1468

Natural Rubber : Agromanagement and Crop Processing
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Chapter 29

Plantation management

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1. INTRODUCTION

Structural changes in the natural rubber (NR) production sector leading to a steady growth in the relative share of the smallholdings in area and production have been noticeable

during the past few decades. Consequently, there has been a remarkable transformation in the organization of production from the initial 'estate system' of plantation agriculture to the dominant smallholdings with far reaching implications on policy inputs pertaining to management, cultural practices, processing and marketing. For crops which do not require centralized processing and marketing, estates have no significant advantage over the smallholdings as exemplified by the sustenance of natural rubber, cocoa, cardamom, coffee, coconut, tobacco and cotton, over time. Structural transformation, especially in the context of a considerable reduction in the average operational size of the holdings, concomitantly demands appropriate modifications in management practices for the smallholding sector.

Efficient management of rubber plantations, in both estate and smallholding sectors, essentially consists of planning, organizing, implementing and monitoring different aspects of the plantation to achieve optimum output. The basic components of management in a rubber plantation are material and processing management, marketing management, financial management and labour management.

2. MATERIAL AND PROCESSING MANAGEMENT

2.1 Farm records

Farming is a complex business activity involving many transactions and day-to-day decisions. The outcome of past transactions and decisions often serves as a guide in taking new decisions. Therefore, systematic maintenance of records is an essential part of rubber plantation management both in the estate and smallholding sectors. Adequate records provide the information vital for decision making.

2.1.1 Stock registers

Stock registers are essential in rubber plantations. The entries should include stock in hand, dates of procurement and consumption, value of materials, details of sources of procurement, details of consumption, balance held, *etc.*

2.1.2 Farm map

A survey map of the plantation, showing all the boundaries, is essential. It helps in planning various operations. A farm map is a prerequisite for availing financial assistance and in settling boundary disputes. The plantation may be conveniently apportioned to various divisions, fields, *etc.* Access, building, *etc.* shall be shown in the map.

2.1.3. Labour engagement records

Monitoring of the labour engaged for different farm operations is essential. Proper labour engagement records like (1) muster roll indicating attendance, (2) work distribution register showing details of deployment for each item of work, (3) check roll containing particulars of attendance (based on muster roll), rate of wages, incentives and net wages due to each and (4) personal files containing details like name, roll number, provident fund number, date of permanency, date of birth, educational qualification and permanent address are to be maintained. Separate records have to be maintained for leave accounts, medical benefits, provident fund accounts, maternity benefit, advances and recoveries, *etc.*

2.1.4 Field register

Permanent records of the planted area have to be maintained fieldwise. The field register should contain details like area, year of planting, planting materials, number of trees, operations carried out, costs incurred, girth measurements, exploitation procedures, yield, *etc.*

2.1.5 Daily rubber production register

Daily yield records should be maintained on a tapping block basis. Quantity of latex, dry rubber content (DRC), quantity of field coagulum, *etc.* shall be recorded.

2.1.6 Cash receipts and expenditure records

Proper booking of receipts and expenditure is an important exercise for both estates and smallholdings.

2.1.7 Factory records

The factory records include crop receipts, output and despatch, assets and capacity utilization register of machines, *etc.* in addition to the usual records like attendance register, check roll, *etc.*

2.1.8 Other records

Records connected with items such as plantation insurance, plantation tax, provident fund (PF) remittance, returns to government and labour department, details of other farm produce, worker's duty rostrum, disciplinary proceedings, holidays, labour welfare measures, *etc.* should also be maintained.

2.2 Operations

Efficient organization and implementation of different operations in a rubber plantation require proper planning and monitoring.

2.2.1 Calendar of operations

A calendar of operations or operation schedule is an essential component of good management of rubber plantations. This should cover all operations with probable dates for each (Table 1). Although the dates may have to be altered slightly depending on climatic conditions and other unforeseen factors, it is helpful in planning the operations well in advance. It is also necessary to estimate the seasonal/periodic labour and financial requirements.

