Bano (Bihar)        | Support for Sustainable Society | 150                 |
| Natapara                 | Nilgiri (Orissa)    | SAGEN                           | 80                  |
| St. Ignatius High School | Gumla (Bihar)       | Jan Jatiya Seva Vihar           | 1500                |
|                          |                     | Total                           | 1805                |



## PUBLICITY

### Exhibitions organised and participated

The institute had participated in a number of exhibitions and put up stall on various aspects of lac (Table 25).

### NGOs' Meet

A meeting with NGOs was held at the institute on 22.12.98 under the chairmanship of Dr. S. C. Agarwal, Director. Twelve participants were there, comprising of representatives from the



*Lac stall put up jointly by BISCOLAMF and ILRI at Jharkhand Udyog Mela*

institute and eight NGOs including Vardan, New Delhi and VIKASAM, Ranchi. The problems faced in the

**Table 25 Details of exhibitions participated/organised by the Institute**

| Date              | Venue   | Organiser  |
|-------------------|---|--|
| Feb. 25, 1998     | Kamre, Ranchi District, Bihar   | Canara Bank, Kamre Branch                              |
| Mar. 22, 1998     | Agrotech-98, Kanke, Ranchi, Bihar   | Birsa Agricultural University, Ranchi                  |
| Aug. 3-16, 1998   | India's Science Vision Exhibition, AGRASAR-Achievement of Science and Technology since Independence and Vision of Future, New Delhi | Govt. of India   |
| Aug. 8, 1998      | Balarampur, West Bengal   | Indian Lac Research Institute, Ranchi                  |
| Sept. 18-19, 1998 | Gumla, Bihar  | Janjatiya Sewa Vihar, Gumla                            |
| Oct. 9-13, 1998   | Jharkhand Udyog Mela, Ranchi, Bihar   | Chotanagpur Small Scale Industries Association, Ranchi |
| Oct. 14-27, 1998  | India International Trade Fair, New Delhi   | Trade Fair Authority of India, New Delhi               |
| Nov. 15-16, 1998  | Ukauli, Bano, Gumla, Bihar  | Support for Sustainable Security, Ranchi               |
| Dec. 17, 1998     | Berhampur, West Bengal  | N.H.D.C., Govt. of India                               |
| Dec. 22, 1998     | Bagma, Murhu, Ranchi  | Nav Bharat Jagriti KenDra, Murhu                       |



*Meeting of NGOs held at the Institute*

extension of lac based technologies and the services available from ILRI were discussed in detail.

### Sale Counter

The TOT Division operates a sale counter for promotion of lac-based products. Various products, such as melfolac, water-soluble lac, lac ornaments, sealing wax were sold amounting to Rs. 15,478 during the period.

### Video Films on Lac

Shooting of two video films on lac was initiated during the period under report.

### Kisan Mela organised and participated

| Date           | Venue            | Organised by                    |
|----------------|------------------|---------------------------------|
| Jan. 17, 1998  | ILRI, Namkum     | Indian Lac Res. Inst., Namkum   |
| Feb. 7, 1998   | Silli, Ranchi    | INDALCO, Chotamuri              |
| Mar. 3-4, 1998 | Getalsud, Ranchi | R. K. Mission, Morabadi, Ranchi |

### Publicity through Mass Media

The institute continued its activity towards creating awareness of different aspects of scientific methods of cultivation of lac through different electronic media.

### Radio Talk

| Topic   | Speaker                               | Date of broadcast |
|---|---------------------------------------|-------------------|
| <i>Samaya-samaya par lakh utpadkon ko dee jane wali sarkari suvidhayen</i>  | Dr. S. K. Saha                        | 28.2.98           |
| <i>Lakh utpadan ke vaigyanik tareeke apnayen aur adhik upaj prapt karen</i> | Mr. R. Ramani                         | 28.3.98           |
| <i>Lakh keet palan ke adhunik tareeke evam unke labh</i>                    | Dr. A. Bhattacharya                   | 21.6.98           |
| <i>Lakh keet palan ke poshak vriksh evam unki dekh-rekh</i>                 | Dr. B. P. Singh                       | 26.7.98           |
| <i>Lakh keeton ki suraksha evam samuchit dekh-rekh</i>                      | Dr. A. K. Jaiswal                     | 30.8.98           |
| <i>Modern methods of lac production</i>                                     | Dr. S. C. Agarwal                     | 6.9.98            |
| <i>Lakh keet palan mein vipnan vyavastha ki samasyaen evam nidan</i>        | Mr. R. Ramani                         | 30.10.98          |
| <i>Paricharcha-lakh keet palan ke vaigyanik evam adhunik tareeke</i>        | Dr. S. C. Agarwal & Dr. A. K. Jaiswal | 14.11.98          |
| <i>Achievements of ILRI, Ranchi (AIR, News Section)</i>                     | Dr. S. C. Agarwal                     | 10.12.98          |

### T. V. Programme

| Topic  | Speaker          | Date of broadcast |
|--|------------------|-------------------|
| <i>Lakh keet palan mein samekitnashi jeev prabandh</i> | Dr. K. K. Sharma | 23.2.98           |
| <i>Lah keet palan pra-shikshan karyakaram</i>          | Dr. K. K. Sharma | 27.7.98           |
| <i>Lah keet palan ki vaigyanik vidhi</i>               | Dr. K. K. Sharma | 22.10.98          |

## PUBLICATIONS

### Research Papers

Agarwal, S. C., Jaiswal, A. K. and Sharma, K. Krishan (1998) Problems and prospects of lac culture in India, *Journal of Non-timber Forest Products*, 5 (3/4) : 127-132

Bhattacharya, A., Mishra, Y. D., Jaiswal, A. K., Sharma, K. K., Malhotra, C. P. and Sushil, S. N. (1995) Ovicidal action of diflubenzuron (Dimilin 25 WP) on *Eublemma amabilis* Moore (Lepidoptera : Noctuidae) - a serious predator of lac insect, *Pest Management and Econ. Zool.*, 3 (1), 29

Bhattacharya, A., Sushil, S. N., Mishra, Y. D., Jaiswal, A. K. and Sharma, K. K. (1998) Effect of U. V. light on eggs of *Eublemma amabilis* Moore (Lepidoptera Noctuidae), *Insect Environ.*, 4 (1), 15

Bhattacharya, A., Naqvi, A. H., Sen, A. K. and Mishra, Y. D. (1998) Artificial rearing of *Pseudohypatopa pulverea* Meyr. - a predator of lac insect *Kerria lacca* (Kerr), *J. Entomol. Res.*, 22 (1), 83

Chaudhari, S. G., Mishra, Y. D., Bhattacharya, A., Bhagat, M. L. and Naqvi, A. H. (1998) Management of predators of lac insect for broodlac production on *Butea monosperma*, *The Indian Forester*, 124 (11), 976

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Jaiswal, A. K. and Saha, S. K. (1998) Growth analysis of lac production, *J. Non-timber Forest Prod.*, 5 (1/2), 64

Jaipurkar, S. K., Kumar, P. and Ramani, R. (1998) An air-Dry method for cytological preparation of lac insects (Coccoidea : Homoptera), *Insect Environ.*, 4 (2), 46

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Majee, R. N., RajenDran, I. and Agarwal, S. C. (1998) Simple Synthesis of 1, 4 - Dioxa - 2,3 - dioxocyclopentadec - 6 - ene from aleuretic acid, *J. Indian Chem. Soc.*, 75, 522

Majee, R. N. (1998) Simple Synthesis of (Z) - 9 - Hexadecen - 1 - al, *Res. J. Chem. Environ.*, 2 (1), 9

Mishra, Y. D., Bhattacharya, A., Sushil, S. N. and Agarwal, S. C. (1998) *Adansonia digitata* Linn (Bombacaceae) as a lac host plant, *Insect, Environ.*, 4 (2), 49

Mishra, Y. D., Bhattacharya, A., Sushil, S. N. and Agarwal, S. C. (1998) Genetic variation in the density of settlement and initial mortality of nymphs in lac insects, *Kerria* spp. (Tachardiidae Homoptera), thriving on *Flemingia macrophylla* - a promising bushy host, *J. Ent. Res.*, 22 (4), 381

Saha, S. K., Jaiswal, A. K. and Singh, B. N. (1998) Pre-harvest forecasting of sticklac yield from culture of lac insect *Kerria lacca* (Kerr) on *Butea monosperma* (Lam.) Taub., *J. Ent., Res.*, 22 (3), 273

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Srivastava, S. C., Kumar, P. and Singh, B. P. (1997) Air-layering in *kusum*, *Schleichera oleosa* (Lour.) Oken, *J. Non-timber Forest Prod.*, 4 (3/4), 180

Srivastava, S. C., Kumar, P., Mishra, Y. D. and Jaiswal, A. K. (1998) Estimation of *kusmi* winter crop sticklac yield from *Flemingia macrophylla* (Willd O'Ktze) based on insect characters of *Kerria lacca* (Kerr), *Indian J. Forestry*, 21 (1), 9

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Agarwal, S. C. (1998) Lac processing and utilisation at 33rd Annual Convention of Indian Society of Agricultural Engineering at CIAE, Bhopal, 21-23rd Sept.

Mishra, Y. D., Bhattacharya, A., Agarwal, S. C. and Kumar, K. K. (1998) Productivity management in lac culture in National Seminar on Entomology in 21st century held during Apr. 30 - May 2, 1998 at Rajasthan College of Agriculture, Udaipur.

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Mishra, Y. D., Sushil, S. N., Kumar, K. K. and Agarwal, S. C. (1998) Production and expert of Indian Lac in 21st Century - a vision in "National Symposium on Strategies for Promotion of Consumption of Lac", held at ILRI, Ranchi on 14-15 May, 1998

Naqvi, A. H., Kumar, P., Mishra, Y. D., Singh, B. P. and Bhattacharya, A. (1998) Lac culture - a system approach to bio-resource management in Chhotanagpur, in the Proceedings of National symposium "Bioresources of Chhotanagpur and their industrial significance", Indian Lac Research Institute, Ranchi, p. 97.

Ramani, R. and Agarwal, S. C. (1998) Pharmaceutical potential of shellac and other lac derived products in National Seminar on Pharmacy, Education and Research at B.I.T., Ranchi, 8-10 November.

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Saha, S. K., Goswami, D. N., Srivastava, B. C., Prasad, N. and Majee, R. N. (1998) Industrial potential of lac and some other natural products of Chhotanagpur and their industrial significance, in the Proceedings of National Symposium on Bioresources of Chhotanagpur and their industrial significance, Indian Lac Research Institute, Ranchi, p. 90.

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### Popular articles

Agarwal, S. C. (1998) *Lakh ek parichaya, Vigyan Garima Krishi Vigyan - Special issue*, 24, 231

Agarwal, S. C., Singh, B. P. and Jaiswal, A. K. (1998) *Lakh keet ke audyogic mahatva* (in Hindi), *Mati Mudeer*, 1 (5), 2

Kumar, K. K. and Bhagat, M. L. (1998) *Chhotanagpur mein sattar pratishat adivasi lah ki khetti karte hain*, Ranchi Express (in Hindi), April 10.

Kumar, K. K. and Bhagat, M. L. (1998) *Bihar lakh sanrakshan : kyon or kaise*, Ranchi Express (Hindi), July 12.

### Patents

Provisional patents have been applied for the following :

- Goswami, D. N. - Anti-tracking air-Drying type shellac based insulating varnish
- Goswami, D. N. and Saha, S. K. - High thermal resistant baking type insulating varnish based on shellac and alkyd resin
- Gupta, P. C. - Shellac based heat and water resistant varnish in non-conventional solvent
- Gupta, P. C. - Use of lac by-products for making coal block
- Gupta, P. C. and Sarkar, P. C. - Shellac based tin can laquer composition in non-conventional solvent for lac resin
- Saha, S. K. - A process for improving the flow and heat polymerisation time of shellac.



## Technical pamphlets/folders/leaflets published by the Institute

### Folders and pamphlets

- ◆ *Palas tatha ber par lakh ki sammilit kheti ki unnat vidhi* (Hindi), 4 pp.
- ◆ *Aiya seekhen - unnat vidhi se lakh ki kheti* (Hindi) - 4 pp.
- ◆ High thermal resistant baking type modified shellac insulating varnish - 4 pp.
- ◆ Air-Drying type anti-tracking modified shellac insulating varnish - 4 pp.
- ◆ Aleuritic acid - a fine chemical from lac - 4 pp.
- ◆ Isoambrettolide from aleuritic acid - 4 pp.
- ◆ ILRI training prospectus - 8 pp.
- ◆ ILRI training prospectus (Hindi) - 8 pp.
- ◆ *Lakh chaser paddhati* (Bangla) - 8 pp.
- ◆ Lac dye - 8 pp.
- ◆ *Muhar lagane ki lakh* (Hindi) - 1 p.
- ◆ Lac - from antiquity to eternity - 8 pp.
- ◆ A pictorial introduction to lac - 2 pp.



