

# Mechanization of Lac Cultivation

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## ABSTRACT

*Lac, a natural resin, is the secretion and protective covering of tiny lac insect species mainly of Kerria genus. Lac is produced in India, Thailand, Indonesia and China. Butea monosperma (palas), Zizyphus mauritiana (ber) and Schleicheria oleosa (kusum) are the major commercial lac host trees in India. Mostly tribals of Jharkhand, Chhattisgarh, W.B., Maharashtra, M.P., Orissa, Gujarat and Assam carry out lac production. About 3 million people are involved in lac production in India. On an average, India produces 20 thousand tons of lac per year. It is an export-oriented product and 75-80 % of India's total production is exported, which earns about \$ 30 millions as foreign exchange annually. The lac production involves operations like - pruning of host trees, bundling of broodlac twigs, tying of broodlac on trees for infestation, removal of used up broodlac sticks (phunki) from trees, harvesting of crop and lac scraping. These operations are carried out manually with the help of locally available traditional tools i.e. pruning knife, axe, sickle etc. Lac production operations involve climbing on trees. Pruning, tying of broodlac bundles on host tree at different places. Harvesting and spraying of pesticides are done by men, while bundling and selection of broodlac, collection of phunki, collection of harvested lac sticks and scraping of lac encrustation from twigs etc. are carried out by women. To reduce drudgery and to improve the work output of the lac farmers, equipments/machines i.e. Tree pruner, Broodlac placement tool, phunki hook, Hand operated lac scraper, Pedal operated lac scraper and Motor operated lac scraper, have been designed and developed which are discussed in the paper.*

**Keywords:** Lac, lac cultivation, lac cultivation mechanization

## INTRODUCTION

Lac cultivation is carried out mostly by the tribal in the states of Jharkhand, West Bengal, Chattisgarh, Madhya Pradesh, Maharashtra, Orissa and Gujarat, generating about 4 million man-days every year. About 55-60 per cent of the world demand for lac is met by India. Lac is an export-oriented commodity as 75-80 % of lac produced in the country is exported mainly in refined/semi-refined form to over 100 countries all over the world. Lac is nature's boon to mankind, and a bio-resource unique in several respects. It yields basically three useful materials i.e. resin, wax and dye. These are natural, renewable, non-toxic and eco-friendly and can be put to an unbelievably wide range of applications. A definite demand already exists for the materials derived from lac, besides a tremendous potential for much higher consumption, due to global trend

for safer natural products. India possesses a huge untapped potential of lac production and it is possible to achieve a multifold increase in lac production. The mechanization of lac production can play an important role in increasing lac production and reducing the drudgery of lac growers. In the following sections traditional equipment used by the lac farmers, useful equipment/machines available in the market which could be used for lac cultivation and equipment/machines developed by different organizations are discussed operation wise.

## EQUIPMENT AND MACHINE FOR LAC CULTIVATION

Lac cultivation involves five major operations viz. pruning of lac host tree, broodlac placement on host tree, used up broodlac removal, pesticide application, lac crop harvesting and lac scraping. The operations

like pruning, broodlac placement, used up broodlac removal and harvesting are carried out by men, where as selection of broodlac, bundle making and scraping are carried out the by women. To carry out operations like pruning, broodlac placement used up broodlac removal and harvesting, farmers climb on the tree, which is time consuming, laborious and dangerous. Lac farmers use locally made pruning knife for host tree pruning, mature crop harvesting and lac scraping. Sometimes they also use tree pruner, secateur, pruning saw and axe for pruning and harvesting operations.