2.2.2 Pre-planting operations

Clearing, lining, pitting, pit manuring, refilling, *etc.* are the major pre-planting operations. For successful rubber plantation development, it is essential that the pre-planting operations are undertaken well in advance so as to ensure that the land is ready for planting with the onset of first showers. In India, June to July has been generally observed to be the ideal time for rubber planting. In order to ensure timely planting, the pre-planting operations should be started by February/March. Tracing of roads should be taken up to facilitate transport of materials. Proper lining of a plantation not only increases the aesthetic value but also helps in easy and efficient movement of workers. Care should be taken to excavate deep pits near rocky patches, hill tops, *etc.* so that plants can grow vigorously and maintain uniform growth.

Table 1. Calendar of operations

Item of work		Month	Remarks
Land clearing		January-March	
Lining and pitting		February-April	Should be commenced as soon as the soil becomes workable
Terracing and soil conservation		June-September	
Raising seedling nursery		July-August	
Budding/raising polybag plants		April-May/September-October	
Planting		June-July	
Manuring		April-May September-October	Depending on the age of the plants, terrain, *etc.*
Cover crop establishment including weeding, thinning, *etc.*		May-August	
Vacancy filling		June; August-September	
Plant protection		May-September	For control of abnormal leaf fall, shoot rot, black stripe, pink and *Gloeosporium* diseases
		January-March	For control of powdery mildew and leaf spot diseases
Weeding	1st round 2nd round 3rd round 4th round	April-May July-August October-November January-February	Immature areas would need 3 - 4 rounds of weeding with about 20 man-days/ha in the initial years Mature area may need only 2 rounds with 5 - 10 man-days/ha

2.2.3 Cover crop establishment

Early cover crop establishment will help to reduce subsequent weeding cost which is an important cost component during the immature phase. Proper legume cover will reduce future nutrient requirements as well as help in conservation of moisture and reduction of erosion in slopes. Selection of a suitable legume cover is also important. This will depend on factors such as level of management, size of holding, availability of labour, *etc.* A vigorously growing cover crop like *Mucuna bracteata* needs a high level of management and frequent supervision and is suited especially for areas where cattle is grazed freely.

2.2.4 Planting

Field planting should be undertaken when climatic conditions are conducive.

2.2.4.1 Density

Density of planting is an important aspect of rubber cultivation and depends on the priorities of the planter. A smallholding, depending on family labour is inclined to maximize income per unit area and therefore tends to increase the density of planting while an estate employing hired labour will be guided by optimization of density so as to increase the tapping efficiency (per tree and per tapper yield).

2.2.4.2 Choice of planting material

Choice of the proper planting material is of prime importance in the development of a rubber plantation. Raising the required planting material in the area to be planted would be the most ideal. However, availability of suitable land, irrigation facilities, labour, *etc.* may be the constraints.

Selection of clones should be based on the suitability to the location, terrain, size of holding and management levels. A clone blend consisting of a mixture of location–specific clones would be preferable to a monoclonal planting. Clone blends are useful for better disease resistance, yield ensurance and tolerance to climatic vagaries.

Adequate care should be taken to ensure the genuineness of planting materials. Budgrafts raised in polybag are currently the most popular planting material. Direct planting of budded stumps can also successfully be undertaken provided adequate moisture levels are maintained. Areas with assured irrigation facilities like proximity of a stream can directly be planted with budded stumps along with moisture conservation practices like mulching. An obvious advantage of uniformity in the growth of plants is a higher percentage of tappable trees per unit area in the initial years of tapping and the resultant higher income. Planting of relatively more vigorous plants on hilltops and rocky patches as compared to foothills and areas with adequate soil depth will also help in ensuring uniformity of plants.

2.2.5 Post-planting operations

2.2.5.1 Manuring

Systematic fertilizer application is an important operation both in the mature and immature phases of rubber. During the immature phase, manuring is directed towards achieving accelerated uniform growth. An increase in the number of split applications would accelerate growth of weak plants. Manuring should be undertaken when there is sufficient moisture in the soil. The deciduous nature of the rubber tree brings about a significant amount of biomass recycling. Therefore, a discriminatory fertilizer application incorporating soil and plant nutrient status is the most scientific method of manuring. Data on number of unyielding trees, scrap percentage, latex flow abnormalities like panel coagulation, low DRC, *etc.* should be pointed out so as to take these factors into consideration while assessing the nutrient requirements. Mixing of straight fertilizers is always preferable since it is economical and often necessary for achieving specific nutrient ratios. As fertilizer application is labour intensive, it should be planned well in advance to ensure adequate availability of workers.