Dr. R. P. Kachru, ADG (PE) releasing folders on lac product technologies

### Books/Booklets

- ◆ Souvenir - National Symposium on Strategies for promotion of lac consumption - 40 pp.
- ◆ Proceedings of the National Symposium on Bioresources of Chhotanagpur and their industrial significance - 116 pp.
- ◆ Safari of ILRI through seven decades - 84 pp.

### News-letters

- ◆ ILRI News-letter, July - December 1997.
- ◆ ILRI News-letter, January - June 1998.

## 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**

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  - 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**

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  - 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**

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  - 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**

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  - 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**

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  - Mechanisation of lac cultivation operations
  - Publication and publicity activities

- Survey of current status, technology assessment of potential 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



## IMPORTANT COMMITTEES

### Staff Research Council

A meeting of Staff Research Council was held on 17-18 March, 1998 to review the progress of work done on the on-going projects. New project proposals were also considered and recommended for placing before the Research Advisory Committee for approval.

Staff Research Council meetings were also held on 3-5 December, 1998 to discuss the progress of on-going research projects as per the following schedule :

1. 3rd December '98 - (a) All scientists of Lac Production Division and (b) Scientists of Transfer of Technology Division (Agriculture - related discipline).

2. 5th December '98 - (a) All scientists of Lac Processing and Product Development Division and (b) Scientists of Technology Division (Chemistry - related discipline).

### Research Advisory Committee

A meeting of the Research Advisory Committee was held on 26-27 March, 1998 under the Chairmanship of Dr. A. V. Rama Rao, Retired Director, IICT, Hyderabad. The members present were Dr. R. P. Kachru, ADG (PE), ICAR, New Delhi, Dr. S. C. Agarwal, Director, ILRI, Sri R. L. Sharma, M.D., Tajna Shellac Factory, Khunti, Ranchi and Dr. S. K. Saha, Pr. Sc. & Head, LP&PD Div., ILRI, Ranchi.



The committee reviewed the progress of on-going research projects. The following new projects were approved :

1. Varnish composition based on aleuritic acid-free gummy mass
2. Development of lac-wax based formulations
3. Use of refuse lac/by-products/modified lac for making particle board/composite from various agro-wastes
4. Mechanisation of lac cultivation operations
5. Publication and publicity activities
6. Survey of current status, technology assessment and marketing problems
7. Training, demonstration, extension education and impact analysis on lac culture, processing and product development

The committee considered and finalised the five core programmes of the Institute for the next five years, which are as follows :

1. Evaluation and improvement of lac crop management practices under integrated agro-forestry system covering soils, host plants (*ber*, *akashmani*, *F. semialata* and Rain tree) and pest management
2. Improvement of productivity and quality of lac through different breeding approaches for lac insect and their host plants

3. Development of value added products (sex pheromones, plant growth regulators, polyblends) and surface coating materials from lac resin
4. Utilisation of by-products (lac dye, wax and refuse lac) of lac industry for food grade dye, varnishes/lacquers and bonding material for particle board
5. Transfer of technology to farmers and entrepreneurs through training, demonstration, consultancy, information service and quality certification

#### Constitution of a new Research Advisory Committee

After the expiry of the period of the present RAC and in the light of council notification 8 (14) 94-I.A. II (AE) dated 24th July, 1998, RAC has been constituted as follows :

1. Dr. B. L. Amla - Chairman  
121/1, Basavanahalli  
Hiakai - 570 017, Mysore, Karnataka
2. Dr. R. P. Kachru - Member  
ADG (PE), Indian Council of  
Agricultural Research  
Krishi Bhawan, New Delhi - 110 001
3. Dr. S. C. Agarwal - Member  
Director, Indian Lac Research  
Institute, Namkum, Ranchi
4. Dr. N. Krishnamurthy - Member  
Head, Surface Coating and Polymer  
Division, Indian Institute of Chemical  
Technology, Hyderabad - 500 007

5. Prof. D. R. C. Bakhetia - Member  
Head, Dept. of Entomology  
Punjab Agricultural University  
Ludhiana - 141 004 (Punjab)
6. Dr. M. Yaseen - Member  
Dy. Director and Head (Ret.)  
7-85, Zaheer Nagar, Scientist Colony  
Habshiguda, Hyderabad - 500 007
7. Shri Madhu Agarwal - Member  
Secretary, Maharashtra Rajya Lah  
Utpadak and Chapra Nirmata Sangh,  
Gondia - 441 601 (Maharashtra)
8. Shri R. L. Sharma - Member  
Managing Director  
Tajna Shellac (P) Ltd.  
Khunti, Ranchi - 835 210
9. Shri R. Ramani - Member - Secretary  
Sr. Scientist, TOT Division  
Indian Lac Research Institute  
Namkum, Ranchi

#### Management Committee

The Institute Management Committee has been reconstituted as under :

- |  |            |
|--|------------|
| Dr. S. C. Agarwal, Director  | - Chairman |
| Dr. R. P. Kachru, ADG (PE),<br>ICAR, New Delhi                                       | - Member   |
| Prof. G. S. Dubey, Dean<br>(Extension), Birsa Agricultural<br>College, Kanke, Ranchi | - Member   |
| Dr. K. K. Kumar, Head,<br>TOT Division, ILRI, Ranchi                                 | - Member   |
| Dr. P. C. Gupta<br>Pr. Sc., ILRI, Ranchi   | - Member   |

- |   |                        |
|---|------------------------|
| Sri Ganauri Singh<br>Sr. Sc., ILRI, Ranchi          | - Member               |
| Dr. J. B. Tomar, In-charge<br>NBPGR, Ranchi Station | - Member               |
| Fin. and A.O., CFRRI,<br>Barrackpur                 | - Member               |
| Administrative Officer,<br>ILRI                     | - Member-<br>Secretary |

The 26th meeting of the Management Committee was held on 2nd November, 1998 at this Institute. Dr. S. C. Agarwal, Chairman, welcomed the new members and apprised them about the salient achievements and development of the Institute since the last meeting of the IMC (i.e., 11-12 Dec. 1997).

The important decisions taken during the meeting were as follows :

- A special task committee has been constituted comprising of Director (Chairman), Head, L. P. Division and Head, TOT Division (members) to use lac cultivation for the development of the NEH region
- Approval has been given for enhancing the remuneration of the institute AMA to Rs. 4000 p.m.
- A proposal has been sought for a revolving fund scheme for preparing lac based products for sale
- Approval for free-of-cost distribution of a maximum of 25% of the printed copies of the institute publications, on the discretion of Director.

**Quinquennial Review Team**

The Quinquennial Review Team, which was constituted (vide Council Office Order No. 3 (1)/96-IA.II. (AE) dated 11.2.97) to review the work done by the Institute for the period 1991-96 has submitted its final report to Dr. R. S. Paroda DG, ICAR on 31.07.98.

**Steering Committee on Lac (SCL)**

The first meeting of SCL was held on 16.12.98 under the chairmanship of Dr. S. C. Agarwal, Director who welcomed the members and apprised them of the achievements of the Institute. Representatives from RIADA, BISCOLAMF, IFP, TRIFED, NABARD,

BAU, Tajna Shellac Pvt. Ltd., XISS, BOI, BIKASAN attended the meeting.

The Committee opined that publicity campaign about lac based products developed by ILRI should be intensified; Shellac Export Promotion Council may be entrusted with bufferstocking of all the seedlac produced in the country to promote lac not only abroad but also within the country; lac hosts should be raised in large numbers and action should be taken for ensuring certain minimum lac consumption in selected industries. Two special ad hoc committees were also constituted for broodlac distribution and lac production and entrepreneurship development.

Several training 14-18 September 1998 at IARI Ranchi.

Dr. V. K. Rao Scientist, U & PD (Lac) Sr. J. K. Saha, Technical Officer (L) and Sr. E. Kumar, Sr. Chief, attended training course on Use of Computer in Agriculture Research and Administration at IARI, New Delhi from 10.11.98 to 28.11.98.

Sr. E. Kumar attended training course on Basic and Prospective Applications of ARIS Hardware and Laser Network Operating System during 13-27 November 1998 at Gujarat Agricultural University, Gandhinagar.

Attended by the Scientists and Staff-Members

Dr. N. Prasad, Scientist, TOT Division successfully completed a foundation course for Agricultural Research Scientists (ARCARS) at the National Academy of Agricultural Research Management, Hyderabad from October 3, 1997 to January 29, 1998.

Dr. K. K. Kumar, Head of TOT Division, attended a training course on "Management Development Programme in Agricultural Research Management", Hyderabad from June 29 to July 4, 1998.

## PARTICIPATION OF SCIENTISTS IN TRAINING, MEETINGS, SYMPOSIA ETC.

### Attended by the Director

- 33rd Annual Convention of Indian Society of Agricultural Engineering at CIAE, Bhopal, 21-23rd September 1998 as a nominated member of Steering Committee.
- XIII Extension Education Council meeting at Birsa Agricultural University, Kanke in Sept., 1998.
- Workshop on Non-timber Forest Products : Availability, Consumption, Marketing and Management in Eastern India at XISS, Ranchi on March 22, 1999.

### Attended by the Scientists and Staff-Members

- Dr. D. N. Goswami, Dr. K. K. Sharma, Dr. S. N. Sushil, Shri R. Prasad, Shri R. P. Tewari, Shri D. Ganguly, Shri K. P. Oraon and Shri A. K. Tripathi attended training on 'Computer Network' during 14-15 July 1998 at CMC Training Centre, Ranchi.
- Shri D. Ganguly and Shri A. Pandey attended training on 'Management of Information Centre' during 7-18 September 1998 at NAARM, Hyderabad.
- Shri R. Prasad and Shri A. K. Sahay attended training on Sun Unix Server during 14-18 September 1998 at ILRI, Ranchi.
- Dr. V. K. Rao, Scientist, LP & PD Div., Shri A. K. Sahay, Technical Officer (T-5) and Shri P. Kumar, Sr. Clerk attended 'Training Course on Use of Computer in Agriculture Research and Administration' at IASRI, New Delhi from 16.11.98 to 28.11.98.
- Shri D. Ganguly attended training course on 'Basic and Prospective Applications of ARIS Hardware and Linux Network Operating System' during 23-27 November 1998 at Gujarat Agricultural University, Anand, Gujarat.
- Dr. N. Prasad, Scientist, TOT Division, successfully completed 61st Foundation Course for Agricultural Research Scientists (FOCARS) at the National Academy of Agricultural Research Management, Hyderabad from October 3, 1997 to January 29, 1998.
- Dr. K. K. Kumar, Head of TOT Division, attended a training course on "Management Development Programme in Agricultural Research Management", Hyderabad from June 29 to July 4, 1998.



- Dr. N. Prasad, Scientist, TOT Div. attended training programme on 'Design, Testing and Production Technology of Harvesting and Threshing Equipment', at Central Institute of Agricultural Engineering, Bhopal during 14-24 December 1998.
- Dr. K. K. Kumar, Head, Div. of TOT participated and Mr. R. Ramani, Sr. Sc. presented a paper in the seminar on "Pharmacy, Education

and Research" at B.I.T., Mesra, Ranchi held during Nov. 8-10, 1998.

