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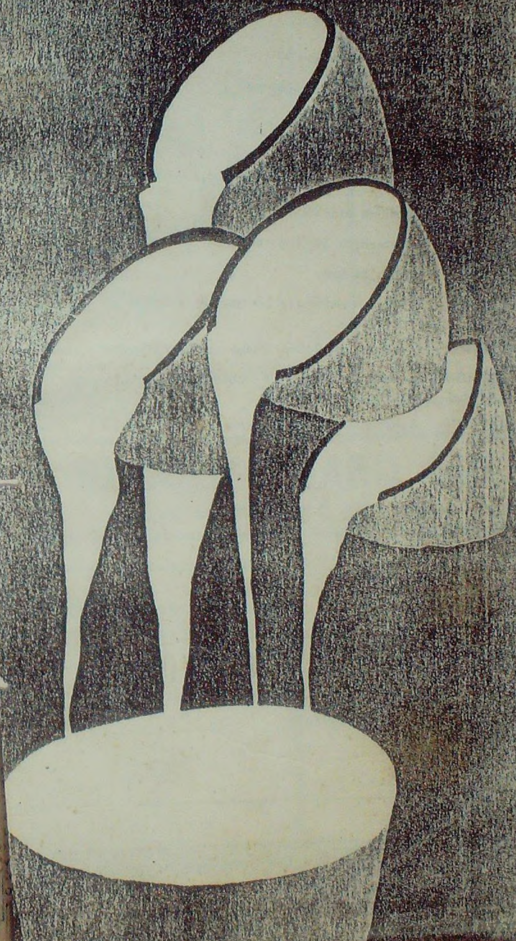
RUBBER BOARD BULLETIN



will be able to
share to the national exchequer.

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THE RUBBER BOARD
KOTTAYAM 686 001 INDIA

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Director of Research
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THE QUARTER

In one of his articles published in the financial daily the "Economic Times", Shri P. C. Cyriac, Chairman Rubber Board has struck a note of optimism with regard to the production prospects of natural rubber in India. The article is entitled "Self-sufficiency in rubber by 2000 AD". Stepping up production means saving of valuable foreign exchange now being spent on imports. At present only 85% of our requirements is met by indigenous production. For the remaining 15%, India is spending about Rs. 40 crores of foreign exchange annually towards import of rubber. As estimated by the Chairman Rubber Board, India would attain self-sufficiency by the turn of the century. The result is India will have an annual saving of about Rs. 400 crores of foreign exchange by that time. Rubber Board has the expertise and capability to carry on the great task ahead. By realizing this objective, the Board will be able to give its due share to the national exchequer.

TRAINING PROGRAMMES OF THE RUBBER BOARD

The Department of Training, Rubber Board is conducting various training courses intended for persons interested in rubber cultivation, crop processing and those who are employed in supervisory capacity in estates. The trainings on the following topics are being conducted by the Department.

1. Rubber Culture

This course offers technical training to personnel engaged in rubber estates in a supervisory capacity, for providing them with up-to-date knowledge on improved scientific methods of cultivation, crop processing and estate management. Persons employed in rubber estates as managers/superintendents, assistant superintendents, assistants and other supervisory personnel are eligible for admission. Persons intending to take up rubber planting/jobs in rubber plantations and officers and staff of Government Departments/Public Sector organisations having programme for taking up rubber plantations will also be eligible for admission. The required qualification for the candidates is a pass in SSLC or equivalent. The medium of instruction is English. Only 25 candidates are given admission in one batch. The fee for the course is Rs. 1,000/-per candidate. The duration of the course is four weeks.

2. Manufacture of Rubber Goods from Latex

This is mainly meant for those who are already in the manufacturing field and those who are interested in starting small-scale manufacture/production of rubber goods from latex and dry rubber. The medium of instruction is English. The qualification and other conditions of admission for the course are the same as that in the course in Sl. No.1. Admission of candidates is limited to 20. The fee for the course is Rs. 350/-per candidate and the duration is for ten days.

3. Manufacture of Rubber Goods from Dry Rubber

A similar training course as that of training course in Sl. No. 2.

4. Rubber Processing

Training in Rubber Processing is given to candidates from North-eastern region and other non-traditional areas. Candidates sponsored by Government Departments and Public/Private Sector undertakings will be given preference. Candidates from other rubber growing areas and those deputed from Co-operative Societies/RPS will also be given training in rubber processing. The fee for admission to this course is Rs. 350/per trainee. The training course is for a period of ten days. The medium of instruction of this course is also English.

5. For Small-holders

This course, for a duration of eleven days, is intended for small rubber growers and supervisors in rubber estates. This is a comprehensive training programme covering all aspects in rubber cultivation, tapping, crop processing etc. The fee for the course is Rs. 100/-per candidate. Medium of instruction of the course is Malayalam.

6. For analytical chemists

Analytical chemists employed in Rubber manufacturing units will be given training for a period of one month. For this, candidates with Chemistry main for their B.Sc. Degree will only be admitted. The course fee is Rs. 500/- per candidate and the medium of instruction will be English.

7. Rubber Sheet Grading

This is a three day training programme in which theory and practical classes are included in grading of rubber sheets. Private planters, nominees from Co-operative Societies/RPS and rubber dealers and their nominees can attend the course. A course fee of Rs 25/- per candidate is levied for admission. Training is given in Malayalam/English.

8. Maintenance of Plant Protection Equipments.

A one day training is imparted as to how the plant protection equipments are maintained properly for use in rubber plantations.

9. For Rubber Nursery Owners.

Detailed training is given to nursery owners and their employees for raising nurseries, its proper maintenance etc. The training covers all aspects of nursery management.

Venue

Venue for all these courses is the Rubber Research Institute of India, Rubber Board P. O., Kottayam-9, Kerala State.

General

The candidates shall make their own arrangements for accommodation in Kottayam town or nearby places for attending the training. Application for admission should be in the specified form which can be obtained from the Joint Director (Training), Department of Training, Rubber Board P. O., Kottayam-9 Kerala State. For the training course in Sl. No. 1' the course material is the "Handbook of Natural Rubber Production in India". For other courses also detailed lecture notes will be supplied. Transport will be provided for candidates by the Rubber Board from Kottayam town to the place of training (Rubber Research Institute of India) and back. Similarly, transport of trainees to estates and back, while on study tour, will also be arranged by the Rubber Board. Concession/exemption on course fee will be given to the nominees of the Co-operative Societies/RPS.

At the end of all training courses an evaluation will be carried out and suitable certificates will be issued to the trainees who sucessfully complete the training programme.

M. O. JOSEPH

Expansion of Rubber Plantation in Assam

Rubber appears to be the choicest cash crop for small farmers in Assam on account of the vast and varied benefits whether socio-economic or ecological. The rubber growers could lead a settled way of life by means of the steady income throughout the year. In Assam this commercial crop holds out the promise to accelerate rural development and improve the quality of life among the rural poor. The author at present Jt. Rubber Production Commissioner, Rubber Board Zonal Office, Guwahati-1 explains the vast potential for the expansion of rubber cultivation in Assam. He is of the view that with the adequate support from the related agencies including the Govt. of Assam, rubber plantation activities there, will certainly make faster strides.

Rubber cultivation was introduced in Assam on a small scale experimental basis during late 1950's from the South. For quite sometime the new crop was confined to Departmental farms. The initial trials however proved successful owing to the pioneering efforts of veterans like Sri. M. C. Jacob who headed the Forest and Soil Conservation Departments in the undivided Assam. Setting up of a Plant-tion Corporation for large scale cultivation of rubber and coffee n 1973 by the State Government narked a milestone in the annals f rubber plantation development Assam. Over the years, the ssam Plantation Crops Dev. orporation (APCDC Ltd) has ised over 1300 hectares of bber. But, adoption of the crop the small holder community as not significant till recently. onsidering the vast potential r development in this non-tradi-onal area, the Rubber Board s extended its activities to orth Eastern Region. With the bjective of bringing about ccelerated development of ubber plantations, the Board has strengthened its machinery by opening a Zonal Office at Guwahati in 1985. Even though the Zonal Office is responsible for co-ordination and control of the developmental activities of the Board in the entire North Eastern Region, special attention is paid for the development in Assam.

Priority for Smallholding Sector.

High priority and importance is given to spearhead development in the small holding sector. Rubber is a sophisticated longterm crop requiring considerable investment and technical know-how. For catering to the special needs of small growers, the Board has established bases in potential centres in Assam. To begin with, three Regional Offices located at Guwahati, Silchar and Diphu havebeen initalliy started. Technical officers recruited from the State and specially trained in the Board's Headquarters in Kerala render necessary extension support at the village level through field visits, demonstration, training and mass contact programmes. Since high yielding planting materials are not adequately available here, large quantities of budded stumps are being transported from Kerala and distributed free of cost. Polythene bags are also supplied for raising polybag nurseries in large numbers. In order to achieve self sufficiency in planting materials, the Board has newly established 5 Rubber nurseries in Assam. They are located at Ballacherra and Madhura in Cachar district, Darrangiri in Goalpara district and Diphu & Khatkati in Karbi Anglong district. Further, an experimental station at Sorutari (near Byrnighat) has been set up by Rubber Research Institute of of India as part of its Research Complex, for applied and adaptive research to tackle the special problems of this non traditional location.

Financial aid

In addition to the technical and material assistance, the Board is extending financial aid to growers by way of maintenance grant for raising Plants in polybag nurseries and cash sudsidies to meet the cost of field planting and maintenance. The Board also has been continuously giving technical support and financial assistance to the Assam Plantation Crops Dev. Corporation Ltd, thereby helping its expansion. A regular programme of conducting study tours in Kerala for teams of selected farmers from Assam also has been systematically undertaken by the Board as a promotional measure.

As a result of all the concerted efforts of the Board, it has been possible to create widespread awareness about the benefits of rubber cultivation. Also, the technical know-how in improved methods of planting and upkeep could be successfully disseminated to a large measure among small farmers and the tribal population. The response received from the small holder community has been quite encouraging and exciting. The present organisational set up of the Board, though quite small, could successfully effect a real break through in the tempo and quality of rubber planting activity in the State. Even though rubber is a raw plantation crop here, it is now well familiar to thousands of small farmers. During 1986/87 it has been possible to raise rubber cultivation in 450 hectares and in 1987/88 over 1500 hectares with the assistance of the Board in Assam alone involving around 2000 small farmers. The tribal population and educated unemployed are really the major beneficiaries. The situation is now well poised for rapid expansion in the years to come. Now, the targets for 1988/89 and 1989/90 envisage extension of planting in 2500 hectares and 3500 hectares respectively in Assam. This may be achieved without fail, inspite of several constraints inherent to the Region.

Collective approach.

In order to facilitate orderly development, especially in the small holding sector, a collective approach is being pursued by the Board. Common facilities and inputs are provided to organised groups in selected localities. The help of co-operative societies, voluntary agencies, village chiefs and opinion leaders are all enlisted gain fully to mobilise farming groups.

Rubber appears to be the choicest cash crop for small farmers in Assam on account of the vast and varied benefits, whether socio-economic or ecological. It gives quite remunerative returns ovar a long span of 25 years. Rubber has proved to be an effective anralternative crop to wean away the tribal population from the age old practice of jhumming or shifting cultivation. They could lead a settled way of life by means of the steady income throughout the year. Rubber plantations also open up vast avenues for self employment and prosperity to the educated unemployed in the State. This commercial crop holds out the promise to accelerate rural development and improve the quality of life among the rural poor. In fact, cultivation of rubber is a measure of afforestation also as the verdant growth provides thick green coverage to the denuded hillocks thereby improving the eco-systems. Substantial production of this raw material will pave the way for setting up of small and large rubber based industrilisation. Trading in rubber will also yield income to the State exchequer by way of taxes etc.

Transformation

Expansion of rubber cultivation will thus bring about vast socio-economic transformation to the State. The Rubber Board is planning on a long term basis to create the essential development infrastructure locally. Considering the increasing future demands, it is imperative to establish new nurseries, demonstration-cum-training units, group processing centres, marketing facilities etc. in all potential areas. In the first instance, the Board proposes to start small demonstration-cum training centres in 10 selected districts of Assam which will serve as nucleus supply and service bases for small growers. A comprehensive scheme in this regard has been drawn up for implementation with the assistance of North Eastern Council, Shillong. It is expected that the plots of land required for setting up each district centre will be allotted by the Govt. of Assam. On the Research front also, the Board is planning to conduct trials and studies relevant to the local conditions. The tissue culture and other ldboratory complex set up in Guwahati under Rubber Research Institute of India will be expanded and well equipped to cater to the special needs of North Eastern Region. Here again the active support of the State Govt. is very much needed to secure the premises for the Research Complex.

It is gratifying to see that rubber is widely accepted as a small growers' crop now. With adequate support from the State Government cnd active co-operation of all the related agencies, rubber plantation development will certainly make faster strides. Tripura is leading all other North Eastern States in fieild of rubber plantation. Before long, Assam, having a vaster potential is bound to catch up.

Rubb. Board bull. 23, No. 1

On Rubber Prices and Buffer Stock

P C Cyriac IAS

We often come across reports on rubber price fluctuations. These reports create panic among rubber producers and rubber goods manufacturers. The sudden fall and the steep rise both represent the nature of fluctuations in the market.

How this phenomenon takes place? Shri P C Cyriac I A S Chariman, Rubber Board, analyses the reasons for this and brings forth the basic issues involved in them. Importing rubber as and when required will not pose many difficulties. Rubber market in India is sensitive. Even a small quantity of 500 tonnes of surplus or deficit has resulted on many occasions in disproportionate fluctuations in prices.