2.2.5.2 Weeding

Weeding is the single largest operation during the immature phase. It is also important during the mature phase. Chemical weed control is relatively less popular in smallholding sector compared to the estate sector due to higher initial investment needed for purchase of sprayers. Manual slash weeding by engaging female labour is the most popular method in both estate and smallholding sectors. Generally, three to four rounds of weeding per year are necessary during the immature phase while two rounds are adequate in mature rubber plantations. Perennial grasses like *Imperata cylindrica* and other noxious weeds often need chemical methods of control. An integrated weed management system including chemical and manual weed control methods would be economical and eco-friendly.

2.2.5.3 Mulching

Mulching is a very useful practice especially during the initial years of rubber cultivation. It helps not only to conserve moisture but also to keep the plant bases free from weeds. Non-availability of mulching materials in adequate quantities is an important

constraint. *Mucuna bracteata*, the vigorous cover crop which is capable of generating adequate mulching material at a comparatively fast rate, is an alternative source.

2.2.5.4 Summer protection

Protection from exposure to direct sunlight is essential in the immature stage. During the first year of planting, shade baskets or plaited coconut fronds can be used. Subsequently, whitewashing of brown portion of the stem preferably by end of December or first week of January is effective till the canopy closes. Contact shading using china clay is a cheap method which could be used for reducing transpiration.

2.2.5.5 Plant protection

Timely plant protection measures are necessary for a successful rubber plantation. Spraying of chemicals should be undertaken as per schedule at the recommended time of the day and strict adherence to the recommended practices should be ensured. The workers undertaking plant protection activities should be well trained and also supplied with protective gear to ensure safety.

2.2.5.6 Pruning and branch induction

Selective pruning and branch induction are important practices for development of canopy. Branching at the recommended height would ensure a balanced canopy which in turn would reduce wind damage. Pruning should be undertaken by workers well trained in the operation.

2.2.5.7 Tapping

Tapping is a skilled operation which needs proper training and guidance. An ideal tapping system is one which gives the highest yields at the lowest tapping cost, satisfactory growth and bark renewal and the lowest incidence of brown bast (Baptiste, 1962). Emphasis has to be given to the correct slope, depth and time of tapping and bark consumption. The guide lines marked using a template help to maintain the correct slope of the cut which is also an important aspect. Periodic inspection is necessary to check bark consumption, depth of tapping, tapping wounds, slope and direction of the cut, position of spout and cup hanger, *etc.* Any anomaly should immediately be pointed out to the tapper and remedial measures adopted. Crop collection should be properly timed and checked to reduce quantity of field coagulum.

2.2.5.8 Rainguarding

Rainguarding should be done in order to increase the number of tapping days. Different types of rainguards are approved and recommended by the Rubber Board. Rainguards should be installed before the onset of the monsoon. The work should be undertaken by experienced workers. The adhesive used should be of high quality. Any leakage should be rectified immediately.

2.2.5.9 Processing

The relative size-neutrality and technological options of primary processing of NR compared to other plantation crops are advantageous to the smallholdings for reaping the benefits of value addition at the primary level. The crop consists of latex and field coagulum. Latex can be processed into ribbed smoked sheets (RSS), preserved field latex (PFL) and

latex concentrates, technically specified rubber (TSR) and pale latex crepe (PLC). The field coagulum can be processed into TSR and crepe rubbers. Except for sheets and PFL, all other methods of processing require setting up of factories with substantial investment, technical manpower and continuous supply of raw material round the year. The type of processing depends mainly on market orientation and requirements of the consuming industry. This is the major reason for the remarkable differences between NR processing in India and other major producing countries. NR processing in other countries is primarily guided by the requirements of the export markets while in India the focus is on the domestic market.

Large plantations have facilities to process latex into different types and grades of rubber. The small growers mainly process latex into sheets. They also have the option to sell the produce as latex to the collection centres of cooperative society or Rubber Producers' Society (RPS). The estates process the field coagulum into either TSR or crepe rubber whereas the small growers sell field coagulum as such either in dry or wet condition.