- Dr. A Bhattacharya delivered a lecture on "Lac entomology and Culture" on 1.12.98 at Academic Staff College, Ranchi University.
- Shri R. Ramani delivered a lecture on "Lac marketing, processing, utilization, research and extension" on 5.12.98 at Academic Staff College, Ranchi University.

|            |                     |
|------------|---------------------|
| 11:30 a.m. | Dr. N. Prasad       |
| 11:20 a.m. | Dr. K. K. Kumar     |
| 11:13 a.m. | Mr. R. Ramani       |
| 10:50 a.m. | Dr. A. Bhattacharya |
| 10:40 a.m. | Shri R. Ramani      |
| 10:30 a.m. | Dr. N. Prasad       |
| 10:20 a.m. | Dr. K. K. Kumar     |
| 10:10 a.m. | Mr. R. Ramani       |
| 10:00 a.m. | Dr. A. Bhattacharya |
| 9:50 a.m.  | Shri R. Ramani      |
| 9:40 a.m.  | Dr. N. Prasad       |
| 9:30 a.m.  | Dr. K. K. Kumar     |
| 9:20 a.m.  | Mr. R. Ramani       |
| 9:10 a.m.  | Dr. A. Bhattacharya |
| 9:00 a.m.  | Shri R. Ramani      |
| 8:50 a.m.  | Dr. N. Prasad       |
| 8:40 a.m.  | Dr. K. K. Kumar     |
| 8:30 a.m.  | Mr. R. Ramani       |
| 8:20 a.m.  | Dr. A. Bhattacharya |
| 8:10 a.m.  | Shri R. Ramani      |
| 8:00 a.m.  | Dr. N. Prasad       |
| 7:50 a.m.  | Dr. K. K. Kumar     |
| 7:40 a.m.  | Mr. R. Ramani       |
| 7:30 a.m.  | Dr. A. Bhattacharya |
| 7:20 a.m.  | Shri R. Ramani      |
| 7:10 a.m.  | Dr. N. Prasad       |
| 7:00 a.m.  | Dr. K. K. Kumar     |
| 6:50 a.m.  | Mr. R. Ramani       |
| 6:40 a.m.  | Dr. A. Bhattacharya |
| 6:30 a.m.  | Shri R. Ramani      |
| 6:20 a.m.  | Dr. N. Prasad       |
| 6:10 a.m.  | Dr. K. K. Kumar     |
| 6:00 a.m.  | Mr. R. Ramani       |
| 5:50 a.m.  | Dr. A. Bhattacharya |
| 5:40 a.m.  | Shri R. Ramani      |
| 5:30 a.m.  | Dr. N. Prasad       |
| 5:20 a.m.  | Dr. K. K. Kumar     |
| 5:10 a.m.  | Mr. R. Ramani       |
| 5:00 a.m.  | Dr. A. Bhattacharya |
| 4:50 a.m.  | Shri R. Ramani      |
| 4:40 a.m.  | Dr. N. Prasad       |
| 4:30 a.m.  | Dr. K. K. Kumar     |
| 4:20 a.m.  | Mr. R. Ramani       |
| 4:10 a.m.  | Dr. A. Bhattacharya |
| 4:00 a.m.  | Shri R. Ramani      |
| 3:50 a.m.  | Dr. N. Prasad       |
| 3:40 a.m.  | Dr. K. K. Kumar     |
| 3:30 a.m.  | Mr. R. Ramani       |
| 3:20 a.m.  | Dr. A. Bhattacharya |
| 3:10 a.m.  | Shri R. Ramani      |
| 3:00 a.m.  | Dr. N. Prasad       |
| 2:50 a.m.  | Dr. K. K. Kumar     |
| 2:40 a.m.  | Mr. R. Ramani       |
| 2:30 a.m.  | Dr. A. Bhattacharya |
| 2:20 a.m.  | Shri R. Ramani      |
| 2:10 a.m.  | Dr. N. Prasad       |
| 2:00 a.m.  | Dr. K. K. Kumar     |
| 1:50 a.m.  | Mr. R. Ramani       |
| 1:40 a.m.  | Dr. A. Bhattacharya |
| 1:30 a.m.  | Shri R. Ramani      |
| 1:20 a.m.  | Dr. N. Prasad       |
| 1:10 a.m.  | Dr. K. K. Kumar     |
| 1:00 a.m.  | Mr. R. Ramani       |
| 12:50 a.m. | Dr. A. Bhattacharya |
| 12:40 a.m. | Shri R. Ramani      |
| 12:30 a.m. | Dr. N. Prasad       |
| 12:20 a.m. | Dr. K. K. Kumar     |
| 12:10 a.m. | Mr. R. Ramani       |
| 12:00 a.m. | Dr. A. Bhattacharya |

representatives of different lac based enterprises put forward their views on the theme subject of the symposium. A number of recommendations emerged from the deliberations which focused mainly on increasing internal consumption of lac.

**Objective**

The symposium aimed at formulating strategies to achieve the united goal of boosting the demand for lac and to create a favourable environment for sustenance and growth of the trade.

**Themes**

- \* Strategies for promoting domestic consumption of lac
- \* Sustenance and boosting foreign trade of lac

## SEMINAR, SYMPOSIUM, ETC. ORGANISED

A two-day National Symposium on "Strategies for Promotion of Lac Consumption" was organised on 14-15 May, 1998 to commemorate India's Golden Jubilee year of Independence. Out of nine papers received, four were presented. About 100 delegates representing lac industries, R & D organisations, Government organisations and extension workers from the states of Bihar, West Bengal, Orissa, Madhya Pradesh and Maharashtra attended the symposium. Representatives of different lac based enterprises put forward their views on the theme subject of the symposium. A number of recommendations emerged from the deliberations which focused mainly on increasing internal consumption of lac.

### Objective

The symposium aimed at formulating strategies to achieve the unified goal of boosting the demand for lac and to create a favourable environment for sustenance and growth of the trade.

### Themes

- Strategies for promoting domestic consumption of lac
- Sustenance and boosting foreign trade of lac

- Quality control
- Control of market influencing factors

### Programme

14.5.98

|   |                          |
|---|--------------------------|
| <b>Inaugural Session</b>  | <b>9.30-11.00 a.m.</b>   |
| Welcome song  | 9.30 a.m.                |
| Welcome address<br>by Director, ILRI, Ranchi  | 9.35 a.m.                |
| Lighting of Lamp  | 9.55 a.m.                |
| Release of Publications<br>of ILRI  | 10.00 a.m.               |
| Keynote address by<br>Dr. R. P. Kachru, ADG (PE)<br>ICAR, New Delhi   | 10.10 a.m.               |
| Address by<br>Sri Ranjeet Tibrewal<br>Sri V. K. Prasad<br>Sri Giriraj Kumar Agrawal<br>Sri Madhusudan Agarwal<br>Sri R. L. Sharma<br>Md. Sohail<br>Dr. M. A. Mohsin | 10.20 a.m.               |
| Address by the Chief Guest<br>Sri Rajeev Kumar, IAS<br>Managing Director<br>RIADA   | 11.00 a.m.               |
| Vote of thanks by<br>Dr. K. K. Kumar<br>Head, TOT, ILRI   | 11.15 a.m.               |
| Inauguration of Exhibition<br>TEA   | 11.20 a.m.<br>11.30 a.m. |

### Technical Session-I 12.00-1.30 p.m. Lac Production & Related Aspects

Chairman Dr. R. P. Kachru, ADG (PG) ICAR  
Rapporteurs Dr. P. Kumar, Head LPD and  
Dr. A. K. Jaiswal, Sc. (SS)

- Papers
- Production and export of Indian lac in 21st Century - a vision by Y. D. Mishra *et al.*
  - Strategic need for increasing the lac consumption among the tribals of Bastar, M.P. by M. A. Khan *et al.*
  - The participatory approach for consumption and enhancing the lac cultivation in tribal belt of Chhattisgarh region (M.P.) by P. R. Singh and S. L. Swamy
  - Scope and preliminary evaluation of performance of lac scraping, crushing and grading machine by R. Ramani *et al.*

LUNCH 1.30 - 2.30 p.m.

### Technical Session-II 2.30 - 4.30 p.m. Product Development & Lac Consumption

Chairman Dr. B. C. Mitra, Director, NIRJAFT, Calcutta  
Rapporteurs Dr. N. Prasad, Sr. Sc. and  
Dr. K. K. Sharma, Sc. (SS)

- Papers
- Role of refuse lacs/by-products in making particle boards/composites from agro-waste and in increasing domestic consumption of lac by B. C. Mitra *et al.*
  - Scope of lac as a raw material for production of bioactive and perfumery substances by L. N. Misra
  - Dyeing of cotton yarns with lac dye by S. Saxena *et al.*

- Lac products for twenty first century by S. K. Saha *et al.*
- Strengthening of lac industry in Balaghat by Krishi Vigyan Kendra by H. S. Singh *et al.*

15.5.98

### Technical Session-III 10.00-1.00 p.m. Open House Discussion

Chairman Dr. R. P. Kachru, ADG (PE), ICAR  
Rapporteurs Dr. K. K. Kumar, Head TOT &  
Shri R. Ramani, Sr. Sc.

LUNCH 1.00 - 2.00 p.m.

### Valedictory Session 2.00 - 4.30 p.m.

Chairman Dr. R. P. Kachru, ADG (PE), ICAR  
Rapporteurs Dr. S. C. Agarwal, Dr. K. K. Kumar

- Presentation of reports of different technical sessions by the Rapporteurs
- Finalisation of recommendations

Vote of thanks Dr. K. K. Kumar, Convenor  
Head, TOT

### Recommendations

- Concerted effort should be made to increase the internal consumption of lac to at least 50% to reduce dependency on overseas market and thereby bringing stability in the price of lac and growth of lac industry.
- Internal demand for lac should be extended by market research and through awareness programme for the potential consuming industries.
- Production of value-added products based on lac should be encouraged to suit domestic as well as external market.

- R & D effort should be made for development/improvement of lac based products with high market potential for conventional and novel applications.
- Lac - based particle boards appear to have good potential as a substitute for wood in packaging industries. Avenues should be explored for making particle boards based on agro-waste and lac by-products to promote it as a small-scale industry.
- Lac dye has an emerging market, concerted efforts should be made to push its use in suitable areas.
- Lac industries should make effort to diversify their product lines in select fields to increase the internal consumption of lac.
- Lac industries should try to follow BIS/ISO specifications for their products to meet market quality level. The ILRI is ready to provide the facilities for the quality control.
- Free movement of lac should be allowed within the country by lifting inter-state restrictions to create a healthy environment for smooth production and marketing of the commodity.
- A mechanism may be evolved in the interest of lac growers for an effective minimum support price for lac especially, during distress sale.
- An efficient and reliable model for forecasting of yield of lac crop should be developed.
- The lac scraping, crushing and grading machine may be popularised in co-operative sector. Further improvement of machine may be taken up to suit the industrial requirement.
- A quarterly News-letter on lac may be brought out regularly for information flow among various lac related organisations and industries.
- A body on lac may be constituted consisting of R & D units, industries, cultivators, consumers, State/Central agencies, GOs, NGOs, to deal with the various problems related to production, processing and marketing of lac.

#### Kisan Mela

A one-day *Kisan Mela* organised by the institute on 17th January, 1998. Chief guest Dr. M. A. Mohsin, VC, Birsa Agricultural University, Ranchi inaugurated the mela and Swamy Shashankanand of Divyayan Krishi Vigyan Kendra chaired the function.

About 400 farmers especially lac cultivators including farm women of neighbouring villages attended the mela. A *Kisan Goshthi* was also organised for the benefit of the farmers wherein queries relating to lac cultivation were attended to.



Inaugural ceremony of the symposium on "Strategies for Promotion of Lac Consumption" at the Institute



Technical session of the symposium on Strategies for Lac Consumption in progress

Various organisations i.e., ILRI, KRIBHCO, IFFCO, Central Tasar Research and Training Institute, Central Horticultural Experiment Station, Divyayan KVK and some business establishments put up

impressive stalls depicting different aspects of Lac cultivation, Agriculture, Horticulture, Fish farming, Home Science and Animal Husbandry. The *Kisan Mela* generated an enthusiastic response among the farmers.



Inaugural ceremony of the Kisan Mela organized by the Institute

## DISTINGUISHED VISITORS

The museum has always attracted visitors from all walks of life. During the period under report, about 1815 persons visited the museum and gained knowledge about lac. Some of the distinguished visitors were :

- Dr. G. D. Diwakar, P.S., ICAR, Krishi Bhavan, New Delhi.
- Dr. R. P. Kumar, All India Institute of Medical Sciences, New Delhi - 110 024.
- Prof. Amitabh Chatterjee, Head of Div., Deptt. of Lib. and Information Science, Jadavpur University, Calcutta - 700 037.
- Mr. D. K. Manavalan, IAS, M D TRIFED, Ministry of Welfare Govt. of India, Khel Gaon Marg, New Delhi - 110 016.
- Mrs. Olive Tigga (Kujur), Distt. Agri. Officer, Ranchi.
- Mr. Surya Narayan Sharma, LRO, DAO, Ranchi.
- Dr. S. C. Joshi, Assistant Director General (Media), IC FRE, Dehradun, (U.P.).
- Mr. Rajeev Kumar, IAS, MD, RIADA, Ranchi.
- Dr. B. C. Mitra, Director, NIRJAFT, Regent Park, Calcutta (W.B.).
- Dr. H. D. Kulkarni, Dy. Chief Manager (PR), ITC, Bhasachalam, 106, Sardar Patel Road, Secundrabad (A.P.).
- Mr. D. N. Rao, JNU, New Delhi.
- Dr. (Mrs.) Niva Bara, BAU, Kanke, Ranchi.
- Dr. N. B. Singh, ADG (OP), Crop Science Div., ICAR, New Delhi.
- Dr. H. D. Das, Principal Acctt. General, Bihar.
- Dr. (Mrs.) R. Veeregowda, Principal Scientist, IIHR, Bangalore.
- Dr. Premal Gautam, Director, NBPGR, New Delhi - 110 012.
- Sri Laksman Prasad, Officiating Director, Udhimita Vikas Sansthan, Patna.
- Col. Y. K. Goorha, Sr. Advisor, Pathology, Command Pathology Lab., Lucknow.