While the producers pleaded for a higher price, the consumers pointed to the lower prices. To escape from this state of affairs, a cost study was conducted. As a result a fair price has been determined. It has to be acceptable to both sides.

We frequently see screaming headlines in our economic newspapers voicing concern at either the steep rise or sudden fall in rubber prices and wonder what exactly is wrong with this commodity. Rubber is the raw material which sustains a thriving Rs. 3000 crore annual turn-over industry, producing a wide range of products. On one end of the spectrum we have the multi-crore tyre companies producing aircraft tyres, truck tyres and heavy earth mover tyres. On the other end are the tiny cottage units manufacturing rubber bands and gloves and balloons. Most of the rubber products are essential goods, required for our daily life and many of them have secured reliable export markets too. Last year the foreign exchange earned by the rubber products crossed Rs.100 crores. The majority of these rubber products manufacturing units are small scale units providing regular jobs for a large number of skilled ane unskilled workmen. For the stability and the steady growth of this industry it is essential that rubber the basic raw material required is made available in sufficient quantity at stable and fair prices.

Hard working people

Rubber is produced mostly in the southern plantations and it is a small grower crop. About 77 per cent of the production is from small farmers in extent. Very often these farmers are entirely dependent on the rubber they produce. A sudden crash in prices can ruin an entire generation's hard work. The crop which calls for scientific cultural practices and management will need 7 years to start yielding after planting. During these 7 years the small holder invests everything he has in his rubber plantation and patiently and carefully tends it. If, at the end, the crop fails to fetch a fair price the hopes of 300,000 small farmers would be crushed. Maintaining a stable and fair price level for rubber is the minimum which should be done to help these hardworking small farmers. Thus stable and fair price emerges as the goal and both the manufacturing industry and the rubber producer want it.

Justice to both sectors

What is the difficulty in maintaining a stable and fair price? The production of rubber is not the same round the year. From August to end January, the production is more, about 26,000 tonnes per month on an average, while the consumption is only about 23,000 tonnes per month. When supply is more than the demand the price tends to fall. But during the period from February to July, the production is less, but consumption continues at the same level and prices tend to rise during this period. Taking the whole year, the demand by the manufacturing industry is more than the production to the tune of about 15 per cent. This gap between demand and supply is made good by imports from South East Asia. If only the imports are brought in and distributed to the consumer during the months when the domestic production is less, any runaway price rise can be checked. This looks easy on paper but very often the schemes do not get executed as planned. Due to some unforeseen reasons or the other, the imports fail to come in time. The climate of deficit pushes the prices upwards and the consumer suffers. But by the time the imports, do arrive, the peak production season would have begun when the domestic production itself is more than sufficient to cover the demand. But the imports also reach the market and a price crash follows. As an insurance against the recurrence of this very familiar scenario, the Government decided in February, 1986, to introduce a buffer stocking scheme, responding to the industry's suggestion. It was decided to maintain always a buffer stock of 2500 T of rubber in the STC's godowns in the country

Even if the import is getting delayed, using this buffer stock, the upward pressure on prices can be relieved to a great extent, for sometime. Meanwhile, more supplies can be brought in from the nearby rubber producing countries, as required. As the price level in the market is the most reliable indicator of the demand-supply position, the Government decided to link the releases from the buffer stock to the price level. Now that the Government has fashioned a machinery to prevent price risebeyond an upper ceiling, it decided to prevent its fall beyond the floor level, by making domestic procurement of rubber at the floor price fixed. The aim was to do justice to both the sectors -the consumers and producers and keep the price floating within a price band, between the floor price and the ceiling price.

Advance Planning

Two questions arise here: 1) Is the quantum of buffer stock viz., 2500 tonnes, enough to serve the purpose and be effective? ii) What is the fair price which is "reasonable and fair" to both the sides? The total annual deficit has been around 35000 tonnes during the last few years, both the production and the consumption increasing steadily. The actual deficit can be more accurately assessed on the basis of the latest production and consumption figures, as the season advances. The time when this deficit occurs is also known. Therefore, with some care, advance planning can be done and import can be made in time. Rubber is available in plenty at any time and at short notice in major rubber producing countries like Malaysia, Indonesia and Thailand. There is also a large stock of over 300,000 tonnes of rubber with the International Natural Rubber Organisation. In short, importing more rubber whenever required will not pose many difficulties. To guard against unexpected domestic price increases the buffer stock of 2500 tonnes will be sufficient. Further, the rubber market in India has been an extremely sensitive market. Even a small quantity of 500 tonnes of surplus or deficit has resulted on many occasions in apparently disproportionate fluctuations in prices. 2500 tonnes can be considered in this context as a respectable quantity capable of playing an effective role in controlling the market price. In any case, maintaining a buffer stock is a costly operation, today's interest charges and storage costs being what they are. Considering all these aspects one will agree that the quantum of buffer stock is sufficient.

Fair Price

Now about the fair prico. When the fair price for RMA-4 grade rubber was fixed at Rs. 16.50 in February, 1986 both the producers and consumers were unhappy. The government had actually fixed a price band from Rs. 16.00 to 17.00, considering Rs. 16.50 as the desirable fair price. While the producers pleaded for a higher price, the consumers pointed to the lower prices in Malaysia and Indonesia. To resolve this controversy, the Government ordered a comprehensive study of the cost of production of natural rubber in India to be undertaken by the Cost Accounts Division of the Finance Ministry. This study was conducted between April and September of 1986 and a report was submitted to the Government by the Cost Accounts Division soon afterwards. During March 1987 after examining the report and recommendations the Government revised the price band of RMA-4 grade rubber as from Rs. 16.50 to Rs. 17.50, fixing the desirable fair price at Rs. 17.00. As the fair price has been determined only after an independent cost study, by a professional and specialist group under the Finance Ministry, it is only fair that both the side s accept this.

Steady Market

What has been the experience after February, 1986? Has the buffer stock scheme achieved its goal and maintained price stability? I think the scheme produced the desired results. Price levels were kept within the price band for most of the period, by judiciously releasing inported rubber. In September-October 1986, as soon as the prices went below the floor level, domestic procurement was undertaken to mop up the market surplus and bring up the price back into the band. The experiment has by and large succeeded. Of course the operation can be fine tuned and improved upon in the light of the experience gained For example, the imports planned for summer of 1987 did not arrive in time. The reason there was delay in releasing the required foreign exchange to the STC. This pushed up the prices. The lesson learnt was that STC should apply for the release of foreign exchange well ahead of the requirement The concept of safe level imports also has come up for consideration to solve such problems. In general, as a result of the buffer stocking scheme and the careful monitoring of the production and consumption figures and arranging of regular imports, the rubber market has been very steady, for sometime now. While the average price for 1985-86 fer RMA-4 grade rubber was Rs. 1732/- the same for 1986-87 was only Rs. 1660/-.

Year	Average RMA-4 price
1983-84	Rs. 1752
1984-85	Rs. 1655
1985-86	Rs. 1732
1986-87	Rs. 1660

These figures show that the price stability of rubber has not been matched by any other industrial raw material in our country. Both the producers and the consumers have come to realise that this stability is advantageous to them and this realisation would enable the Government also to work effectively for stability. And with the dream of price stability being realised, an era of fast progress for the rubber industry has begun. □

Bee-keeping and Its Off-seasonal Management in Rubber Plantation-based Apiaries in India*

C. R. NEHRU[1] and K. JAYARATHNAM[2]

Rubber Research Institute of India, Kottayam, Kerala, India

ABSTRACT

Lack of nectaries during the prolonged period from April to December in rubber plantations in India necessitates interim bee flora for off-seasonal arrangements for the Indian honey bee Apis cerana indica F. Introduction of five major alternative bee forage plants viz. Antigonon leptopus Hook. & Arn., Callistemon lanceolatus DC., Manihot glaziovii Muell. Arg., Pongamia glabra Vent. and Thunbergia spp. in association with twenty-one major sources of nectar and pollen made a full complement of alternative bee flora for off-seasonal management of honey bee colonies in rubber plantations. Observations on the start, peak and decline of the blossoming of the different plants highlight a synchronisation in the activities of bees and the flowering periods of plants throughout the year. Hevea brasiliensis Muell. Arg. records a decline in honey flow in late March, while the introduced alternative bee flora maintain their flowering till December resulting in a shift in the foraging thythm of bees from the former to the latter. About ten important pollen sources and eleven important nectar sources, if suitably tapped, can provide surplus honey to the rubber plantation-based bee-keepers. The non-availability of alternative bee flora tends to suspend the brood-rearing activity during the April to December period in rubber plantation-based apiaries. To overcome this draw-back, five useful bee forage plants have been successfully established at the Rubber Research Institute of India farm and found to be the best suited for off-seasonal bee management in rubber plantations. Details of five useful off-seasonal bee flora, their methods of propagation, period of maturity as bee forage plants, etc are given. A model floral calendar for continuous and successful bee-keeping in rubber plantations is also formulated.

Bee-keeping (Apiculture) is one of the oldest agro-industries of India. It is a branch of agriculture dealing with the seasonal and off seasonal management of honey bee colonies. The importance of honey is amply highlighted in the literature on Indian Ayurveda and Islamic culture. With the standardisation of management practices for Apis cerana indica F. (Apidae:Hymenoptera), bee-keeping in rubber plantations is currently emerging as a fast-developing cottage industry in the Southern States like Kerala and Tamil Nadu occupying nearly 98% of the total area under rubber cultivation in the country which account for about one-third of the total honey produced in India[1-3]. The non-availability of continuous perennial sources of nectar and pollen are the most significant limiting factors in the survival, abundance and distribution of honey bees especially during the prolonged dearth period, April to December in the rubber plantation-based apiaries. It is in this context that an attempt is made to confirm the pollen and nectar yielding potentialities of five major alternative bee flora[2] highlight a synchronisation in the activities of bees and the flowering periods of plants in various seasons of the year. Five promising bee forage plants along established in and around the plantations of the Rubber Research Institute of India (RRII) and proved to be best suited for off-seasonal bee management [1,2,4]. Seasonal bee flora[2] highlight a synchronisation in the activities of bees and the flowering periods of plants in various seasons of the year. Five promising bee forage plants along with twenty-one major and minor sources of nectar and pollen form a continuous chain of alternative bee flora for offseasonal bee management.

The honey flow period of rubber plants (*Hevea brasiliensis* Muell

* Source of the article ie., the Proceedings of the International Rubber Conference 1985, Vol. 3

The authors thankfully acknowledge the Rubber Research Institute of Malaysia for giving permission to publish this article. 1. Entomologist 2. Dy. Director

Even if the import is getting delayed, using this buffer stock, the upward pressure on prices can be relieved to a great extent, for sometime. Meanwhile, more supplies can be brought in from the nearby rubber producing countries, as required. As the price level in the market is the most reliable indicator of the demand-supply position, the Government decided to link the releases from the buffer stock to the price level. Now that the Government has fashioned a machinery to prevent price rise beyond an upper ceiling, it decided to prevent its fall beyond the floor level, by making domestic procurement of rubber at the floor price fixed. The aim was to do justice to both the sectors -the consumers and producers and keep the price floating within a price band, between the floor price and the ceiling price.

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ABSTRACT

Lack of nectaries during the prolonged period from April to December in rubber plantations in India necessitates interim bee flora for off-seasonal arrangements for the Indian honey bee Apis cerana indica F. Introduction of five major alternative bee forage plants viz. Antigonon leptopus Hook. & Arn., Callistemon lanceolatus DC., Manihot glaziovii Muell. Arg., Pongamia glabra Vent. and Thunbergia spp. in association with twenty-one major sources of nectar and pollen made a full complement of alternative bee flora for off-seasonal management of honey bee colonies in rubber plantations. Observations on the start, peak and decline of the blossoming of the different plants highlight a synchronisation in the activities of bees and the flowering periods of plants throughout the year. Hevea brasiliensis Muell. Arg. records a decline in honey flow in late March, while the introduced alternative bee flora maintain their flowering till December resulting in a shift in the foraging thythm of bees from the former to the latter. About ten important pollen sources and eleven important nectar sources, if suitably tapped, can provide surplus honey to the rubber plantation-based bee-keepers. The non-availability of alternative bee flora tends to suspend the brood-rearing activity during the April to December period in rubber plantation-based apiaries. To overcome this draw-back, five useful bee forage plants have been successfully established at the Rubber Research Institute of India farm and found to be the best suited for off-seasonal bee management in rubber plantations. Details of five useful off-seasonal bee flora, their methods of propagation, period of maturity as bee forage plants, etc are given. A model floral calendar for continuous and successful bee-keeping in rubber plantations is also formulated.

Bee-keeping (Apiculture) is one of the oldest agro-industries of India. It is a branch of agriculture dealing with the seasonal and off seasonal management of honey bee colonies. The importance of honey is amply highlighted in the literature on Indian Ayurveda and Islamic culture. With the standardisation of management practices for Apis cerana indica F. (Apidae:Hymenoptera), bee-keeping in rubber plantations is currently emerging as a fast-developing cottage industry in the Southern States like Kerala and Tamil Nadu occupying nearly 98% of the total area under rubber cultivation in the country which account for about one-third of the total honey produced in India[1-3]. The non-availability of continuous perennial sources of nectar and pollen are the most significant limiting factors in the survival, abundance and distribution of honey bees especially during the prolonged dearth period, April to December in the rubber plantation-based apiaries. It is in this context that an attempt is made to confirm the pollen and nectar yielding potentialities of five major alternative bee flora[2] highlight a synchronisation in the activities of bees and the flowering periods of plants in various seasons of the year. Five promising bee forage plants along established in and around the plantations of the Rubber Research Institute of India (RRII) and proved to be best suited for off-seasonal bee management [1,2,4]. Seasonal bee flora[2] highlight a synchronisation in the activities of bees and the flowering periods of plants in various seasons of the year. Five promising bee forage plants along with twenty-one major and minor sources of nectar and pollen form a continuous chain of alternative bee flora for offseasonal bee management.