3. MARKETING MANAGEMENT

Marketing management of rubber involves planning, implementation and monitoring the nature of primary processing, timing and pattern of sale, selection of marketing channel, *etc.* Rubber, being an industrial raw material, is a completely market-oriented crop. However, the flexibility over supply in response to market fluctuations in the short-run is limited to the adoption of rainguarding, higher tapping intensity and application of stimulants. Properly-processed rubber can be stored for a reasonable period without deterioration in properties.

3.1 Market structure

The market structure of NR in India is characterized by around 0.9 million producers, numerous traders and a few major buyers approximating an oligopsony model. The number of dealers in the country operating at different levels is around 10000. To aid marketing of smallholders' produce, the Rubber Board has been promoting setting up of cooperative rubber marketing societies through share participation and technical assistance. At present, there are 37 societies engaged in rubber marketing, with the Kerala State Cooperative Rubber Marketing Federation as the apex body. The estimated sale volume of the cooperative sector was 11.9 per cent of NR production during 1994-95 (George and Chandy, 1996). In addition, there are about 1700 RPS, many of which provide marketing assistance to member growers.

3.2 Market orientation

The Indian NR market is primarily domestic oriented. The country has been a net importer of NR since 1946 except for short intervals. However, fluctuations in the market orientation due to factors linked with industrial growth cannot be ruled out. The indigenous rubber goods manufacturing sector is characterized by dominance of dry rubber-based products especially automotive tyres and tubes, cycle tyres and tubes and footwears. In sharp contrast, NR market in major producing countries (with the exception

of China and Brazil) has high degree of export orientation, the share of NR export being 66, 93 and 89 per cent in Malaysia, Indonesia and Thailand respectively.

3.3 Marketing options

Small growers normally sell the produce as latex when the price is high, and process it into sheets to hold stock when prices fall. The option to sell has been mainly to unlicenced dealers who visit the units periodically, but a significant quantum of field coagulum is currently sold to TSR processing factories in view of the relatively higher procurement price. The sheets, however, are often sold without grading. The rubber marketing cooperative societies and some of the RPS also aid marketing of smallholders' produce and play a key role in rubber marketing.

Flexibility over producf mix enables the large estates to design marketing strategy according to price conditions in the market segments. Negotiations are often made directly with the intermediate or terminal dealers or with the end-users and the estates market sheets only after grading.

3.4 Price

NR has remained as a controlled commodity in India due to historical reasons and its strategic importance. Statutory price control, under different forms, has been operative since 1942. The intervention measures consisted of notification of mininum/maximum prices, import control, buffer stock scheme, *etc.* One of the positive features of the Indian NR market is the easy accessibility to day-to-day market information through the media, which serves as the base for fixing price.

Forces of supply and demand, subject to imperfections in market structure and government interventions, primarily determine the price. Properties and availability of substitutes, international price, foreign trade policy, technological innovations in downstream sector, *etc.* also influence NR price. Among these, supply of NR is the most important variable influencing price determination. Even though NR price in the country grew at an annual rate of 7.6 per cent during the 27 year period from 1968-69 to 1994-95, the growth has since then been at a decreasing rate (Lekshmi *et al.*, 1996).

The presence of the strong cooperative sector, institutional control and ready availability of market information have allowed sheet rubber to attain one of the highest farm gate prices (92%). The combined farm gate price for sheets and field coagula is 88 per cent (Sreekumar *et al.*, 1990).

4. FINANCIAL MANAGEMENT

Financial management consists of estimation of financial requirements, fund mobilization, optimum allocation of resources and analysis of financial performance. Thorough knowledge of physical variables is necessary as financial variables are the monetary expressions of the former. Systematic maintenance of proper records on accounts and financial transactions is essential irrespective of the holding size, but smallholders often ignore this.