### Foreign Visitors

- Mr. Timmyt Tom Kottle, BERG. Kanke, International Corporation, 411, Heodok Hend Ave, Rye-Hy, USA 70580.
- Dr. Steinhoff, Moscow, Idaho, USA.
- Mr. Charks R Math, College of FWR, University of Idaho, Moscow, ID, USA 83843.
- Mr. Charles W McKetta, Forest Economist, Moscow, Idaho, USA.
- Mr. David Quintan, Kane International, 401E-Jensen St. 2400 Tampa, FL 33629, USA.
- Mr. Helen Grouas, Cornwell, UK.
- Mr. M. J. Swinkicol, Cornwell, UK.

## PERSONNEL

(As on 31.12.1998)\*

| Name  | Designation                                     |
|---|---|
| Dr. S. C. Agarwal   | Director  |
| <b>Division of Lac Production</b>                         |   |
| Dr. P. Kumar  | Principal Scientist & Head of the Division      |
| <b>Division of Lac Processing and Product Development</b> |   |
| Dr. S. K. Saha  | Principal Scientist & Head of the Division      |
| <b>Division of Transfer of Technology</b>                 |   |
| Dr. K. K. Kumar   | Head of the Division                            |
| <b>R.F.R.S., Dharamjaigarh, M.P.</b>                      |   |
| Dr. S. K. Jaipuriar                                       | Senior Scientist (Agric. Entomol.) I/c          |
| <b>R.F.R.S., Balarampur, W.B.</b>                         |   |
| Dr. A Bhattacharya  | Senior Scientist (Agric. Entomol.) I/c          |
| <b>Administrative Section</b>                             |   |
| Sri S. Veeraswami   | Administrative Officer                          |
| Sri R. K. Singh   | Finance & Accounts Officer (Joined on 28.12.98) |
| <b>Director's Cell</b>                                    |   |
| Sri Ramesh Prasad   | Technical Officer (T-6) Lab.                    |
| <b>Library</b>  |   |
| Sri R. P. Tewari  | Technical Officer (T-5)                         |
| <b>Quality Control (Testing Lab.)</b>                     |   |
| Sri D. Ghosh  | Technical Officer (T-5) Lab.                    |
| <b>Farm Unit</b>  |   |
| Dr. B. P. Singh   | Senior Scientist (Agronomy), I/c                |
| <b>Maintenance and Workshop Unit</b>                      |   |
| Sri S. K. Srivastava                                      | Technical Officer (T-5)                         |
| <b>Hindi Cell</b>   |   |
| Sri Lakshmi Kant  | Asstt. Director (O. L.)                         |
| <b>Medical Unit</b>                                       |   |
| Dr. N. P. Sahu, M.D.                                      | Authorised Medical Attendant (Part-time)        |

\* See Appendix II for details.

## INFRASTRUCTURE DEVELOPMENT



*Local Area Network (LAN) facility at the Institute*

- Local Area Network (LAN) has been established and made functional connecting all the major Divisions and Sections of the Institute.
- Internet connectivity has been installed at the institute by National Informatic Centre, New Delhi on 2nd November, 1998 through VSAT. The browsing facility has been configured and the facility is now available at all the terminals of LAN at the Institute.
- Initial phase of computerisation has been completed as a part of user facility for the in-house staff in the AGRIS, AGRICOLA and DIALOGWSCA databases. The search softwares and

CD-ROM discs have been obtained from the ARIC Office (ICAR), New Delhi. The DIALOG software for searching WSC4 database and CD-ROM disc have been obtained.

- The publicity wing of the Transfer of Technology Division has been equipped with a Gestetner Copyprinter 5385 for production of multiple copies for publicity and other materials of superior quality at a cheaper rate. The equipment is provided with six colour options and a computer interface for copying directly documents (up to A-3 size) composed on a computer.



*Copyprinter for mass copying of publicity literature*



## SUPPORT SERVICES

### Library and Documentation Centre

The library has been partially computerized with CD-ROM search facility. The library caters to the Information needs of the scientists of this Institute and the research scholars from other Institutions like BIT, Mesra, University of Ranchi, RIT, Jamshedpur, IIT, Kharagpur etc. The library resources are given below :

| Document holding     | Additions during 98-99 | Total |
|----------------------|------------------------|-------|
| Books (Bound vols.)  | 207                    | 23514 |
| Annual Reports       | 210                    | 3481  |
| Reprints/Photocopies | 22                     | 293   |
| Bulletins/Res. Notes | 4                      | 505   |

A total sum of Rs. 10 lacs was spent towards the purchase of books, journals, microdocuments etc. during the period. Most of the books and journals were purchased directly from the respective publishers.

Library continued to maintain exchange of ILRI publications with scientific institutions and libraries throughout the world. Details of periodicals received are given below :

| Particulars                                       | National | International |
|---|----------|---------------|
| No. of Journals subscribed                        | 70       | 29            |
| No. of Journals received in exchange or on gratis | 54       | 30            |
| Annual Reports                                    | 112      | 15            |

**Computerization :** Initial phase of computerization has already been completed as a part of user facility for the in-house staff in the AGRIS, AGRICOLA and DIALOG-WSCA databases search softwares. CD-ROM discs have been obtained from the ARIC office (ICAR), New Delhi. The DIALOG software for searching WSCA database and CD-ROM disc has been obtained on complimentary basis as a demodisc with the courtesy of M/s Globe Publications Pvt. Ltd., Calcutta.

Efforts are being made to start the feeding of articles through KWIC platform into AGRIS/AGRICOLA database through ARIC, New Delhi in the field of forestry and allied agrobiological sciences.

### Farm Unit

Management, upkeep of Farm Plantation and landscaping area were continued. Hoeing, weeding and mulching operations were carried out in the plots of lac host plants. Unwanted and obnoxious weeds were eradicated from *ber*, *khair*, *kusum*, *putri* and *sisam* plots manually as well as by frequent ploughing. Seedlings of various species of lac host plants such as *kusum*, *ber*, *galwang*, *palas* and *khair* were raised in polythene bags as well as in nursery beds for filling up the vacant spaces in respective plots,

for research experiments and for distribution amongst trainees and farmers. Transplanting of seedling of host plant and irrigation works were also undertaken as and when required. For beautifying the landscaping area, seasonal flowers, shrubs and ornamented foliage especially, tuberose and gladiolus plants were planted at various places in the office campus.

#### Farm development activities

(a) Paddy (Mansuri MTU 7029 BRU, IR36 and Basmati 1310) transplanted in low lying areas of the institute plantation, in Plot Nos. 22 and 61, gave satisfactory yield. Inter cropping system was introduced during *kharif* season by integrating agricultural crops like, arhar, maize *gora* paddy in plot No. 30 and turmeric and colocasia in plot No. 29 in mixed plantation of *bhalia* and *galwang* plot.

(b) Seedlings of *kusum* (187), *ber* (45), *palas* (50), *khair* (50), *akashmani* (20) and *galwang* (25) were planted in their respective plots.

(c) Plot No. 61A and 70 were developed and utilised for cultivation of mustard during *rabi* season '97-98 and *ragi* during *kharif* 1998 respectively.

(d) Approximately, 600 trainee farmers, students from different corners of the country visited the Institute Farm under short and long

term training programmes organised by the T.O.T. Division of the Institute. Proper arrangements were made to acquaint them with lac insect, lac hosts and about improved techniques for lac cultivation etc.

Total return from the Farm was Rs. 20,000 by sale of farm produce such as vegetables, paddy, ragi, soya bean, mustard, seedling of plants, seasonal flowers, straw and firewood and also from monthly contract for grass cutting.

#### Workshop-cum-Maintenance Unit

The unit undertakes electrical maintenance work of entire office and lab buildings, residential quarters, street lights, pump houses, HT/LT substations and also electric supply through Gensets. Total electrical jobs undertaken during the period were 840. 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 undertakes monthly record of electricity consumption and billing in all residential quarters. It undertook 438 jobs for minor repair of instruments/equipments. A total of 1053 jobs were undertaken towards repair/overhauling of pumps, motors, starters, machining (lathe, Drilling, grinding, fabrication), electric/gas

welding and carpentry. The unit maintains water pipe line from the pumping station situated about 2.5 km away from the Institute at the bank of Swarnarekha river and also the pipe lines within the various establishments/residential quarters of the Institute.

### **Health Care Unit**

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A part-time Authorised Medical

Attendant visits the Institute Dispensary to attend to the medical needs of the staff and their dependents on the working days. He is supported by one Stockman-cum-compounder and an attendant. During the period, 6374 patients were attended to, 105 patients were referred to specialists at RMCH, Ranchi and six patients were admitted in the Institute's dispensary for medical treatment.

SUMMARY REPORT IN HINDI

Attendant visits the patients  
 Dispensary to attend to the medical  
 needs of the staff and their dependents  
 on the working days. He is supported  
 by one Stockist cum compounder  
 and an attendant. During the period,  
 634 patients were attended to, 102  
 patients were referred to specialists at  
 BML Hospital and six patients were  
 admitted in the Institute's dispensary  
 for medical treatment.

welding and carpentry. The unit  
 includes water pipe line from the  
 pumping station situated about 5 km  
 away from the Institute at the bank  
 of Swarnarekha river and also the  
 pipe lines within the various  
 establishments/residential quarters of  
 the Institute.

Health Care Unit

A part-time Authorized Medical

**SUMMARY REPORT IN HINDI**

## प्रस्तावना



अनुसंधान एक निरंतर चलने वाला प्रयास है, किसी तकनीकी को जितना ही पूर्ण बनाया जाता है तो भी उसमें सुधार की आवश्यकता प्रतीत होती है। अनुसंधान का क्षेत्र जितना बड़ा बनाया जाय उसमें फिर भी उतनी ही और अधिक नये क्षेत्र में ध्यान देने की आवश्यकता होती है। भारतीय लाख अनुसंधान संस्थान जैसे एक अनुप्रयुक्त अनुसंधान संस्थान होने के कारण अनुसंधान कार्यक्रमों के चयन में उपभोक्ताओं के मांग, विशेष कर लाख की उपयोगिता को ध्यान में रखते हुए विशेष रूप से अति इन्द्रिय गोचर होना चाहिए। साथ ही साथ भारतीय कृषि

अनुसंधान परिषद् के समस्त संस्थानों में पंचवर्षीय पुनरावलोकन से प्राप्त निर्देशों/सलाहों के अनुरूप नियमित रूप से ऐसे प्रयास किए जाने चाहिए। गत पांच वर्षों की अवधि में किए गए प्रगति एवं संस्थान के अनुसंधान कार्यक्रम अपनाने हेतु पंचवर्षीय पुनरावलोकन दल ने अनुशंसा की है। उक्त अनुशंसा को भारतीय कृषि अनुसंधान परिषद् से अनुमोदन प्राप्त हो चुका है जो आगामी पांच वर्षों के लिए शोध कार्यों में दिशा-निर्देश का कार्य करेगी।

हाल के कुछ वर्षों में लाख के बाजार में पुनः अस्थिरता देखना पड़ा है, फलस्वरूप भारतीय लाख को विदेशी बाजार पर निर्भर होना पड़ा। भारतीय लाख के लिए मुख्य रूप से उचित एवं स्थायी बाजार तैयार करने हेतु इस संस्थान में 'लाख की खपत में वृद्धि हेतु उपाय' विषय पर दो दिवसीय राष्ट्रीय संगोष्ठी का आयोजन किया गया। इस संगोष्ठी में विचार विमर्श के पश्चात मुख्य रूप से अनुशंसा की गई कि विदेशी खरीदारों पर से निर्भरता को कम करने के लिए लाख के घरेलु खपत में वृद्धि की जाए।

इस संगोष्ठी की दूसरी महत्वपूर्ण अनुशंसा के परिणामस्वरूप रांची औद्योगिक क्षेत्र विकास प्राधिकरण के प्रबंध निदेशक की अध्यक्षता में लाख की संचालन समिति गठित की गई। इस समिति की पहली बैठक में मुख्य रूप से अनुशंसा की गई है कि :

- (1) लाख के लिए अनुकूल बाजार तैयार करने हेतु चपड़ा निर्यात संवर्धन परिषद् के उद्देश्यों को पुनर्भाषित कर लाख की घरेलु खपत में वृद्धि को भी शामिल किया जाय।
- (2) परिषद् को देश में उत्पादित लाख को क्रय कर चौरी के रूप में भंडारण कर एवं बाजार की मांग के अनुरूप लाख को प्रचालित करने की सहमति व्यक्त की गयी। यह लाख के मूल्य में स्थिरता लाने में सहायक होगा।

*(सतीश चन्द्र अग्रवाल)*  
(सतीश चन्द्र अग्रवाल)