The honey flow period of rubber plants (*Hevea brasiliensis* Muell

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1. Entomologist 2. Dy. Director

Arg.) ranges from January to March and during this period honey bees collect large quantities of nectar from the extra-floral nectary glands at the distal end of petioles where the leaflets join. Early in the morning (6 a.m to 8 a.m) and late in the evening (5 p.m. to 7 p.m.) the foraging activity on *Hevea* becomes quite intense and the bees devote long hours on this crop.

The present studies were carried out at the RRII during 1982-84 with a view to evaluating the nectar and pollen yielding potentialities of a number of bee flora and to formulate a model floral calendar for off-seasonal bee management in rubber plantation-based apiaries.

Materials and Methods

Bee flora exploited by honey bees in and around the RRII were periodically recorded and identified as major and minor sources of nectar and pollen. Slides of the pollen from the hive pollen loads and herbarium specimens were prepared according to the methods given by Wodehouse[5] and Erdtman[6,7] and those from pollen sediments of honey samples were prepared by the method described by Maurizio[8]. Pollen grains from hive pollen loads and honey samples were compared and identified with reference of slides of pollen. Data on the start, peak and decline of the blossoming different plant sources were recorded at monthly intervals throughout the year. The successive blossoming peaks of these off-seasonal bee flora, following the honey flow season of *Hevea* were recorded. Details of five off-seasonal bee flora, their methods of propagation, period of maturity as bee forage plants were also studied. A model floral calendar is drawn up to depict the major economic plant and tree species for off-seasonal bee management.

Results and Discussion

The importance of nectar and pollen yielding potentialities of bee flora is highlighted by Singh[9], Mishra *et al.*[10], Atwal et al.[11] and Goyal and Atwal[12] for economic bee management in North India. Over seventy plant species were identified in and around the RRII farm as major and minor sources of pollen and/or nectar[2]. The potential pollen sources identified were *Acacia* spp., *Antigonon leptopus* Hook&Arn., *Bauhinia* spp., *Cassia* spp., *Cocos nucifera* L., *Lagerstroemia indica* L., *Manihot glaziovii* Muell. Arg., *Thunbergia* spp.,*Tridax procumbens L. and Musa* spp., *and the major nectar* sources were *Antigonon leptopus* Hook. & Arn., *Callistemon lanceolatus* DC., *Eucalyptus* spp , *Pongamia* spp., *Santalum album* L., *Tridax procumben* S., *andThunbergia*spp. Records of the sequence of the flowering in different seasons of the year are presented in *Table* 1.

The absence of plant food is by far the most important limiting factor in the overall activities of honey bees reared in rubber plantations. Nehru *et al.*[2] published a detailed list of garden plants, weeds, shrubs, trees and ornamental plants which serve as major and minor sources of nectar and pollen for bee-keeping in rubber plantation-based apiaries in Kerala State. Jayarathnam[13], Suryanarayana[14], Wickramasinghe[15] and Nehru *et al.* [1,2] highlighted *Hevea brasiliensis* Muell. Arg. as a potential source of nectar and its honey flow spreads over the months of January to March. The prolonged non-availability of nectar and pollen in rubber plantation-based apiaries from April to December prompted a search for an alternative interim bee flora for off-seasonal arrangements for the Indian honey bee, *Apis cerana* Indica F. Proper exploitation of available bee flora having varying blossoming periods together with the intensive cultivation of five major alternative bee forage plants in and around the border of rubber plantations can readily provide a continuous chain of food for bees reared on rubber plantations round the year. Honey flow season in the rubber plantation declines in late March while the off-seasonal bee flora *viz. Antigonon leptopus, Callistemon lanceolatus, Manihot glaziovii, Pongamia* spp. and *Thunbergia* spp. maintain continuous flowering till December, resulting in a shift in the foraging rhythm of *Apis cerana* indica F. from the former to the latter flora[2]. Intensive research on bee-keeping further reveals a synchronisation in the activities of bees reared in rubber plantation-based apiaries at the RRII farm and the successive flowering peaks of the newly introduced alternative bee forage plants throughout the year (*Table* 2 and *Figure I*).

Details of five off-seasonal bee flora, their methods of propagation, period of maturity as bee forage plants are also given in *Table 2.* A model calendar drawn up to depict the flowering times of various economic plant species for bee-keeping and its off-seasonal management in rubber plantation-based apiaries is given in *Table 3.*

Before the establishment of alternative bee flora, the brood-rearing activity of rubber plantation-based honey bees remained almost suspended from mid-April to mid-June due to the non-availability of a supplementary bee flora. With the establishment of the off-seasonal bee flora in and around the RRII, the queen started laying eggs and the suspended brood-rearing was found to be resumed vigorously and fresh brood-rearing was continued actively even during April-June. The prolonged floral gaps not only arrested the growth and development of honey bee colonies but also induced desertion and consequent colony losses to a greater extent. These floral gaps in rubber plantation-based apiaries ranging from April to December are readily supplemented by the introduced off-seasonal bee flora.

The research on the introduction of *Apis cerana indica* F. in rubber plantations has opened new vistas for increasing the planter's income. It is estimated that twenty bee hives can be well maintained in a hectare of rubber plantation having 400 mature

TABLE 1. SOURCES OF MAJOR NECTAR AND POLLEN DURING DIFFERENT SEASONS OF THE YEAR IN AND AROUND THE RUBBER RESEARCH INSTITUTE OF INDIA FARM

Plant species	Family	Available (months)	Period of flowering (month)			Type of food source	Occurrence	References
			Start	Peak	Decline			
Acacia spp	Leguminosae	1-12	1	4-5	12	P_1N_3	C	
Antigonon leptopus Hook & Arn.	Polygonaceae	1-12	1	7-9	12	P_1N_1	VC	Nehru *et al*[3]
Bauhinia variegeta L	Leguminosae	4-9	4	7-8	9	P_1N_3	C	
Callistemon lanceolatus DC	Myrtaceae	1-12	1-12	9-10	11	P_3N_1	VC	Nehru *et al*[3]
Cassia spp.	Leguminosae	5-9	5	6-7	9	P_1	VC	
Cocos nucifera L	Palmae	1-12	1	6-8	3	P_1	VC	
Eucalyptus spp.	Myrtaceae	1-3	1	2	3	P_3N_1	C	
Helianthus annus L.	Asteraceae	1-4 & 6-10				P_2N_1	C	
Hevea brasiliensis Muell. Arg.	Euphorbiaceae	1-3	1	6	10	N_1	VC	Nehru *et al*[2] Jayarathnam[13]
			1	2-3	3			
Lagerstroemia indica L.	Lythraceae	4-9	4	5	8	P_1	C	
Manihot glaziovii Muell. Arg.	Euphorbiaceae	4-11 & 1-12	1	9-11	12	P_1N_2	VC	Nehru[2]
Moringa oleifera Lam.	Moringacaeae	4-6 & 11-2	2	4-5	1	N_2	VC	
Mangifera indic L.	Anacardiaceae	1-3	1	2	3	P_3N_3	VC	
Musa spp.	Musaceae	1-12	1	5-6	12	P_1N_1	VC	
Polygonum spp.	Polygonaceae	6-10	6	8-9	10	P_2N_1	VC	
Pongamia glabra Vent	Leguminosae	4-6	4	5-6	6	N_1	VC	Nehru *et al.*[5]
Santalum album L.	Santalaceae	4-6	4	5	6	N_1	R	
Thunbergia spp.	Acanthaceae	1-12	1	11-1 & 4	12	P_1N_1	VC	Nehru *et al.*[5]
Tridax Procumbens L.	Asteraceae	1-12	1	5-6	12	P_1N_1	VC	

Numbers 1 to 12 refer to the months of the year.
P = Pollen; P_1 major, P_2 medium, A_3 minor
N = Nectar; N_1 maior, N_2 medium, N_3 minor
V = Very common
C = Common
R = Rare
VR = Very rare

TABLE 2. BEE FLORA FOR OFF-SEASONAL BEE MANAGEMENT IN RUBBER PLANTATION-BASED APIARIES

Plant species	Family	Propagation	Mature as bee forage plants (years)	Period of flowering (months)	Blossoming peaks (months)	Type of food source
Antigonon leptopus[a]	Polygonaceae	Vegetative and generative	$1\frac{1}{2}$–2	Jan-Dec.	Jul-Sep.	P_1N_1
Callistemon lanceolatus[a]	Myrtaceae	Generative but commonly vegetative (air-layering)	3	Jan-Dec.	Sep.-Oct.	P_3N_1
Manihot glaziovii	Euphorbiaceae	Vegetative and generative (stem-cuttings)	1	Apr. Nov. and[b] Jan.-Dec.	Sep.-mid-Nov.	P_1N_2
Pongamia glabra	Leguminosae	Generative	4-5	Apr.-Jun.	May-June	N_1
Thunbergia spp[a]	Acanthaceae	Vegetative	1	Jan.-Dec.	Apr. and Nov. Jan.	P_1N_1

[a]The plants are in flower throughout the year

[b]Varieties with wintering and without wintering.

P = Pollen; P_1 major, P_2 medium, P_3 minor

N = Nectar; N_1 major, N_2 medium, N_3 minor

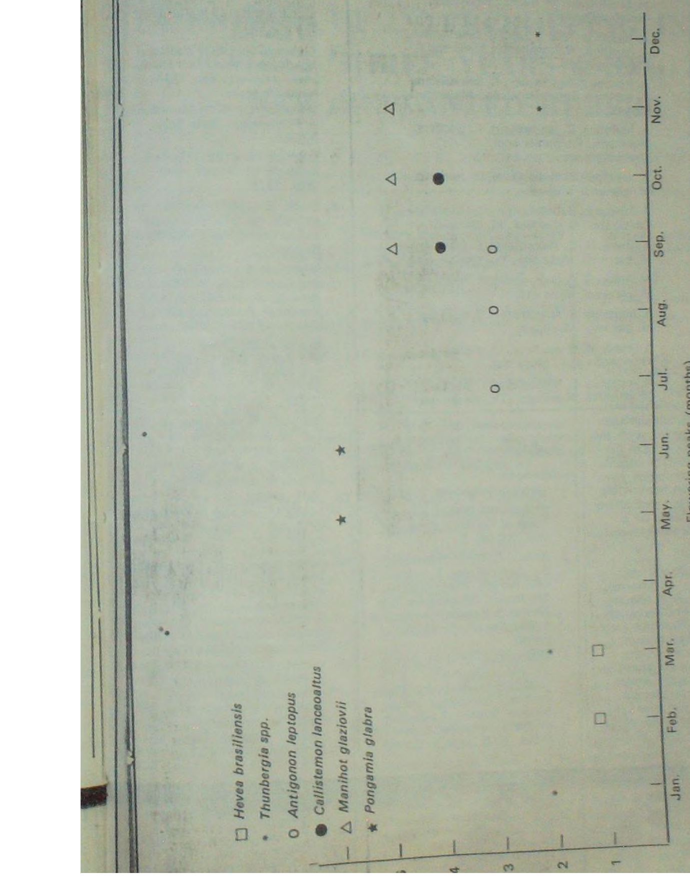

Figure I. Successive blossoming peaks of H. brasiliensis *and five off-seasonal bee flora.*

TABLE 3. A MODEL FLORAL CALENDAR FOR A HYPOTHETICAL REGION FOR ECONOMIC OFF-SEASONAL BEE FLORA

Month	Plant species
Jan.	A. leptopus, C. lanceolatus C. mucifera, H. brasilienM. glaziovii, Musa spp. Thunbergia spp.
Feb.	A. leptopus. C. lanceolatus, C. nucifera, H. brasiliensis, M. indica Musa spp., Thunbergia spp.
Mar.	A. leptopus, Acacia spp., C. lanceolatus, C. nucifera, H. brasiliensis, Musa spp., Thunbergia spp.,
Apr.	A. leptopus, Acacia spp., C. lanceolatus, C. nucifera, Thunbergia spp., M. oleifera, Musa spp.
May.	A. leptopus, C. lanceolatus, C. nucifera, Musa spp., Pongamia spp., Thunbergia spp.
Jun.	A. leptopus, C. lanceolatus, C. nucifera, M. glaziovii, Musa spp.
Jul.	A. leptopus. Bauhinia spp., C. lanceolatus, Cassia spp., C. nucifera, M. glaziovii,
Aug.	A. leptopus, C. lanceolatus, C. nucifera, M. glaziovii, Musa spp., Polygonum spp.
Sep.	A. leptopus, C. lanceolatus, C. nucifera, M. glaziovii, Musa spp.
Oct.	A. leptopus. C. lanceolatus, C, nucifera. M. glaziovii, Musa spp.
Nov.	A. leptopus, C nucifera, M. glaziovii, Thunbergia app , Musa spp.
Dec.	A. leptopus, C. lanceolatus, C. nucifera, M. glaziovli, Musa spp , Thunbergia spp.

trees. Due to advanced management practices coupled with the rich alternative bee flora in the area, RRII on an average records 18–20 kg honey per colony per year. In conclusion, beekeeping is an activity which is particularly suitable for introducing on a large scale in rubber plantations.