4.1 Budgeting

Budget is a detailed statement of the expected expenditures and revenue on an annual basis. It is the simplest method of financial planning and facilitates estimation of financial requirements, comparison of outlays and actuals and time series monitoring of activity/itemwise expenditures. Budgets are of three types : (1) whole farm budget covering all the fields and activities including establishment, processing facilities, *etc.*, (2) partial budget covering only a segment of the farm (for example, a field planted in a given year) and (3) enterprise budget for a specific farming activity to check the comparative suitability of alternative techniques for a given task.

Preparation of budgets and keeping of accounts pre-suppose basic understanding of the cost and revenue heads at disaggregate level.

4.1.1 Costs

4.1.1.1 Labour cost

The heads under which labour can be accounted at different stages are enumerated below :

1. Labour cost-heads up to planting stage
   - (1) Clearing of land
   - (2) Terracing
   - (3) Lining
   - (4) Pitting
   - (5) Filling of pits
   - (6) Budding/nursery management
   - (7) Field planting/vacancy filling
2. Labour cost-heads during immature phase
   - (1) Vacancy filling
   - (2) Mulching of plant bases
   - (3) Cover crop establishment and maintenance
   - (4) Shading and propping
   - (5) Branch induction
   - (6) Thinning out of weak trees.
3. Labour cost-heads during mature phase
   - (1) Tapping
   - (2) Processing
   - (3) Panel protection
   - (4) Application of stimulants
   - (5) Rainguarding
4. Labour cost-heads recurring annually or seasonally
   - (1) Application of manures and fertilizers
   - (2) Weeding

(3) Whitewashing
(4) Fencing
(5) Firebreak preparation
(6) Plant protection
(7) Irrigation
(8) Soil conservation
(9) Maintenance of roads, buildings, boundary protection, *etc.*

4.1.1.2 Material cost

The heads under which material cost can be accounted are listed below :

1. Material cost-heads during immature phase
   (1) Polybags
   (2) Planting material
   (3) Shading and propping materials
   (4) Cover crop seeds and manures
2. Material cost-heads during mature phase
   (1) Tapping/processing accessories
      (1) Marking equipments
      (2) Spouts and hangers
      (3) Plastic/coir thread
      (4) Tapping knife
      (5) Collection cups and scrap baskets
      (6) Buckets and dishes
      (7) Processing chemicals
      (8) Sieves
      (9) Metrolac
   (2) Rainguarding materials
      (1) Polythene sheet/tapping shades
      (2) Adhesive
      (3) Cloth, staplers, pins, *etc.*
   (3) Stimulants
   (4) Panel protection chemicals
3. Material cost-heads recurring annually or seasonally
   (1) Manures and fertilizers
   (2) Plant protection chemicals
   (3) Lime for whitewashing
   (4) Fencing materials
   (5) Materials for soil conservation activities
   (6) Irrigation materials

(7) Weedicides
(8) Tools and implements
(9) Firewood for smoke house

4.1.1.3 Fixed costs

Fixed costs can be accounted under the following heads :

1. Buildings, sheds, staff quarters and labour lines
2. Rollers and smoke houses
3. Other processing facilities
4. Sprayers
5. Other tools and equipment
6. Vehicles
7. Other fixed assets

4.1.2 Revenue

The usual revenue-heads are :

1. Sale of sheets/latex
2. Sale of field coagulum
3. Sale of seeds
4. Sale of rubber wood
5. Sale of worn out/unserviceable items
6. Sale of used polythene, empty barrels, containers, *etc.*

The whole farm budget should include cost and revenue of intercropping, bee-keeping and other ancillary activities adopted by the grower.

4.2 Financial analysis

For analysis the cost heads may be grouped in the following order :

Cost A = Working capital + Interest on working capital
Cost B = Cost A + Interest and depreciation on fixed capital
Cost C = Cost B + Imputed value of family labour
Cost D = Cost C + Rental value of land

The commonly-used income concepts are :

Net income = Gross income – Cost D
Farm business income = Gross income – Cost A
Family labour income = Gross income – (Cost D – Imputed value of family labour)

4.3 Inter-temporal analysis

Static analysis for a given year may be sufficient for seasonal or annual crops but perennials like rubber require inter-temporal analysis (Rae, 1977). As cost and revenue flows occur in different years, any financial analysis should be based on the present values

of the cash flow rather than the actual values. Hence, the yearly cash flow may be converted into streams of present value using an appropriate discount factor using the equations given below:

$$\text{Present value of cost } (PV_C) = \sum_{t=1}^{n} Ct \{1/(1+r)^t\}$$

$$\text{Present value of revenue } (PV_R) = \sum_{t=1}^{n} Rt \{(1/(1+r)^t\}$$

where t is the year from planting
n is the life of plantation
r is the discount rate
R is the revenue and
C is the cost.