To collect information on equipment used for lac cultivation, a survey was conducted on 84 farmers belonging to three districts of Jharkhand *i.e.* Ranchi, Gumla and Hazaribagh and one from W.B. *i.e.* Purulia (Prasad *et al.*, 2001b). Based on the study, it was found that 70.2 per cent farmers were either small or marginal having less than 2 ha of land and majority of them were economically poor. Their poor economic condition was reported to be major hurdle in mechanization. From the survey data, it was found that more than 80 per cent lac farmers used pruning knife for pruning, harvesting and lac scraping operations. In some cases, use of axe and sickle was also reported for pruning and harvesting operations. The study also revealed that broodlac placement and removal operations were carried out manually. Further, study revealed that 92.8 % farmers wanted development of new equipment for lac production.

Research work was carried out to mechanize the lac cultivation operations in different research organizations. Indian Institute of Natural Resins and Gums (IINRG), Ranch has developed Hand Operated Roller Type Lac Scraper, Pedal Operated Roller Type Lac Scraper (Prasad *et al.*, 2001c) and Power Operated Roller Type Lac Scraper (Annon., 2002-03). Birsa Agriculture University, Ranchi has developed Peg Type Lac Sheller (Pandey *et al.*, 1997). Central Institute of Post Harvest Engineering and Technology, Ludhiana has developed Lac Scraper-cum-Grader (Annon, 1998-99). The equipment/machines used by lac farmers and equipment/machines developed by different research organizations are presented and discussed in the following sections.

### Pruning

Lac insect thrives best on tender shoots rather than on old and woody ones. To provide a suitable ground for the insect to feed well and thrive upon, the host plant must be receptive and sustainable. For young plants, no particular preparation is required to receive their first infestation since there is an abundance of tender shoots. For older plants, however, a process of pruning is to be carried out prior to infestation to stimulate the production of fresh and succulent branches. Ordinarily, pruning of branches having a diameter less than 2.5 cm is only advisable. The majority of farmers prune with the help of pruning knife (Fig. 1) and some farmers use axe. The secateur (Fig. 2) and tree pruner (Fig. 3) used in gardening are suitable for lac host pruning in lac cultivation.

**Pruning Knife:** Pruning knife is a multipurpose tool for lac growing farmers. It is used for lac host tree pruning, harvesting mature crop and lac scraping. It is manufactured by a village blacksmith. It is also available in the market. It is usually 0.5 kg in weight and a person alone can operate it.

**Secateur:** Secateur is lightweight equipment generally used in gardening. In lac cultivation, operations like pruning of lac host, broodlac selection and harvesting of mature lac, involve branch cutting, similar to branch cutting operation in gardening. Hence, secateur was found suitable and is recommended as multi-purpose equipment for lac cultivation. It is usually 0.4 kg in weight and a person alone can operate.



Fig. 1: Pruning Knife (*Dauli*)

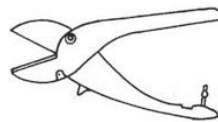


Fig. 2: Secateur



Fig. 3: Tree pruner

**Tree Pruner:** Tree pruner is gardening equipment suitable for use in lac cultivation for pruning lac host trees and harvesting mature lac. The equipment is suitable for pruning branches up to 2.5 cm in diameter, which is located within a height of 3.5 m from the ground. For pruning a tree utilizing a tree pruner, the farmer need not to climb on the tree for small and medium size lac host tree. As tree pruner can be operated from ground even women can contribute in pruning operation. It is usually 2.0 kg in weight and a person alone can operate it. It is most suitable for those lac host trees that have thorny branches. By use of tree pruner branches can be pruned cleanly without splitting. The splitting of branches lead to drying of the branches and emergence of less number of new shoot.

### Inoculation (Infestation)

The process by which host trees are infested with the lac insects is known as inoculation. In this process lac bearing twigs from an infected tree are cut at maturity stage. The female labourer does selection and bundling, a few days before emergence of the larvae. Male labourer climbs on the lac host tree and ties bundle of such twigs known as broodlac to an uninfected tree, on which new tender shoots are plentiful. The larvae emerge out of the broodlac and settle on tender branches of the tree. In existing practice, inoculation is done manually.