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ECONOMICS OF INTERCROPPING IN THE FIRST THREE YEARS AMONG NEW/REPLANTED RUBBER

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Introduction

Intensification of cultivation is a major route to increased agricultural production and productivity. Land being the major limiting factor for agriculture in developing countries intercropping and multiple cropping have special importance. Rubber is a perennial crop with a long gestation period of 6-7 years and an economic life span of about 30 years. The trees take about four years to fully develop the canopy and planting of annual or semi-annual crops can be done during the first three years after planting. During the gestation period, the grower does not realise any returns from rubber. The practise of intercropping provides additional income to the cultivator at the micro level, and at the macro level it adds to the total agricultural production and productivity.

Though rubber should ideally be grown in association with a legume cover, rubber growers are found raising different crops like banana, ginger, turmeric and elephant-foot yam (Amorphophallus) as intercrops, during the first three years after planting rubber. The present analysis is an attempt to probe into the economics of these intercrops and their relative profitability.

Method of Study

The study was based on the data collected from a sample of 80 rubber growers, randomly selected, having new/replanted rubber in Kottayam district. The data were colleceted by interview method using a pre-tested questionnaire and the cost and returns were worked out at cost-c, similar to the procedure followed in the Farm Management Survey of the Government of India. A detailed description of the cost concepts is given below.

Cost concepts

Cost concepts include four main costs:

1 *Cost A-1*:

1 Costs of hired human labour (permanent and casual)

2 Costs of owned machinery

3 Charges towards hired machinery

4 Costs of fertilizers

5 Costs of manures (owned and purchased)

6 Costs of seeds/planting material (owned and purchased)

7 Costs of insecticides and pesticides

8 Irrigation charges (owned and hired)

9 Land revenue, cess and other taxes

10 Depreciation on farm implements

11 Depreciation on farm buildings, machinery and irrigation installations

12 Interest on warking capital

13 Miscellaneous expenses (wages, artisans, repairing and other servicing charges)

2 *Cost A-2*

Is cost A-1 plus

14 Rent paid for land leased in

3 *Cost B*:

Is cost A-2 plus

15 Imputed rental value of owned land (less land revenue paid there upon) and

16 Imputed interest on owned fixed capital (excluding land)

4 *Cost C*:

17 Imputed family labour costs.

Although according to the Ricardian Theory, rent is surplus and price determined for the individual producer, it is a cost. The costs towards owned inputs and indirect costs were imputed at the opportunity costs. The interest on working capital was worked out at a 9%.

The average returns were calculated at the 1985-86 prices during the harvesting period. The relative profitability of the different intercrops were compared by working out the net returns and the benefit cost ratios.

Agricultural income to a large extent is influenced by what the classical economists called "the invisible hand"; (the market prices). Therefore, the sensitivity analysis was conducted at the 1984-'85 and 1983-'84 prices

1. Economics of Intercrops

The study revealed that banana, ginger and turmeric are the main intercrops grown by the rubber growers. Although vegetable crops, elephant-foot yam and pineapple are also grown by a few, due to insufficient degrees of freedom, they could not be considered in the present analysis.

Ginger

Economics of ginger grown as an intercrop with rubber is presented in table-1.

The total costs at cost-C worked out to Rs. 15794.36 per hectare and the average yield was 19.7325 quintals of dry ginger per hectare. Thus the costs of production at cost-C was Rs. 800.45 per quintal. To work out the returns, the average of wholesale prices of ginger at Cochin market during the quarter March to June 1986, which coincides with the harvesting season, was used. The farmers were assumed to get only 80 per cent of the wholesale price in the terminal market and so appropriate adjustments were made.

The total returns thus worked out at the 1986 (March to June) price amount to Rs. 13212.88 per hectare. It did not cover the total costs and gave only a nagative net return of Rs. 2581.48 per hectare over cost-C. India is an exporter of ginger and it may be noted that the prices of ginger during 1985-86 harvesting season plummeted to a very low level due to poor demands in the international market thus explaining the losses during the year. The benefit cost ratio worked out to 0.8365 implying that a rupee invested earned only 0.8365 rupee as returns.

Turmeric

The costs and returns from the cultivation of turmeric as an intercrop with rubber are presented in table-2.

The total costs at cost-C worked out to Rs. 12429.62 per hectare and the average yield was 20.1634 quintals of dry turmeric per hectare. Thus the cost of

Table-1. Costs and returns per hectare of ginger grown as an intercrop with rubber.

Operation	Costs Rs/ha.
1. Land preparation, planting and mulching	2155.15 (13.64)
2. Costs of planting material and its treatment	6214.23 (39.34)
3. Costs of basal organic manure including bonemeal and application charges	915.54 (5.80)
4. First weeding, intercultivation, top dressing and mulching.	921.54 (5.83)
5. Second weeding, top dressing and mulching	912.49 (5.82)
6. Plant protection	146.12 (0.93)
7. Harvesting, processing and drying	1614.04 (10.22)
8. Depreciation allowances	64.84 (0.41)
9. Interests on working capital	1165.17 (7.38)
10. Miscellaneous expenses	60.13 (0.38)
11. Sub total. Cost-A_1	14176.44
12. Rent paid for land leased in	495.4 (3.14)
13. Sub total: Cost-A_2	14671.84
14. Imputed rental value of owned land and interest on owned fixed capital	136.23 (0.86)
15. Sub total: Cost B	14808.07
16. Imputed family labour	986.29 (6.24)
17. Total costs: Cost C	15794.36 (100.00)
18. Total returns (yield 19.7325 quintals/ha)	13212.88
19. Benefit: Cost ratio	0.8365
20. Net returns over	
a) Cost A_1	-963.56
b) Cost A_2	-1458.96
c) Cost B	-1595.19
d) Cost C	-2581.48

(Figures in parentheses are percentages to total cost-C) production at cost-C was Rs. 616.45 per quintal. The total returns at 1986 (March-June quarter) prices, assuming that farmers realise only 80 percent of the prices in terminal markets, was Rs. 18953.57 per hectare. The Benefit; Cost ratio, implying the rate of returns on a rupee invested worked out to 1.5248. The net return over cost-C was Rs. 6523.95 per hectare.

Banana

Table-3 gives the costs and returns from cultivation of banana as an intercrop with rubber. The total costs at cost-C worked out to Rs. 17211.78 per hectare. The plant population per hectare of banana grown as an intercrop was 933 and the cost per plant (at cost-C) was Rs. 18.45. The total returns at 1985-86 price was Rs. 27676.36 including the returns from the byproduct (suckers). The net returns over cost-C was Rs.10464-58 per hectare and the benefit; cost ratio worked out to 1.6079.

2. Relative Profitability of Different Intercrops

Of the three intercrops considered, banana was the most profitable intercrop followed by turmeric at the 1985-86 price levels. The net returns from one hectare of banana and turmeric were Rs. 10,464.58 and Rs.6523.95 respectively. The total returns from ginger did not cover the total costs due to the very low market prices. The analysis of benefit: cost ratio also confirms the above conclusions. Thus the analysis showed that the relative profitability depends primarily on the market prices during the harvesting season.

3. Sensitivity Analysis

Sensitivity analysis may be defined as reworking an analysis as to elucidate what happens to the net worth position (project viability) under alternative conditions, (Gittinger). It is releva-

Table-2. Costs and returns per hectare of turmeric grown as an intercrop with rubber.

	Operation	Costs Rs/ha
1.	Land preparation, planting and mulching	2267.01 (18.24)
2.	Cost of planting material	3921.90 (31.55)
3.	Costs of basal organic manure and bonemeal/fertilizer and application charges	636.05 (5.12)
4.	First weeding, intercultivation, top dressing and mulching	910.62 (7.32)
5.	Second weeding, intercultivation, top dressing and mulching	494.90 (3.98)
6.	Plant protection charges	103.43 (0.83)
7.	Harvesting, processing and drying	1618.28 (13.02)
8.	Depreciation allowances	59.31 (0.48)
9.	Interests on working capital	901.29 (7.25)
10.	Miscellaneous expense	62.18 (0.5)
11.	Sub-total: Cost A-1	10974.97
12.	Rent paid for land leased in	413.21 (3.32)
13.	Sub total: Cost A-2	11388.18
14.	Imputed rental value of owned land and interest on owned fixed capital	138.76 (1.12)
15.	Sub-total: Cost B	11526.94
16.	Imputed family labour costs	902.68 (7.26)
17.	Total cost Cost-C	12429.62 (100.00)
18.	Total returns (yield 20.1634 quintals/ha.)	18953 57
19.	Benefit: cost ratio	1.5248
20.	Net returns over	
	a) Cost A-1	7978.60
	b) Cost A-2	7565 39
	c) Cost B-2	7426.63
	d) Cost C	6523.95

intercrop considered, ginger and turmeric are commodities traded in the international market and hence the demand and supply conditions in the international market affect considerably the domestic prices, which in turn affect the farmers' income.

Sensitivity analysis was done with the market prices prevalent in 1983-84, 1984-85 and 1985-86 and the results are briefly discussed. The net returns and benefit; cost ratios at the 1983-84, 1984-85 and 1985-86 prices are presented in table-4.

The analysis brings out clearly the effects of changing market prices on the relative profitability of the three intercrops. Banana which is traded mostly in the domestic market showed less variations in net income. At 1984-85 prices, turmeric turned out to be more profitable than banana and ginger. Notably, at 1984-85 prices ginger earned a profit of Rs. 5714 per hectare the benefit; cost ratio was 1.3617. At 1983-84 prices, ginger turned out to be highly profitable than the other two crops, followed by turmeric.

The above analysis shows that prices affect considerably the profitability of both ginger and turmeric. Thus the risk associated with price changes is more pronounced in the case of ginger. It also reveals that the price risk is less with the cultivation of banana which is consumed domestically.

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Table–3. Costs and returns per hectare of banana, grown as an intecrrop with rubber.

	Operation	Costs Rs/ha
1.	Land preparation, planting and mulching	3528.85 (20.51)
2.	Costs of suckers and treatment	2965.20 (17.22)
3.	Costs of basal organic manure/ fertilizer and application charges	2064.04 (11.99)
4.	First inter cultivation, top dressing and mulching	1989.16 (11.56)
5.	Second intercultivation, top dressing and mulching	1917.49 (11.14)
6.	Third dose of fertilizers and earthing up	1284.92 (7.46)
7.	Plant protection charges	457.13 (2.66)
8.	Depreciation allowances	70.42 (0.41)
9.	Interests on working capital	1286.28 (7.47)
10.	Miscellaneous expenses	85.24 (0.49)
12.	Sub-total: Cost–A	15648.73
13.	Rent paid for land leased in	502.97 (2.92)
14.	Sub-total Cost A-2	16151.70
15.	Imputed rental value of owned land and interest on owned fixed capital	145.84 (0.85)
16.	Sub-total: Cost B	16297.54
17.	Imputed family labour costs	914.24 (5.31)
18.	Total costs: Cost C	17211.78 (100)
19.	Total returns:	
	a) Main product	24018.12
	b) Suckers	3658.24
	c) Total	27676.36
20.	Benefit: Cost ratio (B/c)	1.6079
21.	Net returns over	
	a) Cost A–1	12027.63
	b) Cost A–2	11524.66
	c) Cost B–2	11378.82
	d) Cost C	13464.58

(Figures is parantheses are percentages to total cost-C)

Table-4. Net returns and Benefit: Cost ratios at 1983–84, 1984–85 and 1985–86 prices.

Year	Crop	Total returns per ha.	Benefit cost ratio B/c	Net returns over cost B per hectare	Net returns over Cost–C per hectare
1985-86	Banana	27676.36	1.6079	11378.82	10464.58
	Ginger	13212.88	0.8365	-1595.19	-2581.48
	Turmeric	18953.57	1.5248	7426.63	6523.95
1984-85	Banana	16452.21	1.5368	10154.67	9240.43
	Ginger	21508.42	1.3617	6700.35	5714.66
	Turmeric	30648.36	2.4657	19121.42	18218.74
1983-84	Banana	26031.19	1.5124	9733.65	8819.41
	Ginger	47752.65	3.0233	32944.58	31958.29
	Turmeric	27018.95	2.1737	15492.01	14589.33

HONEY FROM RUBBER PLANTATION: A STUDY OF ITS POTENTIAL

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Introduction

Bee-keeping as a vocation in rubber plantations was introduced by European Missionaries, who came to South Kerala and Kanyakumari district of Tamil Nadu. The YMCA and the Bee-keeper's Association at Marthandom played the pioneering role in this endeavour. In 1924 Dr. Spencer Hatch of the Marthandom YMCA introduced bee-keeping in that area. A regular training in bee-keeping was started in the YMCA in 1947. The Indian Institute of Honey, Kuzhithurai has also been in tha forefront of propagating bee-keeping. Naturally Kanyakumari district began to take the lead in this respect. Even today the number of bee-keepers is more in that district than any other one in the country and they regularly migrate to other districts for bee-keeping. Since 1950 the Khadi & Village Industries Commission at the Centre and the Khadi & Village Industries Boards at the states have taken up the promotion of bee-keeping by offering financial, technical and training facilities to the bee-keepers.