The important measures to be used in inter-temporal analysis are :

NPV (Net present value) = $PV_R - PV_C$

BCR (Benefit-cost ratio) = PV_R / PV_C

IRR (Internal rate of return) = The discount rate at which BCR = 1 or NPV = 0

PBP (Pay back period) = The period over which the cumulative NPV is non-negative

$A_{(n)}$ (Annuity) = $\dfrac{NPV \times \{r(1+r)^n\}}{\{(1+r)^n - 1\}}$

4.4 Source of funds

The funds may be raised from one's own or institutional sources. The role of informal credit sector is insignificant as the subsidy under the Rubber Plantation Development (RPD) scheme of Rubber Board and the long-term loans from commercial or cooperative banks under the National Bank for Agriculture and Rural Development (NABARD) scheme cover the entire development cost.

4.4.1 Institutional finance

The institutional financial assistance schemes can be classified into three categories: (1) development schemes (2) extension schemes and (3) term-loans under NABARD refinancing, operated through commercial banks. The development schemes are approved by the Government of India and any deviation from the provisions can be effected only with the sanction of the Government. The extension schemes, though continuous in nature, are approved by the Rubber Board on an yearly basis.

5. LABOUR MANAGEMENT

5.1 Labour in rubber plantations

Management of labour is crucial in any labour intensive enterprise like rubber plantation. In India around three-fourth of the development cost of rubber plantations and 60 per cent of the mature phase costs are accounted for by labour alone. The current estimated average daily employment in rubber plantations is 320800 and labour intensity

is 0.62 per ha. The structural transformation of the rubber plantations during the last five decades, characterized by the disintegration of the estate sector and dominance of the smallholdings, had profound impact on the pattern of labour utilization, organization and management. Around 60 per cent of the labourers are tappers while the rest are general field workers. An important issue confronting the industry is the growing shortage of skilled labour and therefore, efforts to improve labour productivity and optimum utilization of labour are of prime importance.

5.2 Labour requirements

5.2.1 Immature phase

The operationwise labour requirement during the immature phase is given in Table 2. Altogether, 827 man-days per ha are required during the first seven years of planting, out of which 319 man-days are to be engaged during the first year itself. The operation-wise labour requirement may vary widely depending upon the terrain and topography and the previous crop status of the land.

Table 2. Labour requirement during the immature phase

Item of work	Number of man-days required (per ha)	
	First year	Subsequent years of the immature phase
Clearing	10	-
Terracing and other soil conservation activities	40	5
Lining and pitting	71	-
Filling and planting	47	2
Fixing shade baskets, propping and lime washing	10	-
Pruning and branch induction	4	6
Weeding and mulching	80	316
Manuring	5	60
Plant protection	12	60
Cover crop establishment and upkeep	13	3
Drainage and miscellaneous work	7	10
Boundary protection, fencing and footpath maintenance	17	28
Security	3	18
Total	319	508

5.2.1.1 Smallholdings

Normally labour requirement for items such as boundary protection and night watching/security is significantly lower in smallholdings while that of manuring is higher due to the popular practice of applying cow dung. The operations such as pitting, refilling and planting are mainly done on a piece-rate basis. The small growers depend mainly on family labour for other cultural operations. Among the smallholdings 29 per cent of the labour requirement during the immature phase is met with family labour and the share of female labour is only 14 per cent (Joseph and Haridasan, 1992).

5.2.1.2 Estates

The estate sector mainly depends on permanent labour on roll and the share of female labour in plantation development operations ranges from 25 to 35 per cent. Normally permanent workers are engaged for tapping and related jobs while seasonal general field operations are carried out with casual labourers. The divisible operations such as pitting, refilling, *etc.* are also done on a casual basis but with a fixed task irrespective of the time of engagement. Any casual worker engaged for 240 days or more in 12 calendar months will acquire the status of a regular worker and will become eligible for benefits under the various labour statutes.