### Broodlac Placement-cum-removal Tool:

Broodlac placement-cum-removal tool (Fig.4) was developed for placing broodlac on branches of lac host tree and its removal after larval emergence (Prasad *et al.*, 2001a). For small and medium size lac host tree broodlac can be placed from the ground

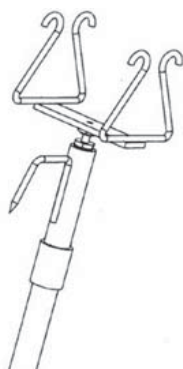


Fig. 4: Broodlac placement-cum-removal tool

level upto 6 m height and the farmers are not required to climb on the tree. Even female worker can place and remove broodlac using this tool. It is usually 1.5 kg in weight and a person alone can operate it.

### Broodlac Removals and Collection

Broodlac left on the tree after larval emergence is removed and lac encrustation is scraped. The optimum time of broodlac removal is three weeks after inoculation. Therefore, timely removal of broodlac is necessary to prevent carryover of pests to new crops. Broodlac is mostly removed from tree, manually, which again requires climbing on the tree. Bundles thus removed are either collected in a bag or dropped on the ground. Some farmers also use inverted J shaped cutting hook or sickle mounted on a bamboo-pole to pull down the bundles from ground level. Female labourer collects the removed bundles.

### Broodlac removal hook

Broodlac removal hook (Fig. 5) is used to remove broodlac bundle from the branches of the host tree. In traditional method, farmers climb on the tree for removing used up broodlac. Sometimes they are required to climb even on thin branches. Thus, the operation is not only tough but dangerous too. For small and medium size lac host tree hook can be used for broodlac removal. The hook consists of a tubular body, a hook shaped cutting blade and a ring for bundle collection. For removing broodlac bundle, the string with which bundle is tied to the branch, is cut. The pointed hook, having sharp edge cuts the string, when it is engaged in the string and pulled down. Once, the string is cut, bundle falls down. To collect the bundle, a ring (Fig. 6) is provided under which a net is tied. By collecting the bundle in the net, shattering loss is minimized, as it prevents the

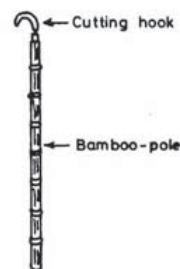
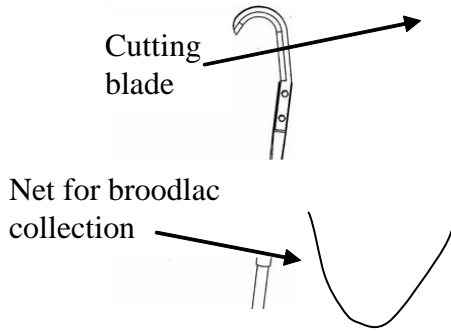


Fig. 5: Broodlac removal tool



**Fig. 6: Broodlac removal tool**

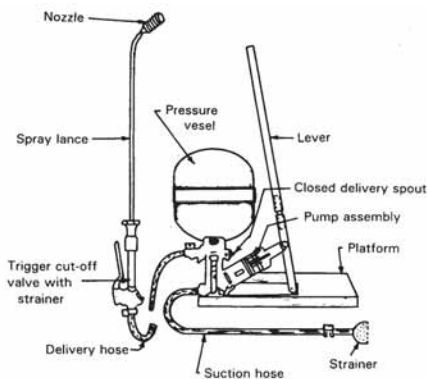
bundle from falling on the ground. Generally used up bundle is removed after 3 weeks. By that time lac encrustation dries up and becomes susceptible to shattering with even minor impact. It is usually 1.5 kg in weight and a person alone can operate it.