According to the Khadi & Village Industries Commission there were around 8.1 lakhs bee colonies in India at the end of 1983-84. The National Commission on Agriculture recommended that the production of honey in India should be increased to 60,000 tonnes by 2000 AD. Taking an average production of 10 kg per colony, 6 million bee-colonies should be established in India by the turn of the century to achieve this target. In this context the role of rubber plantations in increasing the production of honey is worth examining.

Method of Study

For collecting the date for the study, the list of bee-keepers' societies operating in Kerala and Kanyakumari district of Tamil Nadu was obtained from the Khadi & Village Industries Commission. The offices of 28 societies and 11 purchase centres were contacted and the units were visited during the honey producing season in 1987. In the course of the visits it was found out that some of the societies have discontinued bee-keeping while others have come up afresh in the field. The new societies were mainly in Cannanore district. There were more bee-keeping activities in Cannanore district than in any other district in Kerala. The number of societies and the number of honey purchase centres in each district, at the end of March 1987, are shown in table-1.

In addition, the offices of the Sarvodaya Sanghams of Cannanore, Calicut, Alleppey, and Trivandrum were also visited. Supplementary data were collected from the offices of the Khadi & Village Industries Commission and the Khadi Board of Kerala. Visits were also made to the Directorate of Bee Keeping Industry, Bombay and the Central Bee Research Institute, Pune of the Khadi & Village Industries Commission. For estimating the consumption of rubber honey, the list of Ayurvedic Pharmaceutical manufacturers was collected from the Drugs Controllers' Office, Trivandrum and data were recorded through a questionnaire. The production and consumption of rubber honey in Karnataka state were estimated on the basis of discussions with the Khadi Commission Officials

Table-1. Distribution of bee-keeping societies/purchasing centres in traditional rubber growing tract.

District	No. of bee-keepers' societies/organisations	No. of purchasing centres
Trivandrum	4	2
Quilon	1	–
Pathanamthitta	4	–
Alleppey	–	1
Kottayam	3	1
Idukky	3	1
Ernakulam	2	1
Tricnur	2	–
Palghat	–	1
Malappuram	2	–
Kozhikode	3	2
Cannanore	14	1
Total in Kerala	38	10
Kanyakumari dist. of TN	4	3
Grand Total	42	13

Findings

There are two main sources of honey in India viz., wild honey collected from the forests and apiary honey collected from the hives maintained under scientific management. Bee-keeping in the present context means the rearing of certain varieties of domesticated bees. Although there are four such species, *Apis cerana indica* is the one reared.

A colony of bees of *Apis cerana indica* comprises of a queen, which is the only fertile female, 12000 to 15000 infertile female workers and a few hundreds fertile males called drones. Only one colony is reared in each hive. The main duty of the worker-bees is to collect honey and pollen. *Apis cerana indica* is the one reared in the rubber plantations also. Only about 10 per cent of the honey produced in india is from wild sources, the rest is from apiaries.

The rubber tree is a prolific producer of honey. The honey flow period of *Hevea* ranges from January to March and during this period honey-bees collect large quantities of nectar from the extra-floral nectary glands at the distal end of petioles where the leaflets join. Though the nectariferous bud scales and nectariferous glands on the lower surface of the leaf lamina secrete small amounts of nectar only the nectariferous glands on the petiole tips are found to be visited by the bees for nectar. These extra floral nectary glands become very active from January to March, when the rubber tree produces new flushes of leaves. Rubber tree is among the very few plants in nature producing honey not from the flowers. The total production of honey and the share of rubber honey in India are shown in table-2.

According to the tentative estimates, the Indian production of honey is placed at 6500 tonnes in 1986-87 out of which the production of rubber honey is placed around 2750 tonnes (42%).

Table-2. Total production of honey in India and the share of rubber honey.

Year	Total honey production in India (tonnes)@	Estimated share of rubber honey (tonnes)
1981-82	5600	2300 (41%)
1982-83	5700	2700 (47%)
1983-84	4400	1600 (36%)
1984-85	5500	2200 (40%)
1985-86	6200	2600 (42%)
Average	5480	2280 (42%)

@ Source of Indian production of honey: KVIC, Bombay.

Potential Production

Published records indicate that the average production of honey per hive in India is only 7kg per year. Canada is reported to have achieved an average productivity of 53.3kg of honey per hive per year followed by Australia with 43.7kg. In 1987 season the bee colonies at the RRII experiment station at Chethackal produced 681 kg of honey from 35 hives, which worked out at 19.46 kg per hive. Studies made by the RRII indicate that an optimum number of 15 to 20 hives can be placed in a hectare of rubber plantation. At the end of 1985-86 India had 3 lakh hectares of mature rubber plantations capable of producing honey. Assuming even a production potential of 10kg per hive and 15 hives per hectare, the total production of India could be enhanced to around 45000 tonnes under scientific management.

There is an optimum number of hives a bee-keeper can manage. Statistics indicate that on an average there were 37 hives per bee-keeper in Canada in 1982, followed by Greece with 32 hives. Assuming that 30 hives (2 hectares in our calculation) can be managed by a bee-keeper, the rubber plantation industry can give part-time employment to one and a half lakh people. In the experiment station of the RRII, 35 hives are managed by one person.

Properties of Rubber Honey

Honey is a natural sweetening agent devoid of the harmful effect associated with white sugar. The body can easily absorb the source of energy. It is particularly suited to elderly people, invalids, children and athletes and has medicinal and curative properties.

Honey is a super saturated solution of sugars. It contains three major sugars viz, the fruit sugar (levulose or fructose) grape sugar (glucose or dextrose) and cane sugar (sucrose). In the marketing of honey colour, flavour, taste and moisture content considerably influence the preference. The important properties of rubber honey are shown in table-3.

According to Indian Standard Specification, honey is classified into three grades mainly on the basis of moisture percent by weight. This standard prescribes 20 percent moisture for special grade, 22 per cent for grade A and 25per cent for standard grade. Rubber honey generally belongs to grade A under laboratory tests.

Qualitatively the most important drawback of rubber honey is the higher moisture content in it. Table-3 showed that the moisture content ranged between 21.5 and 25.5%. The internationally accepted standards of quality tolerate moisture content is only upto 19 per cent. The higher moisture content creates problems on storage. Activity of yeast in honey becomes brisk when the moisture content is higher leading to fermentation. Therefore there is need for redu-

Table-3. Important properties of rubber honey

		Range	Average
1.	Viscocity (in centipoise) at 27°C	550-3800	1358
2.	Specific gravity at 27°C	1.3985-1.3400	1.379
3.	Moisture (%)	21.50-25.50	22.00
4.	Reducing sugars:	69.08-74.80	72.80
	a) Levulose (%)	34.80-40-70	37.14
	b) Dextrose (%)	33.57-37.97	35.98
5.	Non-reducing sugars (%)	0.78-3.14	1.71
6.	Acidity (%)	0.06-0.20	0.127
7.	Ash (%)	0.09-0.39	0.216
8.	Protein (%)	0.054-0.249	0.138
9.	Yeast (million/g)	103.9-158.0	139.39

cing the moisture content immediately after collection to maintain the quality. The vacuum oven drying process could be introduced for upgrading the quality of rubber honey. Granulation of honey, though not a bad symptom of quality, is suspected by the Indian consumer to be due to adulteration. To prevent granulation and fermentation, honey should be heated at around 63°C under controlled conditions.

Problems of Bee-Keeping in Rubber Plantations.

The honey gathering activity in rubber plantations lasts until the end of March. Afterwards the bee-keeper has to see that the colonies are sustained till December. Carbohydrates are produced by the nectar and the protein by the pollen. An assured source of honey and pollen should therefore be made available in the vicinity to sustain brood rearing activity and maintain the colonies. The need for raising plants which will flower in sequences round the year is all the more important. The Rubber Research Institute of India has identified five promising bee forage plants along with twenty one major and minor sources of nectar and pollen for off-season bee management. These plants provide a source of nectar and pollen during the long dearth period from April to December. These can be raised on the hedges, boundaries, bunds or vacant patches in the plantation.

Marketing of Rubber Honey

As rubber honey forms around 40 per cent of the total honey produced in the country the rubber planters stand to gain by increasing the overall consumption of honey in India. The present study shows that 50 per cent of the honey produced in the rubber plantations is consumed by the Ayurvedic and Allopathic pharmaceutical firms. The Ayurvedic firms consume the lion's share of the production. The remaining part is consumed in various sectors like confectionary, tobacco manufacturing, bakery, dairy and other food products. A small quantity is consumed by the temples in Kerala and Tamil Nadu for manufacturing *Panchamritam*. In addition, there is direct human consumption, through honey parlours and at home. The future promotional activities should be in the form of small packages sold through the Railway Stations, Military stores, Aerodromes and special kiosks in important towns. Rubber Board could also take active steps in the promotion of rubber honey.

The World Situation.

The world production of honey has been placed at 9.4 lakh tonnes in 1984. Of this around 25 per cent enters the international market. China, Mexico and Argentina together account for 60 percent of the trade. The largest producer of honey in the world is USSR with 1.98 lakh tonnes in 1983, followed by China at 1.15 lakh tonnes. The tremendous increase achieved in the production and export of honey by China should be an eye opener to a developing country like India.

The International Trade Centre of the United Nations took up a study of international marketing of honey in developing countries in 1976-77. The study revealed that there was a growing demand for honey in the world because of greater interest in natural foods and higher living standards. The study noted that the supply of honey did not keep up with the increase in demand. Strict quality control requirements in importing countries, specific consumer preferences for certain flavours and colour and consistency of honey were the factors that commanded the market. Most of the markets prefer light and liquid honey than crystallised. Honey from a single plant species fetches higher price than mixed honey obtained from several sources. The future of honey is assured and there is every reason to promot this ancillary activity, on a large scale in rubber plantations.

Acknowledgements

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Pact to preserve plant germplasm

An agreement for technical co-operation in conservation of plant germplasm of south and south-east Asian region was signed between the Indian Council of Agricultural Research (ICAR) and the International Board for Plant Genetic Resources (IBPGR) in November 1987.

It provides for opening a field office of IBPGR for the region in India.

Hailing the accord Mr. G. S. Dhillion, agriculture minister, said it would enable the two organisations to collaborate in strengthening their activities.

Mr Dhillon inaugurated the IBPGR workshop in New Delhi on south and south-east Asian plant genetic resources. Sponsored by ICAR, the workshop was attended by 17 delegates from different countries of the region.

The minister pointed out that the region was the home of several major food crops and other economic plants and possessed enormous diversity in plant genetic resources. However, due to pressure on land as well as improper use, most of these resources were now facing the danger of extinction.

The situation demanded urgent efforts to salvage and preserve the endangered plant species before they were lost for ever, the minister said.

He said India's National Bureau of Plant Genetic Resourcse (NBPGR) maintained international linkages with over 80 countries and generated necessary facilities for long-term storage of germplasm.

and preserve the endangered

Rubber Wood Consuming Units in Keral

Technical Facilities and Problems

VIJU IPE C., REGHU C. P., & HARIDASAN V.
Rubber Research Institute of India, Kottayam-9.

Introduction

In recent years there has been an increase in the demand for timber for wood-based industries in India. The shrinking of forests has lead to a short fall in the supply of wood. The excess demand over supply of timber has resulted in the search for alternative sources or wood. Studies in India and abroad have shown that rubber wood after appropriate treatments could be used as a substitute for quality timber.

Rubber tree is perennial, growing to a height of about 30 m with prolific branches. It yields an average of 198.22 m³ of wood per hectare of which 60% will be trunk wood and the rest branch wood. Until the 1950's rubber wood has been used only as firewood. Increasing demand for wood in recent years has turned the attention of entrepreneurs to rubber wood. Under the plantation development scheme of the Rubber Board, on an average 4000 ha. of old and uneconomic rubber trees have been replanted with subsidy annuelly during the last five years. In addition, approximately 1000ha. of old and uneconomic rubber areas are also being replanted without the Rubber Board's financial assistance. Therefore, the total annual replantings will be around 5000ha. By the end of the seventh five year plan, the area to be replanted annually is targetted at 7000ha. The replanting at the current rate of 5000ha. per annum will give 991108m³ of rubber wood which can be converted into value added products.

Available literature on rubber wood utilization in India shows that about 438900m³ is used in packing case industry, 49800m³ in small scale plywoods, 39600m³ in veeners and splints for safety matches and 3100m³ for other miscellaneous uses (Haridasan, 1985). It has been found that over 400 rubber wood consuming units are functioning in Kerala State. But their problems and technical facilities have not been studied in depth and the survey was taken up in this context.

Method of study

The study was based on the data collected from a sample of 100 rubber wood consuming units selected randomly from a list of 400 units obtained from the Directorate of Industries. Date, relating to the year 1986-87 were collected by interview method using a pre-tested questionnaire. The rubber wood consuming units thus selected were classified into different groups according to the line manufacturing. The data in each group were then tabulated and analysed. Furniture manufacturing units and saw mills handling rubber wood were not included in the present study.

Finding

According to the line of manufacturing seven different groups were identified. The major products manufactured out of rubber wood are (1) packing cases, 2) veneers and splints for safety matches 3) teachest panels 4) general plywoods 5) seat and back for chairs. The distribution of the sample according to the final product is given In table-1.

Table-1. Distribution of sample according to their final product

Line of manufacturing	percentage of the total no.
1. Packing cases	23.65
2. Veneers only	25.81
3. Veneers and splints	6.45
4. Splints only	3.23
5. Tea-chest panels/plywood	31,18
6. Seat and Back for chairs	3.23
7. General plywood	6.45

The tea chest manufacturing units accounted for 31.18% of the total sample size followed by units manufacturing veneers and packing cases. The unit manufacturing splints, seat and back and general plywoods accounted only a lower percentage.