निदेशक

## कार्यकारी सारांश

भारतीय लाख अनुसंधान संस्थान लाख के अनुसंधान एवं विकास के क्षेत्र में एक अग्रणी संस्थान है। उद्योग एवं उत्पादकता की बदलती जरूरतों के अनुरूप संस्थान अपने कार्यक्रमों की सतत समीक्षा करती रहती है क्योंकि प्रौद्योगिकी का विकास एवं उन्हें अपनाया जाना प्रत्यक्ष रूप से इसी से जुड़ा है। लाख के उत्पादन एवं उपयोग में वृद्धि हेतु अनुसंधान संबंधी सहयोग प्रदान करने के लिए संस्थान हमेशा प्रयत्नशील है। रिपोर्ट की अवधि में विभिन्न मोर्चों पर संस्थान द्वारा की गई प्रमुख प्रगति का सारांश निम्नवत है।

### अनुसंधान

संस्थान के अनुसंधान कार्यक्रमों को दो विभागों - लाख उत्पादन विभाग तथा लाख संसाधन एवं उत्पाद विकास विभाग के अन्तर्गत संचालित किये जाते हैं। उपरोक्त क्षेत्र में किये गए महत्वपूर्ण योगदान निम्नलिखित हैं :

### लाख उत्पादन

सरत, मयूरभंज (उड़ीसा) से एक वर्ष में तीन फसल देने वाला लाख कीट को संग्रहित किया गया है जो कुसुम पर अच्छा प्रदर्शन करता है, इससे लाख उत्पादन की वृद्धि के क्षेत्र में एक बड़ी उपलब्धि अपेक्षित है।

अफ्रीकन मूल की एक विदेशी पौध प्रजाति एडेनसोनिया डिजीटाटा (फेमिली-वॉम्बेकेसी) को नये लाख परिपालक के रूप में रिकार्ड किया गया है एवं पौध पर पल रहे सफल लाख कीटों की पहचान केरिया फीसी के रूप में की गई है।

फफूंद मरणशीलता लाख की फसल को प्रभावित करने वाला एक महत्वपूर्ण कारण है। फफूंद

की तीन नई प्रजातियां एस्परगिलस एवामोरी, एंटेरिकोला एवं पेनीसीलीयम साईट्रीनम को लाख कीट से जुड़ा पाया गया।

लाख कीट के परभक्षियों, लाभकारी एवं प्रतिकूल परजीवियों को पृथक करने के लिए लाखनाशी कीट प्रबन्धन की एक सक्षम उन्नत सरल स्वदेशी उपकरण विकसित की गई है।

बेर के वृक्ष के कुल उपलब्ध प्ररोह की लम्बाई का आकलन करने के लिए वृक्ष की धड़ के पारगामी खण्डीय क्षेत्र जैसे आसानी से मापे जाने वाले मानदंडों पर आधारित एक नया तरीका विकसित किया गया है।

कुसमी वीहन लाख का उपयोग कर बेर के वृक्ष पर आच्छादन (कवरेज) एवं उपयोग किये गए वीहन दर के बीच एक नकारात्मक सह संबंध पाया गया।

अगहनी फसल के एक माह आयु के कुसमी लाख कीट पर कुछ कीटनाशियों एवं फफूंद नाशियों के प्रयोग की जाँच से पता चला कि तीन वाणिज्यिक फफूंदनाशी सूत्रण (0.01% तक) सुरक्षित है।

पाँच परजीवियों के अण्डों का प्रयोगशाला में प्रजनन करवाया गया एवं पहली बार दो प्रमुख लैपिडोप्टेरस लाख कीट परभक्षी पर उनके परजीवीकरण क्षमता का मूल्यांकन किया गया।

प्रयोगशाला की स्थितियों में क्राईसोपा प्रजाति के अण्डों का टेलैनोमस रेमस परजीवी के अण्डों द्वारा सफलतापूर्वक परजीवीकरण किया गया।

लाख आधारित कृषि वानिकी फसल मॉडल के अन्तर्गत अगात किस्म के कुसमी कीट का उपयोग कर फ्लैमेंजिया सेमियालाटा एवं एफ. मैक्रोफाइला के मूल्यांकन से प्रति झाड़ी 189 ग्राम छिल्लीलाख का

उत्पादन कर एफ. सेमियालाटा ने बेहतर प्रदर्शन किया। उपलब्ध परिस्थितियों में परीक्षण किये गए अन्य फसलों की तुलना में नेनवा की फसल अच्छी रही।

उच्चतर पौध घनत्व की स्थिति में जेठवी 1998 फसल के लिए लाख की खेती हेतु आकाशमणि के प्रबन्धन पर किये गए अध्ययन का प्रदर्शन बहुत अच्छा रहा।

जीवद्रव्य के विभिन्न लाख कीट स्टॉकों की तुलना से रेजीन डाई के स्तर प्रति मादा रेजीन की उत्पादकता, जननशक्ति इत्यादि में उल्लेखनीय अन्तर देखा गया।

विभिन्न फलेमैजिया प्रजातियों में कुछ पौधों तथा लाख कीट गुणों के बीच उल्लेखनीय सह संबंध पाये गए हैं।

### लाख संसाधन एवं उत्पाद विकास

चौरी (ताजा एवं पुराना), किरि एवं छिल्लीलाख से वाणिज्यिक स्तर पर एल्यूरिटीक अम्ल के सीधे पृथक्करण की अवस्थाओं को मानकीकृत किया गया।

लकड़ी की पॉलिश के लिए मोमरहित लाख पर आधारित एक वार्निश विकसित किया गया जो मेलफोलैक का सस्ता विकल्प है।

खाद्य के लिए, एक धातु लैकर मिश्रण भी विकसित किया गया है जो आइ. एस. : 5818 (1988) के अनुरूप ज्यादातर परीक्षणों पर खरा उतरता है।

नाशीकीट प्रबन्ध कार्यक्रम में प्रभावी ढंग से उपयोग में लाये जा रहे कीट लिंग फीरोमोन को सरलीकृत अभिक्रिया क्रम को अपनाकर एल्यूरिटीक अम्ल से संश्लेषित किया गया है।

आई. पी. आर. पद्धति के अन्तर्गत लाख के छः प्रविधियों (प्रोसेस)/उत्पादों के औपबन्धिक स्वत्वाधिकार के लिए परिषद् में आवेदन दिये गए हैं।

### प्रौद्योगिकी हस्तांतरण

#### प्रसार अनुसंधान

किसानों के द्वारा लाख परिपालकों की उपलब्धता एवं दोहन तथा लाख एवं अन्य फसलों से आय पर राँची जिला के चार ग्रामों के समूह में एक सर्वे किया गया है। कृषि उत्पाद से कुल मिलने वाली आय का 28% लाख उत्पादन से होता है जिसका स्थान धान के बाद दूसरा है। तीन प्रमुख परिपालकों में लाख से आय में पलास का योगदान 47% रहा। इन परिपालकों से दोहन का स्तर 51 से 70% तक रहा।

#### प्रशिक्षण एवं विशेष कार्यक्रम

प्रौद्योगिकी हस्तांतरण विभाग लाख के विभिन्न पहलुओं पर किसानों, छात्रों, प्रशिक्षुओं, परिवीक्षा अधिकारियों एवं उद्यमियों के लिए अनेकों प्रशिक्षण कार्यक्रम आयोजित करता है। सात व्यक्तियों ने लाख की खेती पर सफलता पूर्वक प्रमाण पत्र पाठ्यक्रम पूरा किया। एक दिवसीय अभिविन्यास/प्रदर्शन कार्यक्रम के अन्तर्गत 1533 किसानों, छात्रों एवं प्रशिक्षुओं को लाभान्वित किया गया। एक सप्ताह के कार्यक्रम के अन्तर्गत बत्तीस किसानों को भी लाख की खेती के उन्नत तरीकों का प्रशिक्षण दिया गया। विभिन्न ग्रामों में प्रक्षेत्र में आयोजित प्रशिक्षण शिविर में 1800 से ज्यादा किसानों ने भाग लिया। सात उद्यमियों को एल्यूरिटीक अम्ल/विरंजित लाख के लिए प्रविधियों की जानकारी दी गई। लाख प्रसंस्करण ईकाइयों के तीन व्यक्तियों को लाख की जाँच एवं विश्लेषण के लिए प्रशिक्षित किया गया।

### सफलता की कहानी

राँची जिला के ओरमांडी प्रखंड के जीरावार गाँव में संस्थान द्वारा प्रायोजित किये गए एक किसान को पलास के वृक्ष पर लाख की खेती की जानकारी दी गई। उसने खंड पद्धति के अन्तर्गत लगभग 450 वृक्षों पर लाख लगाकर चार लाख फसलों से करीब रु० 21,275 का लाख उत्पादन किया।

### प्रचार गतिविधियाँ

संस्थान में 17 जनवरी 1998 को एक किसान मेला आयोजित किया गया। संस्थान ने बारह प्रदर्शनियों एवं किसान मेला (भारतीय विज्ञान वीजन प्रदर्शनी, इन्डिया गेट लॉन एवं भारतीय अन्तर्राष्ट्रीय व्यापार मेला, प्रगति मैदान, नई दिल्ली में स्टॉल लगाना इनमें शामिल है) में भाग लिया। लाख की खेती संबंधी प्रौद्योगिकी का आकाशवाणी एवं दूरदर्शन के माध्यम से प्रचार किया गया (सात कार्यक्रम)।

### संस्थान के प्रकाशन

इस अवधि में संस्थान ने 3 पुस्तक, 11 फोल्डर/पत्रक, 02 न्यूज लेटर प्रकाशित किये।

### क्यू०आर०टी० (पंचवर्षीय पुनरीक्षण दल) रिपोर्ट

भा०ला०अनु०सं० की पंचवर्षीय पुनरीक्षण दल ने अपनी रिपोर्ट को अन्तिम रूप देकर जमा किया जिसे भा०कृ०अनु०प० का अनुमोदन मिल गया है।

आर०ए००सी० (अनुसंधान परामर्श समिति) ने भी अपनी वार्षिक बैठक में चलाए जा रहे अनुसंधान कार्यक्रमों का पुनरीक्षण किया। इस वर्ष से आर०ए००सी० तथा आई०एम०सी० (संस्थान प्रबन्धन समिति) दोनों को पुनर्गठित किया गया।

### लाख पर प्रशिक्षण सह प्रदर्शन केन्द्र

भा०ला०अनु०सं० तथा कुटीर एवं लघु उद्योग निदेशालय, पं० बंगाल सरकार के बीच दिनांक 12.02.98 को बलरामपुर में लाख के प्रशिक्षण सह प्रदर्शन केन्द्र खोलने के समझौता ज्ञापन पर हस्ताक्षर किये गए। संस्थान को कार्यालय के लिए निःशुल्क भवन एवं बेराडा, पुरूलिया में 4600 पलास वृक्षों का एक फार्म उपलब्ध कराया गया है।

### अवसंरचना संवर्द्धन

इन्टरनेट संबंध - राष्ट्रीय सूचना केन्द्र के द्वारा इन्टरनेट से संपर्क स्थापित किया गया है तथा इस सुविधा को एल०ए०एन० के माध्यम से सभी अनुसंधान विभागों एवं महत्वपूर्ण अनुभागों तक पहुँचाया गया है।

### कॉपी मुद्रण सुविधा

प्रौद्योगिकी हस्तांतरण विभाग के प्रचार खण्ड को बड़ी संख्या में प्रतियों के शीघ्र प्रकाशन के लिए कम्प्यूटर इन्टरफेस के साथ गेस्टेटनर कॉपी प्रिन्टर 5385 उपलब्ध कराई गई है।



## परिचय

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

आरम्भ में कीट विज्ञान अनुभाग संस्थान की प्रमुख ईकाई थी तथा जैव रसायन अनुभाग उसकी सहयोगी थी। तत् पश्चात् 1920 के दशक में अनुप्रयुक्त अनुसंधान के लिए भौतिक रसायन अनुभाग बना। तदुपरांत इन दोनों रसायन अनुभागों को मिलाकर एक रसायन विभाग बना। इस तरह इस संस्थान का कार्यक्षेत्र कीट वैज्ञानिक एवं रासायनिक दोनों पहलुओं तक फैल 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 गोन्दिद्या (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 दिसम्बर से जून के बीच औसत न्यूनतम मासिक तापक्रम 8.3° से. से 25.0° से. है। इस बीच तथा औसत अधिकतम मासिक तापक्रम जुलाई से मई के बीच 21.4° से. से 37.5° से. के बीच रहा। इस अवधि में कुल वर्षा 1679.0 मी.मी. हुई जिसमें मानसून की वर्षा 1129.5 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।

### वर्तमान 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 परिवर्तन 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 केन्द्रीत किया है। कई उत्पाद एवं प्रक्रियाएं विकसित की गई हैं। 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 संयंत्र 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 पद्धति 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 स्क्व 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 हैं।