5.2.1.3 Non-traditional areas

In the non-traditional areas, the labour requirement for operations such as clearing, terracing and weeding is significantly higher. In the dry areas, additional labour for life-saving irrigation is required especially during the initial years. Similarly,the labour requirement in non-traditional areas for fencing and vacancy filling is also higher (Joseph and Rajasekharan, 1991).

5.2.2 Mature phase

The annual labour requirement during the mature phase depends mainly on the tapping system followed, system of processing, adoption of rainguarding, application of stimulants and panel protection activities. In a mature rainguarded plantation under 1/2 S d/2 system of tapping, the annual requirement of labour per ha is around 180 man-days (Table 3). Female labour can be substantially involved in all the activities including tapping.

Table 3. Annual labour requirement during the mature phase

Item of work	Number of man-days required (per ha)
Weeding	10
Manuring	5
Spraying (Copper oxychloride)	2
Other plant protection activities	2
Tapping and processing (under 1/2 S d/2 system)	150
Rainguarding	4
Panel protection	5
Others	2
Total	180

5.2.2.1 Smallholdings

In the smallholdings, since the tapper himself processes the latex or carries the material to the collection centre of processing factories, there is no need of separate labour for processing. The tapper requirement per unit area is higher compared to that of estates due to higher tapping intensity. Around 23 per cent of the small growers utilize family labour for tapping and in northern Kerala it is up to 44 per cent (RRII, 1997). The small growers normally hire experienced hands for initial marking of the trees, fixing of rainguards, spraying, *etc.* Normally workers do not prefer to be tappers in rubber plantations as the

wage rates are lower by 20 to 25 per cent compared to that of casual labour elsewhere, at a tapping task of 300 trees per tapper. The opportunity cost of a tapper is higher since he has to start work during the early hours of the day and is engaged up to sunset although the actual working hours may be less than eight hours with higher extent of leisure in between. Further, there is the monotony of working alone and the loss of working days during the rainy and summer seasons. Due to the reduction in the size of the holdings, there is the peculiar situation of a tapper working for different growers. Utilization of family labour for tapping would in future prove ideal due to obvious sociological and economic factors.

5.2.2.2 Estates

The number of tappers employed by estates depends on the number of tapping tasks, with an additional five per cent reserve so that tapping days will not be lost due to labour absenteeism or availing of leave by permanent tappers. The task size ranges from 300 to 400 trees per tapper. The tapper requirement depends on the stand under tapping, task size and tapping intensity. An increase in the tapping task with cash incentive for additional volume of latex collected (based on DRC) reduces the total tapper requirements, increases the earnings per tapper and significantly reduces the cost of production. The estates require additional labour for processing depending upon the type of processing.

5.2.2.3 Non-traditional areas

In the non-traditional regions one of the major difficulties is the shortage of experienced tappers. Larger holdings and estates in these areas even go to the extent of employing tappers from the traditional belt.

5.3 Managerial and administrative personnel

The requirement of managerial, supervisory and administrative support personnel depends on the size of the estates. Though this was an important component in large estates, its relevance in the Indian context has declined to a large extent due to the structural devolution resulting in a substantial reduction in the size of the plantations. The dominant smallholding sector is also affected by the steady growth in the share of part-time farmers in the traditional regions. The concepts of 'group farming' and 'centralized processing' with adequate institutional support are becoming increasingly relevant under these situations.

5.4 Impact of technology

The impact of the new technology has been both labour saving and labour augmenting. However, the net impact has been labour displacement manifested through a decrease in labour intensity from 0.67 in 1964-65 to 0.62 in 1996-97 (Rubber Board, 1997). The major labour displacing technologies adopted are low intensity tapping systems coupled with application of stimulants, application of weedicides, cover crop establishment and spraying using power-operated sprayers. The only major labour-promoting operation is rainguarding which facilitates an additional number of around 45 tapping days a year besides the labour employment in fixing them (Joseph *et al.*, 1989).