Annual inputs

The average annual consumption as reported by the sampled units among the different groups are given in table 2.

Table-2. Average annual consumption of rubber wood by different groups of rubber wood consuming units

Line of manufacturing	Average annua consumption (tonnes/year
1. Packing cases	1623.3
2. Veneers only	510.0
3. Veneers & Splints	1445.0
4. Splints only	768.0
5. Tea-chest panels & plywoods	774.4
6. Seat and back for chairs	279.6
7. General plywoods	459.1

The above figures as reported by the sampled units may not be fully true and an underestimate is likely in many cases. However, a comparative analysis of the different groups shows that the units manufacturing packing cases ranked first in the average consumption which is only to be expected. Haridasan (1985) also found that packing case units consume the largest share of rubber wood produced in the country. The average consumption was the lowest in the case of those units manufacturing seat and back for chairs and general plywoods. Most of the plywood manufacturing units reported that they use rubber wood only as the inner plies and the outer veneers are made of better quality wood.

Machinery and impliments

List of machinery available with the different groups of sampled units are given below.

Type of product	*Machinery and impliments*
1. Packing cases	Band saw, Resaw, Circle saw, Cross cutter, Plainer and Electric motor
2. Veneers	Peeling machine, Cutting machine, Grinder, Leveller saw board and Electric motor.
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5. General plywoods	Peeling machine, Trimmer, Splicer, Cutting table, Hydraulic/Hand press, Circle saw, clamp set and Electric motor.
6. Seat and back for Chairs	Peeling machine, Cutting machine, Glue mixer, Glue spreader, Clipper, Hand press, Hand saw and Electric motor.

Storage of Raw materials and Final products

The methods of storage will affect the quality of the final product considerably. All the units surveyed were found to store the raw material in the open yard and are, therefore, exposed to the vagaries of nature. However, the finished products are stored in closed or partially closed sheds to protect them from sun and rain. The duration of storage of the raw material and the finished product was found to vary among the different groups. The average duration of storage of raw material and the finished product among the different groups is given in table-3.

Table-3. Average duration of storage of raw material and finished product among the different groups.

Type of unit	Duration of storage (in days) Raw material	Finished product
1. Packing cases	7-15	8-16
2. Veneers	5-13	7-15
3. Splints	5-9	7-11
4. Tea chest panels	9-14	18-25
5. Seat aud Back for chairs	9-13	20-40
6. General plywoods	7-15	28-30

The variation in the duration of storage was found to depend on the demand for the final product; the duration of storage being shorter during periods of high demand. Since the product cannot be stored for long periods and also due to the poor liquidity position of the owners, the manufacturing units will have to report to distress sales during periods of low demand in order to reduce losses.

It may be recalled that all the sampled units store logs in the open ground. Though the storage of logs in the North-South direction prevents cracking and end-splitting to a certain extent, only 2 per cent of the respondents adopted this practice. By and large, the manufacturers did not know this elementary precaution. The internal loading and transportation of logs was found to be manual.

Sawing and Recovery

Input: output ratios will influence to a large extent the profitability of business and are indicators of productivity. Tapping wound and consequent callous formation and the presence of tension wood are serious problems which affect rubber wood. The wood can be peeled only up to a certain diameter (around 6cm) equal to the diameter of the shaft of the peeling machine. The remaining core portion will thus become a waste which is discarded as firewood. Suitable cost-effective technologists which can be adopted at the small scale level may have to be developed to convert this into value added.

The average recovery as reported by the sampled units is given in table-4.

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Line of manufacturing	Average annual consumption (tonnes/year)
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5. Seat aud Back for chairs	9-13	20-40
6. General plywoods	7-15	28-30

The variation in the duration of storage was found to depend on the demand for the final product; the duration of storage being shorter during periods of high demand. Since the product cannot be stored for long periods and also due to the poor liquidity position of the owners, the manufacturing units will have to report to distress sales during periods of low demand in order to reduce losses.

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Input: output ratios will influence to a large extent the profitability of business and are indicators of productivity. Tapping wound and consequent callous formation and the presence of tension wood are serious problems which affect rubber wood. The wood can be peeled only up to a certain diameter (around 6cm) equal to the diameter of the shaft of the peeling machine. The remaining core portion will thus become a waste which is discarded as firewood. Suitable cost-effective technologists which can be adopted at the small scale level may have to be developed to convert this into value added.

The average recovery as reported by the sampled units is given in table-4.

Rubber Wood Consuming Units in Kerala

Technical Facilities and Problems

VIJU IPE C., REGHU C. P., & HARIDASAN V.
Rubber Research Institute of India, Kottayam-9.

Introduction

In recent years there has been an increase in the demand for timber for wood-based industries in India. The shrinking of forests has lead to a short fall in the supply of wood. The excess demand over supply of timber has resulted in the search for alternative sources or wood. Studies in India and abroad have shown that rubber wood after appropriate treatments could be used as a substitute for quality timber.

Rubber tree is perennial, growing to a height of about 30 m with prolific branches. It yields an average of 198.22 m^3 of wood per hectare of which 60% will be trunk wood and the rest branch wood. Until the 1950's rubber wood has been used only as firewood. Increasing demand for wood in recent years has turned the attention of entrepreneurs to rubber wood. Under the plantation development scheme of the Rubber Board, on an average 4000 ha. of old and uneconomic rubber trees have been replanted with subsidy annuelly during the last five years. In addition, approximately 1000ha. of old and uneconomic rubber areas are also being replanted without the Rubber Board's financial assistance. Therefore, the total annual replantings will be around 5000ha. By the end of the seventh five year plan, the area to be replanted annually is targetted at 7000ha. The replanting at the current rate of 5000ha. per annum will give 991108m^3 of rubber wood which can be converted into value added products.

Available literature on rubber wood utilization in India shows that about 438900m^3 is used in packing case industry, 49800m^3 in small scale plywoods, 39600m^3 in veeners and splints for safety matches and 3100m^3 for other miscellaneous uses (Haridasan, 1985). It has been found that over 400 rubber wood consuming units are functioning in Kerala State. But their problems and technical facilities have not been studied in depth and the survey was taken up in this context.

Method of study

The study was based on the data collected from a sample of 100 rubber wood consuming units selected randomly from a list of 400 units obtained from the Directorate of Industries. Date, relating to the year 1986-87 were collected by interview method using a pre-tested questionnaire. The rubber wood consuming units thus selected were classified into different groups according to the line manufacturing. The data in each group were then tabulated and analysed. Furniture manufacturing units and saw mills handling rubber wood were not included in the present study.

Finding

According to the line of manufacturing seven different groups were identified. The major products manufactured out of rubber wood are (1) packing cases, 2) veneers and splints for safety matches 3) teachest panels 4) general plywoods 5) seat and back for chairs. The distribution of the sample according to the final product is given In table-1.

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1. Packing cases	23.65
2. Veneers only	25.81
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4. Splints only	3.23
5. Tea-chest panels/ plywood	31,18
6. Seat and Back for chairs	3.23
7. General plywood	6.45

The tea chest manufacturing units accounted for 31.18% of the total sample size followed by units manufacturing veneers and packing cases. The unit manufacturing splints, seat and back and general plywoods accounted only a lower percentage.

Annual inputs

The average annual consumption as reported by the sampled units among the different groups are given in table 2.

Table-2. Average annual consumption of rubber wood by different groups of rubber wood consuming units

Line of manufacturing	Average annual consumption (tonnes/year)
1. Packing cases	1623.36
2. Veneers only	510.00
3. Veneers & Splints	1445.00
4. Splints only	768.00
5. Tea-chest panels & plywoods	774.42
6. Seat and back for chairs	279.60
7. General plywoods	459.10

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3. Veneers & Splints	1445.0
4. Splints only	768.0
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6. Seat and back for chairs	279.6
7. General plywoods	459.1

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The average recovery as reported by the sampled units is given in table-4.

Table-4. Average recovery of the final product from raw wood

Line of manufacturing	Recovery (%)
1. Packing cases	83.58
2. Veneers	81.54
3. Splints	72.50
4. Teachest panels	79.08
5. Seat and back	72.00
6. General plywoods	73.00

One m^3 of rubber wood was found to yield 1060-1765 sq. m. of plywood for tea chest panels. Similarly, 1 m^3 of wood when peeled yields 700-850 gross sets of veneers (1 gross = 100nos)

Technical Problems with the use of rubber wood

1. Tension wood

The common occurrence of tension wood, a natural defect, creates a variety of problems in rubber wood working. In the case of packing cases, while sawing, the tension wood fibres (gelatinous fibres) will come up and stick to the saw blade preventing its free movement. During plaining the curly tension wood fibres make the surface rough and fuzzy. Warping and twisting are other problems associated with tension wood.

Problems associated with tension wood are more pronounced in the case of veneers used in safety machines. The veneers peeled from the tension wood zones are very rough. Hence, while folding, the tension wood fibres will be projected out. This will also create problems while pasting the labels on the match box. Severe warping and twisting of the outer and inner veneers will prevent the free movement of the inner veneer of the match box in which splints are placed.

The presence of tension wood also causes warping of splints which, as a results, get distorted. The problems due to tension wood are not so serious in the case of general plywoods, tea chest panels and seat and back for chairs.

2. Tapping wound

Callous formation, discolouration and wood damage due to tapping wound results in severe losses. Losses due to tapping wound are much pronounced in the case of veneers, general plywoods and tea chest panels. Veneers when peeled from such portions for match boxes and tea chest panels will be brittle and break soon:

Discolouration

Discolouration of wood when peeled affects the quality of veneers, splints and tea chest panels considerably. Respondents to the survey reported that discolouration is low if veneers can be dried immediately after peeling. Some of the units were found to fumigate the splints with sulphur to retain the original wood colour. The units manufacturing veneers, splints, and tea chest panels were found to sun-dry them immediately after peeling to retain the original wood colour.

Borer attack

Attack of borers was reported to be the most serious problem in storage of the finished products. The products made out of rubber wood cannot be stored for long periods in Kerala due to the attack of wood borers. However, the respondents pointed out that this is not a serious problem in high altitude regions and North India. The study showed that its attack is more serious during periods of dry spells after occasional rains.

Sap stain fungus infection

When the finished products are stored under moist conditions, especially during rainy season, infection by sap stain fungus causes a bluish black discolouration. Veneers when stored, due to fungus infection will stick together and form a lamp which in turn will result in deterioration in quality of the final product as well as reduction in the rate of recovery.

Seasoning

There is no evidence in the survey as to the treatment of raw material for preservation. However, some manufacturers subject the final product to simple methods of treatment. The producers of splints were found to fumigate it with sulphur to retain the original wood colour. While borax-boric acid treatment was practised by two plywood manufacturing units, one treated it with a chemical formulae supplied by the indian Plywood Research Institute. Only 16 per cent of the surveyed units followed some form of chemical treatment of the finished products

General problems of Rubber wood consuming units in Kerala

Technical problems with the use of rubber wood and the consequent low quality of the product generate problems for rubber wood consuming units in Kerala. The poor quality of the final products results in low demand for products made out of rubber wood.

The units manufacturing veneer and splints are now facing a slump, in the market due to the emergence of card-board boxes as a substitute for the outer veneers of safety matches. They also face severe competition from units in Tamil Nadu procuring rubber wood, mostly from Kerala, as fire wood from which logs of appropriate sizes are converted into veneers and splints for safety matches at comparatively much lower wages. Thus these units in Tamil Nadu have clear edge over those in Kerala in the comparative cost of production. The reduction in the excise duty for card-board box have accelerated the substitution of veneers by card-board boxes. The above factors have resulted in poor demand for veneers and splints manufacturing in Kerala which in turn resulted in accumulation of inventories. Since the product cannot be stored for long periods, accumulation of stock will result in distress sales.

Producers of tea chest panels also face similar problems. The recent introduction of gunny bags with plastic coatings as a substitute for tea chest panels has eroded the demand for tea chests. The poor quality of the final product made out of rubber wood and the emergence of substitutes have resulted in poor demand and consequent distress sales.

There is therefore, necessity to improve the quality of the raw materials and the final products for sustained development of rubber wood based industries. To sum up the technical problems revealed from the survey are presence of tension wood, warping tapping wound, discoloration, borer attack and infection by sap stain fungus. Most of these problems can be tackled by an extension activity from the Rubber Research institute of India and developing cost effective and viable technologies which can be adopted at the small scale level. prospects of using rubber wood in sectors other than those mentioned above also deserve investigation.

Acknowledgements

We are grateful to Dr. M. R. Sethuraj, Director and Dr. A.O.N. Panikkar, Deputy Director (Botany) for critically examining the paper and offering valuable comments.