### बजट

1998-99 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       | बजट अनुमान<br>98-99<br>(रु.लाख) | संशोधित अनुमान<br>98-99<br>(रु.लाख) | वास्तविक<br>व्यय<br>(रु.लाख) |
|------------------|---------------------------------|-------------------------------------|------------------------------|
| <b>योजना</b>     |                                 |                                     |                              |
| स्थापना शुल्क    | 10.00                           | -                                   | -                            |
| वेतन             | -                               | -                                   | -                            |
| समयोपरि भत्ता    | -                               | -                                   | -                            |
| यात्रा भत्ता     | 2.00                            | 2.50                                | 2.47                         |
| उपकरण समेत       | 53.00                           | 50.50                               | 49.49                        |
| कार्य            | 55.00                           | 35.00                               | 34.77                        |
| कुल              | 120.00                          | 88.00                               | 86.73                        |
| <b>गैर योजना</b> |                                 |                                     |                              |
| स्थापना शुल्क    | 249.00                          | 306.95                              | 275.74                       |
| वेतन             | -                               | -                                   | -                            |
| समयोपरि भत्ता    | 0.05                            | 0.05                                | 0.05                         |
| यात्रा भत्ता     | 1.95                            | 2.50                                | 2.40                         |
| उपकरण समेत       | 19.00                           | 35.00                               | 32.06                        |
| कार्य            | -                               | 12.00                               | 9.49                         |
| स्वर्ण जयंती कोष | -                               | -                                   | 1.50                         |
| कुल              | 270.00                          | 356.50                              | 321.24                       |

## राजभाषा प्रकोष्ठ की गतिविधियाँ

### उद्देश्य

भारत सरकार के राजभाषा विभाग (गृह मंत्रालय) द्वारा तैयार किए गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम एवं नियमों के कार्यान्वयन हेतु भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली से समय-समय पर प्राप्त निर्देशों पर अनुवर्ती कार्रवाई तथा सरकारी काम-काज में राजभाषा हिन्दी के अधिकाधिक प्रयोग को बढ़ावा देने तथा प्रोत्साहन योजना को कार्यान्वित करने के अभिप्राय से संस्थान में राजभाषा प्रकोष्ठ का गठन किया गया है। इसमें एक सहायक निदेशक (राजभाषा) एवं एक हिन्दी अनुवादक कार्यरत हैं।

संस्थान के दैनिक कार्यों में हिन्दी के प्रयोग में प्रगति, हिन्दी को सर्वग्राह्य बनाने के लक्ष्य की प्राप्ति हेतु राजभाषा प्रकोष्ठ द्वारा निम्नलिखित कार्य सम्पादित किए जाते हैं :

- संस्थान राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन, कार्यसूची एवं कार्यवृत्त की तैयारी तथा लिए गए निर्णयों पर अनुवर्ती कार्रवाई।
- वार्षिक रिपोर्ट का सारांश, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा सूचना, कोटेशन एवं पत्राचार के विभिन्न सामग्रियों का अनुवाद।
- हिन्दीतर अधिकारियों/कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण कार्यक्रम में सम्मिलित होने के लिए नामित करवाना।
- हिन्दी दिवस, हिन्दी चेतना मास एवं हिन्दी के विभिन्न प्रतियोगिताओं का आयोजन।
- संदर्भ साहित्य, हिन्दी पत्रिकाएं, शब्दकोश एवं तकनीकी शब्दावलियों का उपार्जन।

- द्विभाषी मुहरों का निर्माण।
- प्रचार सामग्रियों, विवरणियों एवं सूचनाओं का संकलन तथा समाचार पत्र में प्रकाशन हेतु प्रेस विज्ञप्ति की तैयारी।
- नगर राजभाषा कार्यान्वयन समिति की बैठकों में सहभागिता एवं उनकी अनुशंसा का कार्यान्वयन।

### संस्थान राजभाषा कार्यान्वयन समिति

वर्ष 1998 में संस्थान राजभाषा कार्यान्वयन समिति में निम्नलिखित सदस्य थे :

|   |                     |
|---|---------------------|
| डॉ. सतीश चन्द्र अग्रवाल, निदेशक                                       | - अध्यक्ष           |
| डॉ. कौशल किशोर कुमार<br>अध्यक्ष, प्रौद्योगिकी हस्तांतरण विभाग         | - सदस्य             |
| डॉ. शिशिर कुमार साहा<br>अध्यक्ष, लाख संसाधन एवं उत्पाद<br>विकास विभाग | - सदस्य             |
| डॉ. प्रणय कुमार, अध्यक्ष<br>लाख उत्पादन विभाग                         | - सदस्य             |
| डॉ. भरत प्रसाद सिंह<br>वरीय वैज्ञानिक, प्रभारी, फार्म                 | - सदस्य             |
| श्री एस. विरास्वामी<br>प्रशासनिक अधिकारी                              | - सदस्य             |
| श्री राम प्रताप तिवारी<br>तकनीकी अधिकारी (पुस्तकालय)                  | - सदस्य             |
| डॉ. अंजेश कुमार<br>हिन्दी अनुवादक                                     | - आमंत्रित<br>सदस्य |
| श्री लक्ष्मी कान्त<br>सहायक निदेशक (रा. भा.)                          | - सदस्य<br>सचिव     |

वर्ष 1998 में संस्थान राजभाषा कार्यान्वयन समिति की बैठक दिनांक 20.1.98, 9.6.98 एवं 10.12.98 को आयोजित की गई जिसमें निम्नलिखित महत्वपूर्ण निर्णय लिये गये:

लाख उत्पादन की उन्नत विधि एवं लाख के औद्योगिक उपयोग पर पाठ्यपुस्तक का प्रकाशन।

- कम्प्यूटर प्रशिक्षण की व्यवस्था।
- शेष साइन बोर्डों की द्विभाषी रूप में तैयारी।
- संस्थान के उद्देश्य का द्विभाषी बोर्ड।
- रांची नगर स्तर पर अंताक्षरी प्रतियोगिता का आयोजन।
- प्रशासनिक एवं तकनीकी कर्मचारियों के लिए कार्यशाला का आयोजन।
- हिन्दी प्रकोष्ठ के लिए कम्प्यूटर की उपलब्धता।

उपरोक्त निर्णयों के आलोक में अंताक्षरी प्रतियोगिता एवं कार्यशाला का आयोजन किया गया। अन्य निर्णयों पर कार्रवाई की जा रही है।

### बैठक में सहभागिता

1. रांची नगर राजभाषा कार्यान्वयन समिति की दिनांक 20.2.98 को रांची जिला दूरसंचार मुख्यालय 'टेलीफोन भवन' में आयोजित बैठक में संस्थान की ओर से डॉ. सतीश चन्द्र अग्रवाल, निदेशक, श्री लक्ष्मीकान्त, सहायक निदेशक (रा. भा.) एवं श्री शरत चन्द्र लाल, कनीय लिपिक ने भाग लिया।

2. दिनांक 21.8.98 को मेकन के कम्प्यूनिटी हॉल में आयोजित न.रा.का.स. की बैठक में डॉ. कौशल किशोर कुमार, कार्यकारी निदेशक, श्री राम प्रताप तिवारी, तकनीकी अधिकारी (पुस्तकालय), श्री लक्ष्मी कान्त,

सहायक निदेशक (रा. भा.) एवं डॉ. अंजेश कुमार, हिन्दी अनुवादक ने भाग लिया।

### हिन्दी कार्यशाला का आयोजन

1. दिनांक 24.7.98 को संस्थान के प्रशासनिक कर्मचारियों के लिए एक हिन्दी कार्यशाला का आयोजन संस्थान के सम्मेलन कक्ष में किया गया जिसमें 32 (बत्तीस) प्रतिभागियों ने भाग लिया। श्री एस. विरास्वामी, प्रशासनिक अधिकारी ने इस अवसर पर व्याख्यान दिया।
2. दिनांक 20.8.98 को संस्थान के तकनीकी अधिकारियों/कर्मचारियों की एक कार्यशाला व्याख्यान कक्ष में आयोजित की गई जिसमें कुल 35 (पैंतीस) प्रतिभागियों ने भाग लिया। श्री राम प्रताप तिवारी, तकनीकी अधिकारी ने 'तकनीकी कार्यों में हिन्दी' विषय पर वक्तव्य दिया।

### अंताक्षरी प्रतियोगिता का आयोजन

नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में दिनांक 3.8.98 को संस्थान द्वारा अंताक्षरी प्रतियोगिता का आयोजन किया गया जिसमें संस्थान के अधिकारियों/कर्मचारियों सहित रांची स्थित केन्द्र सरकार के विभिन्न कार्यालयों के 35 (पैंतीस) प्रतिभागियों ने भाग लिया। इस प्रतियोगिता में प्रथम, द्वितीय एवं तृतीय स्थान प्राप्त करने वाले प्रतिभागियों को संस्थान द्वारा पुरस्कृत किया गया।

### पुरस्कृत

संस्थान में रांची नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में आयोजित अंताक्षरी प्रतियोगिता में संस्थान के वरीय लिपिक श्री प्रह्लाद सिंह को द्वितीय पुरस्कार तथा आयकर आयुक्त कार्यालय, रांची द्वारा



रा. का. स. राँची के तत्वावधान में संस्थान में आयोजित अंताक्षरी प्रतियोगिता

आयोजित वाद-विवाद प्रतियोगिता में श्री राम प्रताप तिवारी, तकनीकी अधिकारी को तृतीय पुरस्कार से सम्मानित किया गया।

#### व्याख्यान/प्रशिक्षण

क्षेत्रीय कार्यान्वयन कार्यालय, कलकत्ता के तत्वावधान में पूर्व और पूर्वोत्तर क्षेत्र के लिए सेन्ट्रल माइन प्लानिंग एण्ड डिजाइन इन्स्टीच्यूट लिमिटेड, कांके रोड, रांची में दिनांक 26-27 मार्च, 1998 को आयोजित क्षेत्रीय राजभाषा सम्मेलन में श्री लक्ष्मीकान्त, सहायक निदेशक (रा. भा.) शामिल हुए।

केन्द्रीय तसर अनुसंधान एवं प्रशिक्षण संस्थान, नगड़ी, रांची द्वारा आयोजित केन्द्रीय कर्मियों के लिए एक दिवसीय पूर्णकालिक हिन्दी कार्यशाला में दिनांक 10 जून 1998 को श्री लक्ष्मीकान्त, सहायक निदेशक (रा. भा.) ने 'हिन्दी में तार कैसे लिखे जाँये और तत्संबंधी नियमों' पर प्रशिक्षण दिया।

हिन्दी परिषद्, भारी अभियंत्रण निगम, रांची के तत्वावधान में दिनांक 12.10.98 को मेकन कम्युनिटी

हॉल में आयोजित 'हिन्दी सेवी सम्मान समारोह' में संस्थान के वैज्ञानिक, डॉ. सत्यानन्द सुशील एवं श्री लक्ष्मीकान्त, सहायक निदेशक (रा. भा.) ने भाग लिया।

#### हिन्दी दिवस समारोह

भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली की स्थानीय इकाई भारतीय लाख अनुसंधान संस्थान, नामकुम, रांची में दिनांक 19 सितम्बर 1998 को हिन्दी पखवाड़ा समापन एवं 'हिन्दी दिवस समारोह' का आयोजन किया गया। समारोह का उद्घाटन पारंपरिक रूप से दीप प्रज्वलित कर मुख्य अतिथि केन्द्रीय विद्यालय दीपाटोली, रांची की प्राचार्य डा. लालिमा वर्मा ने किया। स्वागत गान बाल कलाकार सुश्री कृषा डे, मौसमी डे, पार्थ डे एवं ज्योति लक्ष्मी ने किया।

केन्द्रीय विद्यालय, दीपा टोली की प्राचार्य डॉ. लालिमा वर्मा ने संस्थान के अधिकारियों एवं कर्मचारियों में राजभाषा हिन्दी के प्रति निष्ठा एवं सच्ची लगन की

जानकारी प्राप्त कर प्रसन्नता व्यक्त की तथा संस्थान के कार्य में हिन्दी की और प्रगति की संभावनाओं पर प्रकाश डाला।

संस्थान के निदेशक एवं अध्यक्ष राजभाषा कार्यान्वयन समिति डॉ. सतीश चन्द्र अग्रवाल ने अपने अध्यक्षीय भाषण में संस्थान के अधिकारियों एवं कर्मचारियों को प्रशासकीय तकनीकी एवं वैज्ञानिक कार्यों में बोलचाल की सरल भाषा का प्रयोग करने की अपील करते हुए आत्म सम्मान, राष्ट्र का उत्थान एवं राजभाषा



हिन्दी दिवस समारोह को संबोधित करती हुई मुख्य अतिथि डॉ. (श्रीमती) लालिमा वर्मा। मंच पर संस्थान के निदेशक, डॉ. सतीश चन्द्र अग्रवाल (दायें) एवं समारोह के अध्यक्ष डॉ. निरंजन प्रसाद