5.5 Wages, salaries and other benefits

5.5.1 Unorganized sector

The wage rates in the unorganized sector are fixed informally and are higher compared to the notified minimum wage rates. The wage rates often show a tendency to rise with the price of rubber. But the number of working days in the smallholdings is lower. The tappers in the smallholdings are paid on per tree basis, which also includes remuneration for processing. Since the workers in the unorganized sector are not entitled to the provisions under the Plantation Labour Act, the Rubber Board has been implementing a set of welfare schemes for them consisting of group insurance, housing subsidy, medical care and educational stipend to the children of workers. These benefits, however, are limited to tappers as other plantation development and upkeep operations are undertaken by general workers who work also for other crops and other sectors.

5.5.2 Organized sector

The conditions of workers in the organized sector are governed by the provisions of the Plantation Labour Act of 1951 which is applicable to all plantations admeasuring 5 ha and employing 15 or more workers. The wage rates are fixed through tripartite agreement under the provisions of the Minimum Wages Act. The tappers are paid daily wages (with a task ranging from 300 to 400 trees) and cash incentives depending upon the crop collected. A range of welfare measures covering basic amenities at work place, paid holidays, annual leave, medical care, canteen, residential quarters, educational facility for children, *etc.* are obligatory under the rules. The central and state legislations pertaining to minimum wages, industrial disputes, provident funds, accidents, gratuity, bonus, *etc.* are also applicable in the organized sector.

5.5.3 Non-traditional areas

Generally the wage rates are lower compared to those in the traditional region. Payment on piece-rate basis and daily wages are practised for indigenous tappers while experienced tappers from the traditional belt are paid monthly salaries often with free accommodation.

5.5.4 Managerial and other personnel

The salary, perks and other conditions of managerial, supervisory and administrative staff are negotiated by the concerned planters' associations with staff organizations, and the settlements are normally revised every three years.

5.6 Extent of unionization

The extent of trade union involvement of rubber plantation workers is significantly low as most of them work in the unorganized sector. Even the major category of tappers does not have occupation-specific trade unions though some of them are members of different general agricultural workers' unions. The workers in the organized sector are united under different trade unions affiliated to major political parties and their representatives participate in the tripartite negotiations. The supervisory and other staff also have trade unions of their own. However, the unions of workers and staff are not crop specific and cover workers engaged in other plantation crops also.

5.7 Training and motivation

Operations such as planting, plant protection, tapping, rainguarding, panel protection, application of stimulants, *etc.* require basic practical knowledge and skill on the part of the labourers engaged. Most of the estates have their own systems for training the workers, using the supervisory staff, invited experts and experienced workers as faculty. Skill development of labourers in the smallholding sector is mainly by deputing them for training programmes on tapping, processing, cultural operations, *etc.* organized by Rubber Board. Training and exposure motivate labourers, which in turn is reflected in the maintenance of plantations.

5.8 Future scenario

The estate sector with a heavy burden of establishment expenditure including the maintenance of a costly managerial staff, is always keen on reducing labour per unit area and the number of permanent workers. The unorganized sector is already facing a dearth of experienced tappers/field workers and this may turn into an acute problem in the coming years. The possibilities of modern technology should be exploited to optimize the use of labour. The probable strategies include shorter cut and low frequency tapping systems with the application of stimulants, increased tapping task with incentives, application of weedicides, *etc.* In addition to these, the smallholdings may also consider revision of wage rates of tappers with an incentive component, adoption of optimum plant density, engagement of female labour to the maximum possible extent and group collection and processing of rubber under the co-ordination of RPS.

6. VIABILITY OF RUBBER CULTIVATION

The three major factors affecting the viability of NR are steady increase in cost of inputs, instability in price and shortage of labour. Even though the net impact of the issues clouding the rubber sector varies across the regions, size-groups and managements, the gravity of the problem underlines the need for considerable restructuring of policy initiatives. As the production sector is dominated by the smallholdings, a group approach towards value addition seems to be an important policy option rather than isolated individual efforts. Moreover, a realistic and transparent strategy to contain the challenges arising from the globalization shall have two important components : (1) cost reduction at the farm level and (2) linking the downstream manufacturing segment to the production sector so as to maximize the returns through value addition.

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