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RUBBER CULTIVATION IN VIETNAM

Will the already crowded market for natural rubber soon have more competition? According to Agence France Presse, the Paris-based news organisation, Vietnam, with massive support from the Soviet Union, expects to begin tapping this year or next the first of 50000 hectares of rubber trees planted in 1980/81. However, this joint USSR-Vietnam project faces tremendous obstacles because of the lack of trained plantation workers and an NR processing industry that dates back to the French colonial time. A separate report from the West German Handelsblatt newspaper, said initial tapping began last year, but the quality of the latex wasn't high enough to be offered on the world market. In the AFP interview, Vietnam's Rubber Ministry Director Huynh Van Nghia, said, "This (processing) is our weakness. We will concentrate our efforts on acquiring processing machinery, not only from socialist countries. We will suggest exchanging raw rubber for machinery. "Nghia noted that the Plantation workers, many of whom were "resettled" from Ho Chi Minh City (formerly Saigon) in the early 1980s to help clear the jungle for the plantations, have one of the toughest jobs in Vietnam and yet receive low wages. Vietnam's "new" NR Industry dates back to 1978, following North Vietnam's occupation of South Vietnam. At that time, the Soviet Union and Vietnam agreed to redevelop an NR industry that in its heyday coverad 142000 hectares; in 1978, though, rubber trees covered only 70000 hectares (of which only half were cultivated) and annual production was about 24000 tonnes, according to the AFP article. A similar agreement was reached with Cambodia, the Handelsblatt article stated, for planting rubber trees in the 10-13 degrees N. latitude zone. In Vietnam, the plan calls for 300,000 hectares by the year 2000. In return for its financial assistance in setting up the plantations, the Soviet Union is to receive natural rubber. The Handelsblatt article states that the USSR already has reduced its planned purchases on the open market in anticipation of the plantations coming on stream. Nghia sees grand plans for the Vietnamese rubber industry. "With Soviet assistance, we want to produce goods like foam rubber or bicycle tyres, and later even more valuable products like truck tyres, "Nghia was quoted as saying. The nation's only processing facility is a 65-year old factory built by the French in Dau Tieng, 100 km north of Ho Chi Minh City. (European Rubber Journal)

International Commodity Agreements: The Case of Natural Rubber

THARIAN GEORGE K.
Market Research Officer, Rubber Board

The recent history of commodity agreements is littered with failures, missed opportunities and growing tensions between the developed and developing countries. The fall in oil prices and the dissensions within the Organisation of Petroleum Exporting Countries (OPEC) demonstrated inability of the third world cartels to control commodity prices. Despite the protective commodity agreements, prices of many raw materials have fallen sharply in recent years and the loss in revenues has decimated many third world producers. A corollary of thedeclining commodity prices is the deteriorating terms of trade of the developing exporters vis-a-vis the developed importers.

An international commodity agreement (ICA) is a formal agreement between the countries producing and consuming a commodity to control the market in some respect. Some forty ICAs covering thirteen commodities have been concluded since 1931. Although the details of their objectives have varied, virtullay all have sought to stabilise as well as to increase the price of the commodity concerned. The present plight of many primary commodities suggest that the underlying political and economic factors that determine the fortunes of the commodities are beyond the control of producers. The fate of Chinese green tea during the turn of the 20th century and recently the declining fortunes of sugar are clear cases which illustrate the fact that a handful of transnational corporations can determine the destiny of the primary commodities.[1] At the end of 1985 only four agreements capable of influencing prices were still in operation and only one of these was actively doing so.[2]

The two basic objectives of the commodity agreements appear to be: (1) to stabilise commodity prices and (2) to ensure remunerative or equitable prices-that is, generally to raise them. The available indicators tend to suggest that the efforts of the commodity exporters to achieve the basic objectives are marred by a multitude of factors arising mainly from the basic conflict of interests between the producer and consumer countries on the one hand and the bluntness of the instruments used to achieve the objectives on the other.[3] Even today, after protracted negotiations during more than the last fifty years, the issue of price stabilisation of various commodities remains unsolved and the proposal for setting up a multi-billion dollar fund to finance an ambitious commodity price stabilisation programme has never attracted sufficient international backing to come into force—a measure of dwindling enthusiasm of the industrialised countries for commodity cooperation. None of the new agreements has economic muscle. Like the cocoa and sugar pacts, they are forums where importing and exporting countries exchange information and discuss issues of mutual interest-except the critical one of prices.

Many observers feel that the developed importing countries are dictating terms in the international commodity trade due to a number of interrelated advantages enjoyed by them. One among them is the emergence of close substitutes and synthetics patronised by the developed countries. The synthetic substitutes have steadily and systematically been replacing the natural products from the world market.

This paper is an attempt to analyse the implications of the so-called "substitute revolution" which has contributed considerably to the futility of ICAs by examining the specific case of Natural Rubber (NR).

The case of Natural Rubber

The plight of natural rubber (NR) is a classic case where synthetic rubber (SR) has steadily replaced it in the international market. For instance, as on 1984 around 70 per cent of world rubber production is accounted for by SR and the share of NR in total world rubber consumption has declined from 64.0 percent in 1955 to 32.5 percent. 1984.[4] Table I shows the trends in world production and consumption of NR and SR between 1955 and 1984.

The significance of the year 195[5] was in fact that in that year the U. S. Government sold its Synthetic Rubber production capacities to the private sector. The subsequent dynamic growth of the SR industry was manifested in the continuous decline in the relative price and the relative share in consumption of NR[5]. It is inteteresting to note that during the oil price boom of 1973-75 there was no appreciable increase in NR consumption inspite of the fact that SR prices registered a considerable increase and the NR price relatively decli-

Table 1
Trends in World Production and Consumption of NR and SR (1955-1984)

Base : 1956 = 100

Year	Production index of NR	Production index of SR	Percentage share of NR in World consumption	Percentage share of SR in World consump-tion
1956	100	100	64.0	36.0
1960	105	155	47.9	52.1
1965	123	248	38.8	61.2
1970	161	478	34.7	65.3
1975	172	557	32.4	67.6
1980	200	706	30.2	69.8
1981	192	692	30.4	69.6
1982	195	637	31.5	68.5
1983	209	674	32.3	67.7
1984	221	738	32.5	67.5

Sources : (*1*) Hidde P Smit, *Globe Industry Report, Forecast for World RubberEconomy to the year 2000*, Macmillian Publishers Ltd, *London*P–332.

(*2*) *Rubber Statistical Bullettin*, IRSG, Vol. 40, No. 4, London, January 1986, pp. 4–5.

Table 2
Percentage Share of Major Producers in NR production, net Exports and Relative shares in consumption

Country	Share in World NR production	Share in Net World NR Exports	Domestic NR consumption as a % of domestic production
Malaysia	35.9	43.3	4.3
Indonesia	26.2	28.6	6.6
Thailand	14.8	16.8	5.0
Sub total	76.9	88.7	—
Sri Lanka	3.3	3.5	10.6
India	4.3	nil	—
China	4.5	nil	—
Others	11.0	7.8	—
Grand Total	100.00	100 00	—

Source: Rubber Statistical Bulletin, IRSG, January 1986, London p. 8

ned[6]. The world commodity boom of 1972 also did not have any appreciable impact on the prices of NR.

Any attempt to understand the underlying economic factors behind the erosion of NR share in consumption and stagnant or declining prices has to delineate the production conditions of NR and SR as well as the market structure.

Production Conditions of NR

NR production is concentrated in three South-East Asian Countries, viz. Malaysia Indonesia and Thailand. As on 1984 these three countries accounted for more than 76 percent of total production of NR. Table 2 gives the share of major producers of NR.

NR production is not only concentrated in the developing countries, but a major portion of it comes from the small holdings in these countries. The figures on the relative shares of domestic consumption of the three major producers indicate the absence of a strong rubber goods manufacturing industrial sector in these countries. These two factors, viz. the predominance of small holdings and a relatively higher degree of export-orientation of NR make NR producing countries vulnerable to international price fluctuations and dependent on the developed importing countries. Table 3 shows the relative shares of the major consumers in the net imports of NR and the share of the tyre sector in total NR consumption in each country.

The most striking feature of the world rubber consumption is the remarkably high share of cosumption by the tyre sector in the developed countries. A large portion of the rest is accounted by other automobile components and commercial vehicle industries[7] (See table 3, col. 3). Consequently, the policies pursued by the tyre manufacturing companies are very crucial in determining the long term trends in the consumption of NR and SR.

At this juncture, it is essential to analyse the techno-economic factors that promoted the tyre companies to switch over to SR. Basically, the substitutability between NR and SR in tyre and tube manufacturing stems from the development of 'general purpose' synthetic rubbers having in varying degrees the properties of NR. The basic requirement of a tyre is to satisfy the "product specifications criteria" (tyre strength, high speed and endurance) and under these criteria tyres can be made entirely from NR.[8] However, technological progress in the processing of SR and tyre manufacturing has yielded tyres with improved properties, viz. tyre wear resistance (tread wear), road adhesion (weather resistance), groove and sidewall cracking (resilience), heat durability and cold flexibility (Service Performance Criteria). In fact, 'product specifications' are essential requirements whereas 'service performance' though preferred are not essential. It is claimed that the SR has made its inroads into the tyre industry by virtue of its ability to meet these service performance criteria? The major technological innovation in favour of NR so far has been the penetration of radial tyres into the tyre industry since the mid-sixties in Europe. The spread of radial tyres in Japan and USA in the seventies coincided with the oil crisis of 1973. The radial tyre is known for its longer life compared to the conventional crossply tyres. It uses relatively more NR as raw material. The growing popularity of radial tyres and the rise in prices of SR consequent on the oil price boom of 1973 were responsible for the marginal rise in the consumption of NR in the recent period.

Production conditions of SR

One of the most important characteristics of the structure of the SR industry is a remarkable degree of concentration of production by developed countries who are the major consumers of rubber. Table 4 shows the percentage shares in SR production and the reported synthetic production capacities,

Table 3

The Percentage share of major consumers in the net imports of NR and The Share of Tyre Sector in Total Consumption of NR (1984)

Country	Percentage share in Net World imports of NR	Share of the Tyre sector in total consumption of NR (in percentage)
(1)	(2)	(3)
U. S. A.	21.5	76.6
E. E. C.	18.4	65.4*
Other Western Europe	6.6	N.A.
Japan	14.6	78.9
Sub Total	61.6	—
Total Eastern Europe	11.6	N. A.
China	6.1	N. A.
Canada	2.9	N. A.
Rep. of Korea	4.3	N. A.
Others	14.0	N. A.
Grand Total	100.0	

*The EEC figure includes the combined average of U. K., W. Germany and Italy. During 1984 the share of tyre sector in Brazil was 84.4 per cent.

Source: Some as table 2. See pages 10-12 and 36.

But the most striking characteristic of the structure of the industry is its oligopolistic nature and a higher degree of vertical integration between SR producers and tyre manufacturing industry. For instance, according to one estimate about 44 percent of the SR production capacity in the U.S. is owned by the tyre companies.[10] Further, as mentioned earlier, the SR is processed from petrochemical feed stocks so that the industry is closely linked to the petrochemical industry also. The backward integration entails only marginal extensions of the machinery used for oil refining to process SR. Thus the SR industry has the unique advantage of both backward and forward integrations with petrochemical and tyre industries respectively. Such vertical intergration facilities permits intra-firm transfers and protect the captive sales from market instabilities to a large extent. Thus it becomes evident that the inclination of tyre manufacturers is to use the synthetic rubber production capacity to the maximum at the cost of NR.

As we have noted, the technical progress in SR processing has enabled it to make inroads into the tyre sector through the 'service performance' criteria. However, a study on the relative share of NR concluded that on techno-economic grounds NR's potential share could range between 40 to 50 percent[11]. Interestingly, the observations made in this study regarding the potential share of NR in total rubber consumption stand in sharp contrast with the trends in the share of NR consumption among the major consumers.[12] A tentative observation that can be made on the basis of the trends in the relative shares in consumption of NR and SR is that the patronage of SR consumption by the major consumers will not only increase the dependency of the major NR exporters but also have serious implications in terms of persistent instability of NR prices and export earnings.

Relative Prices of NR and SR

It is very often claimed that the main factor behind the steady growth of the SR industry is the relatively higher and unstable prices of NR. The main characteristic attributed to the NR price is its instability compared to the list prices of SR. The SR prices though very often lower than the NR prices have made a steady increase and since 1980 the SR prices have been ruling higher than the NR prices.

An analysis of the relationship between the trends in prices of NR and SR and their relative shares in consumption during the last fifteen year period (see table 5) gives certain interesting results. In both cases the correlation between price and the relative shares in consumption is found to be insignificant.[13] It becomes evident that the role of price as a determining factor of the relative shares of NR and SR is trivial. Hence any attempt to explain the trends in NR and SR consumption in terms of the observed price trends within the traditional demand-supply framework will not be fruitful.

Meanwhile, it is interesting to note that SR price has steadily increased relative to the NR price which exhibits a higher degree of instability. It is pointed out that even though oil feedstocks and energy inputs constitute about 70 per cent of SR production costs, the elasticity of SR price with respect to oil price approximates only 0.2768.[14] In other words, the observed relationship between the prices of oil and SR is not significant which shows the oligopolistic and verticaly integrated nature of the SR industry. Conversely, the NR production sector is characterised by the dominance of small holdings, oligopsonistic purchase of NR by tyre multinationals and absence of a strong rubber goods manufacturing base in the major NR producing countries. To a large extent, these three factors underlay the formation of the NR price as well as trends in relative share in total rubber consumption. Experience suggests that captive plant owners will regard their supply of SR as an insurance against the danger of the possible formation of an NR cartel with the implication of an upward movement in the price of NR and will not make strict economic comparisons between the cost of using captive SR and the cost of using imported NR.

Besides SR other synthetics such as plastics have also made inroads into rubber market.[15]
Another important area of replacement is latex foam (NR and SBR) which has been in heavy competition with the polyurethane/polyether chemical foams in end uses such as mattresses and cushions. In all the major rubber consuming countries these latter foams have virtually taken over all of the cheaper end of the market, leaving the high quality end of the market, for latex foam. Another important material which has recently emerged as a competitor to rubber is the thermoplastics rubber' whose main uses include adhesives, modifiers for conventional plastics and in products such as footwear, sheeting etc.