**Spraying for insect and pest control:**

Like other crops, chemical control is one of the important methods to control the disease and enemy insect/pest attack on lac crop also. The rocker sprayer (Fig. 7) having long delivery hose is recommended for spraying chemical on lac crop. Spraying is required to be carried out on the branches of the host tree, where lac insect has settled. One person operates the machine, kept on the ground and the other one climbs on the tree and does spraying by one hand and with other hand he catch holds of the tree branches. The rocker sprayer, which is also used for insecticide/pesticide application in agricultural crops are available in market. Two persons are required to operate the machine. The machine is usually 15 kg in weight.

**Lac Harvesting**

The removal of shoots bearing mature lac



**Fig. 7: Rocker sprayer**

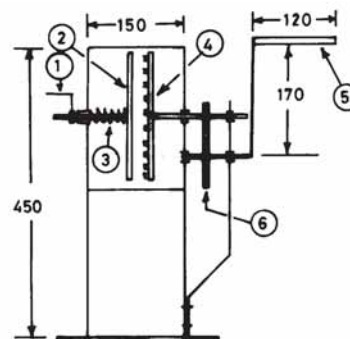
encrustation by cutting is known as lac harvesting. The operation is similar to pruning, but requires more care than pruning, as shoots contain lac encrustation, which are either used as broodlac or scraped lac for sale. Any damage to the encrustation affects broodlac quality. Further, if harvesting operation gives a jerk to the lac bearing sticks, then there is a possibility of shattering loss. The farmers harvest crop with the help of sharp edge knife popularly known as pruning knife. The harvested crop is collected and the lac encrustation bearing twigs are selected and cut into pieces with help of a secateur, to be used as broodlac. Male labourers do the harvesting, while female labourers do collection of harvested material and broodlac selection.

**Scraping**

Lac scraping involves removal of lac encrustation either from used up broodlac (dried encrustation) or fresh lac encrustation from harvested lac stick. Female labourers mainly scrap lac from lac sticks using traditional tools *i.e.* pruning knife, scraping knife, sickle etc. The process is very tedious and slow. It involves sitting on the ground in-group and scraping by means of traditional tools. Few machines have been developed for lac scraping which are discussed below.

**Peg Type Lac Sheller**

A peg type lac sheller (Fig. 8) was developed by the Agricultural Engineering Department, Birsa Agricultural University, Ranchi, India (Pandey *et al.*, 1997). It consists of two disks. One disk is spring-



- 1 Gap adjusting lever
- 2 Plain disk
- 3 Spring
- 4 Disk with pegs
- 5 Handle
- 6 Gears

**Fig. 8: Peg type lac sheller**

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mounted and remains stationary while the other disk is with pegs on working surface and it is driven by hand cranking handle. There is a pair of gears mounted on rotary disk shaft and hand cranking shaft. The number of tooth on the two gears are in 6:35 ratio. The gap between two disks can be adjusted with the gap-adjusting lever. The machine scrapes 5 kg lac sticks in an hour and separates about 93.7 per cent lac from the lac stick. One person alone is adequate to operate the machine.

#### All dimensions in mm

#### Hand Operated Roller Type Lac Scraper:

Indian Lac Research Institute, Ranchi has developed a hand operated roller type lac scraper as shown in Fig. 9 (Prasad *et al.*, 2001c). The machine scrapes lac with the help of two scraping rollers, which move at differential speed in opposite direction. A handle is provided for operating the machine. The lac stick is fed in the machine through feeding hopper. After scraping, the material is discharged on an inclined sieve of 10 meshes. The material finer than 10-mesh size pass through the sieve and the remaining scraped lac along with stick slide down the sieve and come out of the machine. The capacity of the machine is 5.7 kg/h, which is more than any of the traditional equipment used by the farmer. The machine is 50 kg in weight and a person alone can operate it.