का मान बढ़ाने पर बल देते हुए कहा कि अनुसंधान का सीधा संबंध आम किसानों से है, अतः हमारी जिम्मेवारी है कि किसानों तक अनुसंधान की उपलब्धियां हिन्दी के माध्यम से पहुंचाई जाय। हिन्दी भाषा की सर्वव्यापकता एवं सरलता की चर्चा के क्रम में उन्होंने कहा कि हिन्दी भाषा संस्कृत से संस्कारित है और वह विश्व के अत्यंत वैज्ञानिक भाषाओं में गिनी जाती है। हिन्दी हम सबों की राष्ट्रभाषा, राजभाषा एवं सम्पर्क भाषा है। इसकी लिपि अत्यंत सरल है एवं अन्य भाषाओं के शब्दों को अपने आप में समाहित करने की अपार क्षमता रखती है।

वर्तमान पीढ़ी में कम्प्यूटर की उपादेयता के महत्व के अनुसार संस्थान के सदस्यों को कम्प्यूटर प्रशिक्षण दिलवाने एवं कम्प्यूटरों में हिन्दी शॉफ्टवेयर लगवाने की उन्होंने इच्छा व्यक्त की, ताकि राजभाषा हिन्दी के प्रयोग में और गति लाने में अधिक सुविधा हो सके।

सहायक निदेशक (रा. भा.), श्री लक्ष्मी कान्त ने संस्थान में हिन्दी की प्रगति प्रतिवेदन प्रस्तुत करने के क्रम में सूचित किया कि प्रशासनिक कार्यों में हिन्दी का प्रयोग तो होता ही रहा है परन्तु अब तकनीकी एवं वैज्ञानिक कार्यों में भी क्रमवार प्रगति हो रही है। हिन्दी में वैज्ञानिक गोष्ठियाँ नियमित रूप से आयोजित की जा रही हैं। संस्थान के सदस्यों के बीच हिन्दी में कार्य करने के वातावरण तैयार करने के लिए हिन्दी की विभिन्न प्रतियोगितायें आयोजित की जाती हैं तथा सफल प्रतिभागियों को पुरस्कृत किया जाता है। रांची स्थित केन्द्रीय सरकार के कार्यालयों के अधिकारियों एवं कर्मचारियों के लिए नगर स्तरीय 'हिन्दी अंताक्षरी प्रतियोगिता' का आयोजन की शुरुआत की गई है। उन्होंने सादर निवेदन किया कि 'वह दिन ऐतिहासिक था जब भारत स्वतंत्र हुआ, वह दिन महत्वपूर्ण था जब भारत में गणराज्य की घोषणा हुई, वह दिन गौरवपूर्ण होगा - जब देश का प्रशासनिक कार्य राजभाषा हिन्दी में होगा'।

हिन्दी पखवाड़ा की अवधि में आयोजित हिन्दी को विभिन्न प्रतियोगितायों में प्रथम आने पर सर्वश्री कामेश्वर उरांव, कवल किशोर प्रसाद, प्रह्लाद सिंह, अमर कुमार सहाय, ध्रुवदेव प्रसाद एवं द्वितीय स्थान हेतु सर्वश्री रघुनाथ महतो, शरत चन्द्र लाल, बिहारी साहु, गनौरी सिंह, मदन मोहन, अनिल कुमार शर्मा तथा हिन्दी अंताक्षरी में विजयी दल के सदस्य सर्वश्री प्रह्लाद सिंह, कामेश्वर उरांव, अर्जुन शर्मा, इन्द्रदेव दास, हीरालाल भक्त तथा अर्जुन गोप को पुरस्कृत किया गया।

संस्थान से प्रकाशित हिन्दी पुस्तकें, बुलेटिनों एवं प्रचार पत्रकों के साथ-साथ केन्द्रीय सचिवालय हिन्दी परिषद् तथा भारतीय कृषि अनुसंधान परिषद् के हिन्दी प्रकाशनों की एक मनोरम प्रदर्शनी लगाई गई। 'हिन्दी का वर्तमान स्वरूप' विषय पर श्री राम प्रताप तिवारी ने रोचक व्याख्यान दिए। श्री बैजनाथ गोप ने नागपुरी लोकगीत, श्री कवल किशोर प्रसाद तथा श्री अर्जुन कुमार सिन्हा ने कविता पाठ किया, श्री रंगनादन रमणि ने हिन्दी के प्रति रोचक उद्गार प्रकट किए।

हिन्दी चेतना मास की अवधि में भारतीय कृषि अनुसंधान परिषद् के महानिदेशक डा. राजेन्द्र सिंह परोदा की अपील की प्रतियां वितरित की गई। धन्यवाद ज्ञापन हिन्दी दिवस समारोह आयोजन समिति के अध्यक्ष डा. निरंजन प्रसाद ने किया।

### संस्थान के हिन्दी प्रकाशन

लाख की खेती एवं उपयोग के क्षेत्र में संस्थान की उपलब्धियों के प्रचार हेतु नियमित रूप से पैम्फलेट, पत्रक इत्यादि के रूप में निष्कर्षों का प्रकाशन हिन्दी में किया जाता है, ताकि किसानों, उद्यमियों एवं प्रशिक्षणार्थियों के लिए समझ पाना एवं उन्हें अपना आसान हो। रिपोर्ट की अवधि में निम्नलिखित सामग्रियों का प्रकाशन हुआ :

1. पलास तथा बेर पर लाख की सम्मिलित खेती की उन्नत विधि
2. आर्ये सीखें उन्नत विधि से लाख की खेती
3. भारतीय लाख अनुसंधान संस्थान प्रशिक्षण विवरणिका
4. मुहर लगाने की लाख

### हिन्दी में वैज्ञानिक गोष्ठियों का आयोजन

लाख की खेती एवं इसके विभिन्न उपयोग के क्षेत्र में हुई वैज्ञानिक उपलब्धियों को लोकप्रिय बनाने

के लिए संस्थान में हिन्दी संगोष्ठी आयोजित की जाती है। रिपोर्ट की अवधि में निम्नलिखित वैज्ञानिकों ने सरल, रोचक एवं सारगर्भित व्याख्यान हिन्दी में दिये :

| क्र. वैज्ञानिक                                       | शीर्षक  | तिथि    |
|--|---|---------|
| 1. डा. केवल कृष्ण शर्मा<br>वैज्ञानिक<br>वरीय वेतनमान | हनी डियू के<br>मुख्य स्रोत के<br>रूप में लाख    | 23.5.98 |
| 2. डा. कृष्ण मोहन प्रसाद<br>वरीय वैज्ञानिक           | 'लाख के रंग'<br>उपयोग, गुण<br>एवं बनाने की विधि | 23.8.98 |

### अवसंरचना संवर्द्धन

1. संस्थान में स्थानीय क्षेत्र नेटवर्क (लान) स्थापित किया गया तथा सभी प्रमुख विभागों/अनुभागों से जोड़कर कार्ययोग्य बनाया गया।
2. नेशनल इन्फॉर्मेटिक सेन्टर, नई दिल्ली ने 02 नवम्बर 1998 को वी.एस.टी. के माध्यम से संस्थान में इन्टरनेट कनेक्शन लगाया गया। सूचना प्राप्ति की सुविधा संस्थान में लैन के सभी टर्मिनलों पर उपलब्ध है।
3. संस्थान के कर्मचारियों के उपयोग हेतु एग्रीस, एग्रीकोला एवं डायलोग्वास्का डाटविस के प्रारंभिक रूप से कम्प्यूटरीकरण का प्रथम चरण पूर्ण कर लिया गया है। भारतीय कृषि अनुसंधान परिषद्, नई दिल्ली के एरिक ऑफिस द्वारा सर्व सॉफ्टवेयर एवं सीडी रोम डिस्क को खोजने हेतु उपलब्ध कराया गया है।
4. प्रौद्योगिकी हस्तांतरण विभाग के प्रचार स्कंध को गेस्टेटर कॉपी प्रिंटर 5385 प्रचार एवं अन्य सामग्रियों की अनेकों प्रतियां की उत्तम किस्म की छपाई सस्ते दर पर करने के लिए उपलब्ध करवाया गया है। मशीन को 6 रंगों में छापने की विकल्प के साथ एवं कम्प्यूटर द्वारा कम्पोज्ड कागजात (4-3 आकार तक) सीधे प्रतिलिपि तैयार किया जा सकता है।



## Appendix - I

## Summary of Meteorological Data recorded at Namkum, Ranchi during 1998

| Month | Total rainfall | Mean relative humidity | Mean min. temp. | Mean max. temp. | Mean Dry bulb temp. | Mean wet bulb temp. | Highest max. temp. | Lowest min. temp. |
|-------|----------------|------------------------|-----------------|-----------------|---------------------|---------------------|--------------------|-------------------|
|       | (mm)           | (%)                    | (°C)            | (°C)            | (°C)                | (°C)                | (°C)               | (°C)              |
| Jan.  | 117.0          | 76.16                  | 9.33            | 21.45           | 16.54               | 14.46               | 25.0               | 6.6               |
| Feb.  | 25.0           | 74.07                  | 12.09           | 26.33           | 20.10               | 17.27               | 28.0               | 9.4               |
| Mar.  | 121.0          | 70.58                  | 14.01           | 28.34           | 22.44               | 18.92               | 34.0               | 11.0              |
| April | 49.0           | 79.40                  | 19.93           | 34.24           | 27.17               | 25.76               | 39.0               | 16.0              |
| May   | 89.0           | 79.54                  | 22.68           | 37.54           | 29.21               | 26.34               | 44.0               | 20.0              |
| June  | 211.0          | 79.83                  | 25.00           | 33.70           | 29.30               | 26.46               | 44.2               | 21.6              |
| July  | 209.5          | 85.70                  | 23.32           | 30.65           | 26.66               | 24.89               | 34.0               | 20.0              |
| Aug.  | 304.0          | 88.00                  | 22.86           | 30.90           | 26.92               | 25.36               | 34.0               | 21.6              |
| Sept. | 405.0          | 86.76                  | 22.33           | 30.49           | 26.09               | 24.39               | 34.0               | 20.5              |
| Oct.  | 144.5          | 82.09                  | 20.50           | 29.63           | 26.09               | 23.70               | 32.1               | 15.5              |
| Nov.  | 4.0            | 76.93                  | 15.79           | 28.30           | 22.15               | 18.70               | 33.0               | 10.0              |
| Dec.  | Nil            | 62.51                  | 8.30            | 25.75           | 18.69               | 14.50               | 28.0               | 5.5               |

The highest temperature - 44.2 °C on 3rd June 1998  
 The lowest temperature - 5.5 °C on 30th December 1998  
 Total rainfall during the period - 1679.0 mm  
 Monsoon rainfall (June-Sept.) - 1129.5 mm  
 Hailstorm - None

## Appendix - II

PERSONNEL  
(As on 31.12.1998)

| Name  | Designation  | Remarks               |
|---|--|-----------------------|
| Dr. S. C. Agarwal   | Director   | R.M.P.                |
| <b>Division of Lac Production</b>                         |  |                       |
| Dr. P. Kumar  | Head of Division   |                       |
| Dr. B. P. Singh   | Senior Scientist (Agronomy)                                    |                       |
| Dr. A. Bhattacharya                                       | Senior Scientist (Agric. Entomol.)<br>I/c R.F.R.S., Balarampur |                       |
| Sri S. C. Srivastava                                      | Senior Scientist (Plant Breeding)                              |                       |
| Sri G. Singh  | Senior Scientist (Soil Sc. & Agric. Chem.)                     |                       |
| Dr. S. N. Sushil  | Scientist (Agric. Entomol.)                                    |                       |
| Sri S. K. Yadav   | Scientist (Agronomy)   | Joined on 14.09. 1998 |
| Sri M. L. Ravidas   | Field/Farm Technician (T-II-3)                                 |                       |
| Sri R. D. Pathak  | Field/Farm Technician (T-II-3)                                 |                       |
| Sri K. P. Gupta   | Field/Farm Technician (T-II-3)                                 |                       |
| Sri K. A. Nagruar   | Field/Farm Technician (T-I-3)                                  |                       |
| Sri D. W. Runda   | Field/Farm Technician (T-2)                                    |                       |
| Sri R. G. Singh   | Field/Farm Technician (T-1)                                    |                       |
| Sri D. D. Prasad  | Lab. Technician (T-II-3)                                       |                       |
| Sri G. Das  | Lab. Technician (T-I-3)  |                       |
| Sri R. K. Swansi  | Lab. Technician (T-I-3)  |                       |
| Sri Mohan Singh   | Lab. Technician (T-I-3)  |                       |
| <b>Division of Lac Processing and Product Development</b> |  |                       |
| Dr. S. K. Saha  | P.S. and Head of the Division                                  |                       |
| Dr. P. C. Gupta   | Principal Scientist (Org. Chem.)                               |                       |
| Dr. D. N. Goswami   | Senior Scientist (Physics)                                     |                       |
| Dr. N. Prasad   | Senior Scientist (Org. Chem.)                                  |                       |
| Dr. R. N. Majee   | Senior Scientist (Org. Chem.)                                  |                       |
| Dr. K. P. Sao   | Senior Scientist (Physics)                                     |                       |
| Dr. K. M. Prasad  | Senior Scientist (Org. Chem.)                                  |                       |
| Sri P. M. Patil   | Scientist (Sr. Scale) (Phys. Chem.)                            |                       |
| Sri P. C. Sarkar  | Scientist (Org. Chem.)   |                       |
| Sri V. K. Rao   | Scientist (Org. Chem.)   |                       |