#### Pedal Operated Roller Type Lac Scraper:

Pedal Operated Lac scraper (Fig. 10) is similar to Hand Operated Lac scraper. But in pedal operated

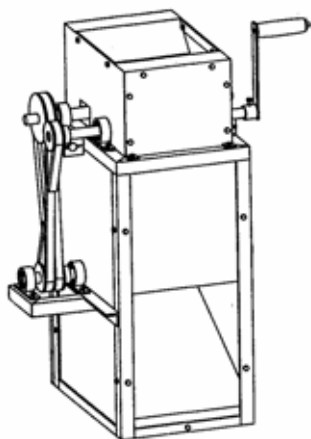


Fig. 9: Hand operated roller type lac scraper

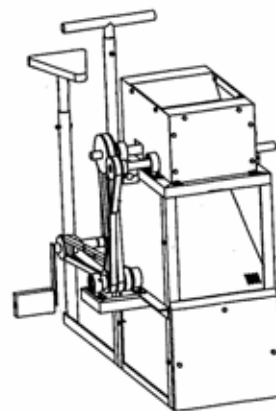


Fig. 10: Pedal operated roller type lac scraper

lac scraper power to the machine is supplied by operating the pedal of the machine. While operating the machine, the operator pedals and feeds the material in the machine. The capacity of the machine is 6 kg/h. The machine is 55 kg in weight and a person alone can operate it (Prasad *et al.*, 2001c).

#### Motor Operated Roller Type Lac Scraper

Lac is mostly grown in tribal area. Many villages in tribal region have been electrified. Considering this fact, a motor operated roller type lac scraper as shown in Fig. 11, was developed to increase the output and to reduce the drudgery of the lac growers (Annon, 2002-03). It is driven by 0.5 hp single-phase electric motor. Only one person is required to operate the machine. The capacity of this machine is 10 kg/h, which is more than any of the traditional equipments used by farmer. The machine is 65 kg in weight.

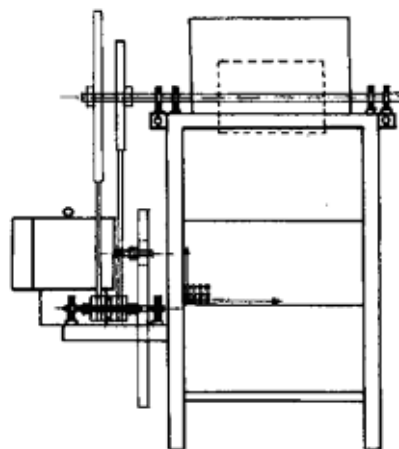


Fig. 11: Motor operated roller type lac scraper

### Power Operated Lac Scraper-cum-Grader

Power operated lac scraper-cum-grader (Fig. 12) does three operations at a time *i.e.* lac scraping, crushing scraped lac and grading crushed lac (Annon, 1998-99). Power to different parts of the machine is supplied by a 2 hp 3-phase electric motor through V type belt and pulley. The place where electricity is not available the machine can be operated by 3 hp small diesel engine. Two persons are required to operate the machine.

Machine can be used by many farmers, collectively or unemployed rural youth can purchase the machine and can scrap lac custom hiring basis. Thus, the unemployed person can get job for few months during harvesting season. The capacity of this machine is 20 kg/h. The machine is 150 kg in weight.

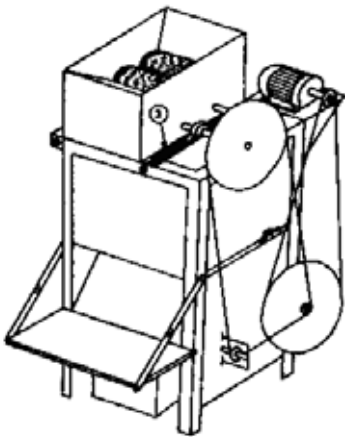


Fig. 12: Power operated lac scraper-cum-grader

### CONCLUSIONS

It is concluded from the above, that farmers use traditional equipment like pruning knife, axe, sickle, knife etc for different lac cultivation operations. Several improved equipment and machines have been developed by different research organizations. The popularization of these machines and equipment may be made in lac growing areas so that the machines could be used in lac cultivation reducing the drudgery and increasing the working efficiency of the lac farmer.

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