|                    |                         |                       |
|--------------------|-------------------------|-----------------------|
| Sri S. K. Pandey   | Scientist (Mech. Engg.) | Joined on 07.01. 1998 |
| Sri B. P. Banerjee | Technical Officer (T-5) |                       |
| Sri D. D. Singh    | Technical Officer (T-5) |                       |
| Sri N. K. Dey      | Technical Officer (T-5) |                       |
| Sri T. K. Saha     | Technical Officer (T-5) |                       |
| Sri Bhola Ram      | Lab Technician (T-II-3) |                       |
| Sri B. P. Ghosh    | Lab Technician (T-II-3) |                       |
| Sri Noas Minz      | Lab Technician (T-II-3) |                       |
| Sri B. P. Keshri   | Lab Technician (T-II-3) |                       |
| Sri Tulsi Ram      | Lab Technician (T-II-3) |                       |
| Sri P. B. Sen      | Lab Technician (T-I-3)  |                       |
| Smt. Prabha Devi   | Lab Technician (T-I-3)  |                       |
| Sri H. Das         | Lab Technician (T-1)    |                       |
| Sri S. K. Tirkey   | Lab Technician (T-1)    |                       |
| Sri Vinod Kumar    | Lab Technician (T-1)    |                       |
| Sri R. K. Rai      | Lab Technician (T-1)    |                       |

#### Division of Transfer of Technology

|                       |   |
|-----------------------|---|
| Dr. K. K. Kumar       | Head of the Division                    |
| Sri R. Ramani         | Senior Scientist (Agric. Entomol.)      |
| Sri Y. D. Mishra      | Scientist SG (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 Machin. & Power)        |
| Sri Lakhan Ram        | Publicity Officer (T-6)                 |
| Sri. L. C. N. Shahdeo | Technical Officer (T-5) Field/Farm      |
| Sri M. Ekka           | Technical Officer (T-5) Lab.            |
| Sri K. K. Prasad      | Technical 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)  |                    |
| <b>R.F.R.S, Dharamjaigarh, M.P.</b> |  |                    |
| Dr. S. K. Jaipuriar                 | Senior Scientist (Agric. Entomol.)<br>I/c, R.F.R.S., Dharamjaigarh, M.P. |                    |
| Sri A. Hussain                      | Lab. Technician (T-II-3)   |                    |
| Sri Jiwan Lal                       | Field/Farm Technician (T-I-3)  |                    |
| <b>R.F.R.S., Balarampur, W.B.</b>   |  |                    |
| Dr. S. Ghosal                       | Scientist (Agronomy)   |                    |
| Sri S. K. Mukherjee                 | Field/Farm Technician (T-1)  |                    |
| <b>Administrative Section</b>       |  |                    |
| Sri S. Veeraswami                   | Administrative Officer   |                    |
| Sri R. K. Singh                     | Finance & Accounts Officer   | Joined on 28.12.98 |
| Sri NagenDra Mahto                  | Asstt. Admin. Officer  |                    |
| Sri Md. Samiullah                   | Asstt. Admin. Officer  | w.e.f. 6.11.98     |
| Sri R. Rabidas                      | Sr. P.A. to Director   | w.e.f. 6.11.98     |
| Sri A. K. Yadav                     | Security Officer   | w.e.f. 30.12.98    |
| Smt. Sushanti Prasad                | Stenographer, Grade II   |                    |
| Sri A. K. Sinha                     | Stenographer, Grade II   |                    |
| Sri R. B. Singh                     | Assistant  |                    |
| Sri K. D. Pandey                    | Assistant  |                    |
| Sri K. N. Sinha                     | Assistant  |                    |
| Sri Budhan Ram                      | Assistant  |                    |
| Sri Ravi Shankar                    | Assistant  |                    |
| Sri Dudheshwar Ram                  | Assistant  |                    |
| Smt. Sati Guha                      | Assistant  |                    |
| Sri Sudershan Ram                   | Assistant  | w.e.f. 6.11.98     |
| Sri R. K. Upadhyay                  | Assistant  | w.e.f. 6.11.98     |
| Sri N. Topno                        | Assistant  | w.e.f. 6.11.98     |
| Sri Md. Mobarak                     | Assistant  | w.e.f. 6.11.98     |
| Sri Vijay Ram                       | Assistant  | w.e.f. 28.11.98    |
| Sri V. K. Rajak                     | Assistant  | w.e.f. 28.11.98    |
| Sri K. L. Chaudhury                 | 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                          | w.e.f. 6.11.98  |
| Sri Bihari Sahu                       | Sr. Clerk                          | w.e.f. 6.11.98  |
| Sri S. C. Lal                         | Sr. Clerk                          | w.e.f. 6.11.98  |
| Sri Raghunath Mahto                   | Sr. Clerk                          | w.e.f. 6.11.98  |
| Sri Wilson Guria                      | Sr. Clerk                          | w.e.f. 6.11.98  |
| Sri K. P. Oraon                       | Sr. Clerk                          | w.e.f. 28.11.98 |
| Sri Pranay Kumar                      | Sr. Clerk                          | w.e.f. 28.11.98 |
| Sri A. K. Tripathi                    | Jr. Clerk                          |                 |
| Sri R. K. Toppo                       | Jr. Clerk                          |                 |
| Sri Arjun Gope                        | Jr. Clerk                          |                 |
| Sri K. K. Deonath                     | Jr. Clerk                          |                 |
| Sri Samal Kumar                       | Jr. Clerk                          |                 |
| <b>Director's Cell</b>                |                                    |                 |
| Sri Ramesh Prasad                     | Technical Officer (T-6) Lab.       | w.e.f. 1.7.95   |
| Sri A. K. Sahay                       | Technical Officer (T-5) Field/Farm |                 |
| Sri D. Ganguly                        | Technical Officer (T-5) Lab.       |                 |
| <b>Library</b>                        |                                    |                 |
| Sri R. P. Tewari                      | Technical Officer (T-5)            |                 |
| Sri V. K. Singh                       | Technical Officer (T-5)            |                 |
| <b>Quality Control (Testing Lab.)</b> |                                    |                 |
| Sri D. Ghosh                          | Technical Officer (T-5) Lab.       |                 |
| Sri K. M. Sinha                       | Technical Officer (T-5) Lab.       |                 |
| Sri Jagdish Singh                     | Technical Officer (T-5) Lab.       |                 |
| Sri J. K. Ambuj                       | Lab. Technician (T-2)              |                 |
| Sri Ajay Kumar                        | Lab. Technician (T-1)              |                 |
| Sri Anup Kumar                        | Lab. Technician (T-1)              |                 |
| Sri BirenDra Kr. Singh                | Lab. Technician (T-1)              |                 |
| <b>Farm Unit</b>                      |                                    |                 |
| Dr. B. P. Singh                       | Sr. Sc., I/c                       |                 |
| Sri R. N. Vaidya                      | Technical Officer (T-5) Field/Farm |                 |
| Sri H. Bhengra                        | Field Farm Technician (T-4)        |                 |

|                                      |                                 |               |
|--------------------------------------|---------------------------------|---------------|
| Sri R. L. Ram                        | Field Farm Technician (T-II-3)  |               |
| Sri Satish Kumar                     | Field Farm Technician (T-I)     |               |
| Sri S. K. Tripathi                   | Field Farm Technician (T-I)     |               |
| Sri M. Surin                         | (T-I-3) Tractor Driver          |               |
| <b>Maintenance and Workshop Unit</b> |                                 |               |
| Sri S. K. Srivastava                 | Technical Officer (T-5)         |               |
| Sri S. K. Bhaduri                    | Technical Officer (T-5)         |               |
| Sri B. L. Dey                        | Boiler Attendant (T-II-3)       |               |
| Sri H. L. Bhakta                     | Instrument Mechanic (T-II-3)    |               |
| Sri I. Das                           | Asst. Mechanic (T-I)            |               |
| Sri K. Tirkey                        | Turner (T-I)                    |               |
| Sri Arjun Sharma                     | Carpenter (T-I)                 |               |
| Sri B. S. Choudhary                  | Glass Blower (T-I)              |               |
| Sri R. K. Ravi                       | Wireman (T-I)                   |               |
| <b>Transport</b>                     |                                 |               |
| Sri Bandhan Runda                    | Driver (T-I-3)                  |               |
| Sri Jaswant Tiwary                   | Driver (T-I)                    |               |
| Sri Narayan Lakra                    | Driver (T-I)                    |               |
| Sri Arvind Kumar                     | Driver (T-I)                    |               |
| <b>Hindi Cell</b>                    |                                 |               |
| Sri Lakshmi Kant                     | Asst. Director (O.L.)           |               |
| Dr. Anjesh Kumar                     | Hindi Translator (T-II-3)       |               |
| <b>Medical Unit</b>                  |                                 |               |
| Dr. N. P. Sahu, M.D.                 | Authorised Medical Attendant    |               |
| Sri C. Pandey                        | Stockman-cum-Comounder (T-II-3) |               |
| <b>Promotion</b>                     |                                 |               |
| Sri S. K. M. Tripathi (Retd.)        | T-8 to T-9                      | w.e.f. 1.1.95 |
| Sri M. Islam (Retd.)                 | T-5 to T-6                      | w.e.f. 1.7.95 |
| <b>Retired</b>                       |                                 |               |
| Sri A. H. Naqvi                      | Sr. Scientist                   | 31.1.98       |
| Dr. A. Pandey                        | Sr. Scientist                   | 31.1.98       |
| Sri Md. A. Ansari                    | T-II-3                          | 31.1.98       |
| Sri R. C. Maurya                     | T-5                             | 31.3.98       |

|                      |                     |          |
|----------------------|---------------------|----------|
| Sri K. C. Jain       | T-I - 3             | 30.6.98  |
| Sri S. G. Choudhary  | Scientist Sr. Scale | 31.10.98 |
| Sri R. K. Banerjee   | Scientist Sr. Scale | 30.11.98 |
| Sri S. K. Chatterjee | T-II - 3            | 30.11.98 |

**Expired**

|                      |                  |         |
|----------------------|------------------|---------|
| Dr. B. C. Srivastava | Sr. Scientist    | 23.3.98 |
| Sri Jharia Pahan     | S.G. II (Beldar) | 3.6.98  |
| Sri Tulsa Munda      | Pump Operator    | 1.6.98  |
| Sri Markus Kujur     | S.G. II (Mali)   | 18.7.98 |
| Sri R. S. Maliya     | T-4              | 19.8.98 |
| Sri Fatimas Xalxo    | S.G. II          | 8.12.98 |

**Transferred**

|                      |  |         |
|----------------------|--|---------|
| Sri D. Dhingra       | Scientist from ILRI to CIPHET, Ludhiana    | 24.1.98 |
| Smt. Sangeeta Chopra | Scientist from ILRI to CIPHET, Ludhiana    | 24.1.98 |
| Sri N. K. Sharma     | Farm Suptd. from ILRI to IARI, New Delhi   | 23.3.98 |
| Sri G. Singh         | Sr. Scientist from CARI, Portblair to ILRI | 20.3.98 |
| Sri Bandhonoo Uraon  | SSG (I) from Izzatnagar to ILRI            | 7.12.98 |

**Regularisation of Temporary Status to S.S.G. I w.e.f. 6.11.98**

Sri Mangal Mahto  
 Sri Paulus Lakra  
 Sri Lodo Lakra  
 Sri Jatru Mahto  
 Sri Raju Tirkey  
 Sri Johan Lakra  
 Sri Rupu Ram  
 Sri Sadho Mahto

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Indian Lac Research Institute, Ranchi

Page 32, Para 2, line 9

Lac host based agroforestry cropping model for tanr I (bari) land

Instead

*Ber* and *galwang* were planted 3 m apart whereas the other two hosts at 1.5 cm spacing.

To be read

*Ber* and *galwang* were planted at 3 m apart whereas *Flemingia spp.* at 1.2 m while spacing adopted between *ber* or *galwang* to *Flemingia spp.* was 1.5 m.

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Management of *akashmani* for lac cultivation

Fig. 7, Key

Instead

- Dry matter
- RGR

To be read

- Dry weight, kg/plant
- RGR, g/g/day