The instability of NR price and the fear of developed countries about the possibility of the formation of a third world rubber cartel after the second oil crisis in 1979 hastened the establishment of the International Natural Rubber Agreement which came into effect in October 1980. The main provisions of INRA are to stabilise NR prices and to obtain a steady growth in the export earnings of the producer countries. After having successfully defended a floor price for several years since 1980, it has been unable to divest itself of its large stocks, despite cuts in its target prices. Recently, in an attempt to link floor price to production costs, the NR exporters argued for an increase in the INRA price range on the basis of an increase in the production costs to the tune of fifty percent. The importers reacted by pointing out that they are after price stabilization, not price support. This is an important distinction which means that a floor price can be lowered in line with the long term market trends-no matter what is happening to the production costs. After the failure of negotiations on a replacement in May 1985, the INRA was extended until 1987 beyond its October expiry date. However, its long term chances of survival are rated as poor by those involved in these talks.

The case of NR is only an instance which exposes the fragility of the framework in which many of the commodity agreements are operating. It also points to the danger facing the third world countries that take recour-

Table 4

Percentage shares of the major producers in SR production and SR production Capacities

Country	Share in SR production*	Share in SR production capacities**
U. S. A.	24.4	23 0
Total Western Europe	21.4	25.3
Japan	12.8	12.6
Sub Total	58.6	60 9
Total Centrally Planned Economics	28.9	27.3
Others	12.5	11.8

* Share in SR production is for the year 1984

**Share in SR production capacities is for the year 1985

Source: Same as Table 3 pp. 23-45

Table 5

Trends in Price and Relative Shares in Consumption of NR and SR

Year	NR Price (London cif) RSS-I £/tonne	Relative share of NR in total rubber consumption (in percentage)	SR price (U.K. list price) SBR-1500/2 £/tonne	Relative share of SR in total rubber consumption (in %)
1970	180.4	34.7	165.00	65.3
1971	143.70	33.4	174.50	66.6
1972	147.70	32.4	176.75	67.6
1973	300.20	31.0	197.00	69.0
1974	342.20	29.4	347.00	70.6
1975	287.50	32.4	386.25	67.6
1976	475.00	30.7	419.50	69.3
1977	508.60	30.1	496.00	69.9
1978	552.70	29.8	545.00	70.2
1979	638.20	29.8	617.75	70.2
1980	663.00	30.2	697.00	69.8
1981	557.00	30.4	749.00	69.6
1982	517.00	31 5	835.00	68.5
1983	754.70	32.3	835.00	76.7
1984	764.90	32.5	N.A.	67.5

Source: Computed from Rubber Statistical Bulletin, IRSG (various issues)

se to undue specialization in export crops, a prescription that today is being doled out by the World bank.[16]

1 Before the introduction of tea cultivation in British Colonies, China was the only source of supply of this beverage in the form of unfermented green tea to the west. But after the successful experiment of cultivating tea in British Colonies, the Chinese green tea was gradually ousted from the world market due to the promotion of fermented black tea by the British Companies. This is a clear case which shows that even the preferences of the consumers can be changed by economic power resulting from a remarkable degree of vertical integration. Today, brand loyalty is the rule though tea is not produced in any of the western countries where these multinational corporations are based.

The gravity of the problems facing the sugar producers is evident from the encroachments made by the artificial sweetners made from petroleum, biotechnology and chemical derivatives. A recent study (for details see Frederic F Clairmonte and John Cavanagh, Destruction of the Sugar Industry", *EPW*. Jan. 14th 1986, P-18) on the sugar industry shows the implications of the policies pursued by the US based soft drink giants on sugar. It is also pointed out that developments in chemical and biological processes are now confronting the familiar beverage trinity of cocoa, coffee and tea. Flavour chemists have deployed enzyme fermentation technology to create cocoa substitutes that cost half as much to produce as natural cocoa extracts.

2 For a detailed discussion see the *World Development Report* (1986), World Bank, Oxford University Press, 1986, pp. 136-137.

3 The two main instruments of ICAs have been buffer stocks and controls on production and exports. For a detailed discussion on the shortcomings of these instruments with regard to individual commodities, see pp. 134-135, ibid. It is also to be noted that, more than the instruments, the fragility of the frame work in which various I C As are operating, also contributed to the failures.

4 For details see Hidde P Smith, *Globe Industry Report, Forecasts for the World Rubber Economy to the year 2000*, Macmillian Publishers Ltd London, 1984, p. 332 Also see Rubber Statistical Bulletin, IRSG Vol. 40, No. 4 January 1986, London, pp.4-5.

5 C. Suan Tan, "World Rubber Market Structure and Stabilisation, An Econometric Study", *World Bank Staff Working paper No. 10*, World Bank, Washington D. C. 1984, P-2.

6 The SR is processed from the oil feed stock and therefore, an increase in oil price will naturally result in an increase in SR price. For instance, during the oil price boom of 1973, the average SR price promptly increased to the tune of 60% in 1974 and in 1975 for the first time the NR spot price became lower than the SR price.

7 For details see *Rubber Statistical Bulletin,* P-36 Opcit and Hidde P Smith, p-185, Op. cit.

8 C. Suan Tan, P-21, Op. cit.

9 ibid, p-22

10 Colin Barlow, Prospects of Natural Rubber" *Economic Record*, Vol. 46, 1970, PP-482-496. It is also to be noted that the world oil and tyre industries are domoinated by seven and nine transnational corporations respectively.

11 PW Allen, P.O. Thomas and BC Sekhar, The Techno-Economic potential of Natural Rubber in Major End uses, *MRRDB, Monograph No. I*, Kualalumpur, 1974.

12 For instance, the share of SR in total rubber consumption has gone upto 73.3% in UK, 63.9% in France, 61.0% in West Germany and 63.5% in Japan respectively as on 1984.

13 Applying 't' test in thes two cases, the correlation is found to be statically insignificant at 1% and 5 % levels of significance.

14 C. Suan Tan, P-164 Op.cit.

15 The areas which have been invaded by plastics are PVC. in flooring, footwear (soles, heels) cables, garden hose and wide range of domestic fittings. PW Allen, P O. Thomas and B. C. Sekhar, p 14, op.cit.

16 See for instance *World Development Report* 1986

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NORTH MALABAR GRAMIN BANK: A new concept in banking

ARAVINDAN

In the nation building task, Banks as premier credit institutions in the country have to play a pivotal role with particular emphasis on ensuring economic emancipation of weaker sections including Harijans, Girijans, Adivasis etc. The Regional Rural Banks set up in 1976 by the Central Govt have rendered yeomen service in this sphere.

In accordance with the rules laid down in the Regional Rural Bank Act, the North Malabar Gramin Bank was established on 12th December 1976. The rural banks function with the active collaboration of Central-State Governments and sponsor banks. The most important objective of the rural banks is to assist the economically weaker sections of the society, small and marginal farmers and farm labourers. A project which is found to be reproductive would be financed by rural banks.

The North Malabar Gramin Bank has 118 branches spread over in its entire area of jurisdiction in the two adjoining districts of Cannanore and Kasargod. There are at present 821 employees working in various departments and branches. The NMGB is sponsored by the Syndicate Bank. The Syndicate Bank is appointing its Chairman, Managing Director and Chief Inspector. The administrative council consists of the representatives of Central-State Governments, NABARD(National Bank for Agricultural and Rural Development) Reserve Bank and Syndicate Bank.

Farmers' Information Exchange Clubs

The bank believes in maintaining personal contacts with the farmers. The success of the functioning of such banks wholly depends on the intimate relationship it maintains with its customers regularly. The Farmers' Information Exchange Clubs have deep roots in villages where both the representatives of the club and the farmers sit together and sort out problems that deserve immediate attention.

The Regional Committee of the Syndicate Agriculture foundation sponsored by the Syndicate Bank is operating from its Head quarters in Cannanore. Shri K M Nambiar, Chairman of the Bank is controlling the activities of the Regional Committee. The Regional Commitiee established in 1980 has 93 Farmers' Information Exchange Clubs. Along with this there are 12 Future Farmers Clubs and 6 Farm Clinics. Of them, 73 are functioning under the various branches of the Bank. Trainings, discussions, study tours, seminars etc are some of the programmes undertaken by the FIECs. Distribution of high yielding planting materials among farmers, free medical camps etc are some of the activities of these clubs. The Bank also gets the unstinted support and co-operation of the Rubber board in implementing these programmes. There is also one rubber nursery at Eruvessy under the auspices of the FIEC from where 4410 polybag seedlings were distributed to its members. The nursery secured a profit of Rs.14448.00 towards sale of planting materials.

State and national level awards are given to the best club which renders meritorious service in their respective areas. The awards for the last 3 consecutive years have been won by the FIECs of the Bank. Every year an ideal farmer is also selected and presented with awards etc.

"Karshaka Lokam" is the publication of the Regional Committee which functions under the Syndicate Agricultural foundation. 1200 copies of the magazine are being printed every month.

The members of FIEC assemble at least once in every month. A minimum of 40 members are attending the meeting convened to discuss the problems pertaining to their area. It is reported that no other bank has ever attempted to organise such centres. The President of Eruvessy FIEC is Francis Alath and Secretary Abraham Kamplanickal. The Chemperi Branch of the Bank has disbursed Rs. 204060.00 under the RPD Scheme.

Rubber Plantation Development Scheme

The Bank had implemented the Rubber Plantation Development Scheme drawn up for the period 1980–85 with the active assistance of the NABARD. In Cannanore, rubber cultivation marked the beginning of a new era of hectic activities. The hardworking people who settled down in the surrounding areas of the hilly tracts identified these areas as most suitable for rubber. During 1959-60 rubber was planted only in 5756 hectares in Cannanore District. By the end of 1984 the total area under rubber cultivation went up to 22330 ha. Relentless efforts of the growers and adoption of modern methods of cultivation helped very much in bringing more area under rubber. As against 187 kg per hectare in 1960-61, the production rose to 598 kg per hectare in 1983–84

The position of Cannanore

Of the total area under rubber in Kerala, Cannanore contributes only 8%, though it is a potential area for expganسion of rubber cultivation. In the annual reports prepared by the Bank separate provision is made for plantation crops.

Under the RPD Scheme for the year 1985-86, the bank had distributed loans for rubber cultivation in 500 hectares. As the scheme ended in 1986, the Bank had drawn up a new programme for 1986-87 with the approval of NABARD.

The cost of production calculated per hectare is Rs. 27,700.00. In the case of those who use polybag plants, loans are disbursed in 6 instalments. For those who plant budded materials, loans are distributed in 7 instalments. Loans are repayable in five equal annual instalments. As on 30 June 1987 the Bank had advanced Rs. 73.05 lakhs towards loans for planting rubber in 573.35 ha. Cannanore being a potential area for rubber development, the Bank proposes to continue the loan schemes in the years to come.

Shri K. M. Nambiar
Chairman, Grameen Bank.

Loan for Rubber Roller

The loan is made available to a grower who has a minimum of one hectare land of his own. The average cost of the roller is calculated as Rs.5500.00. The expenditure for constructing the shed is estimated to be Rs. 1500.00. The loan if availed need be returned in a period of 12 years. Under the scheme which started in 1986, an amount of Rs. 3.50 lakhs has been distributed to eligible growers as on 30.6.1987 towards purchasing the rubber roller and constructing the shed. This scheme also will be continued. During the last 10 years, the Bank has disbursed Rs. 14. 19 crores to 1152714 customers under different sectors.

Development programmes

The Bank is always in the forefront in formulating policies to eradicate poverty under the Integrated Rural Development programmes and implementing the 20 point programme being undertaken by the Central Govt. The Bank secured the first position in Kasargod District for implementing the programmes under the intergrated rural development scheme. It has second place in Kasargod District. Under the IRDP, the Bank disbursed Rs 106.50 lakhs to its 4359 customers. The Bank is implementing various schemes to help the farmers with the refinancing of the NABARD.

The Bank has played a constructive role to implement the various schemes under the social forestry programme of the Kerala Government in 1986.

Vikas Volunteer Vahini Programme (vvv)

VVV is a voluntary organisation and its activities are based on the principle: development through credit. Various programmes that fall under VVV, are undertaken by the active assistance of the National Bank for Agriculture and Rural Development.

The salient features of the VVV are based on the following five principles.

To undertake farming with sophisticated modern technology

- to strictly adhere to the rules and regulations in force from time to time,
- to bring up production with dedication and hardwork,

Shri Samson John, Branch Manager, Eruvessey is inaugurating the distribution of poly bag plants. Shri Urumbil Joseph receives the first poly bag plant.

Customers at the counter of Karuvanchal Branch.

– to save a part of the excess income generated from agriculture and

– to remit the loan promptly.

VVV is functioning at the Padanna Branch of the Gramin Bank and it is popularly known as the club of Bank's friends. The Padanna unit of the VVV is the first of its kind in India which is devoted to the welfare of fisher folk.

Though the Bank had incurred losses in the previous years, it is gratifying that it could overcome the unfavourable periods and make a profit of Rs. 42.02 lakhs till the end of 1986. In view of the slow increase of profits, the loans are disbursed purely depending on the refinancing policies of the NABARD and the Sponsor Bank. Since the loans are given on marginal interests, the Bank confronts much difficulties as a financing institution and so ensuring economic stability also becomes difficult. Apart from being identified as a banking institution, the North Malabar Gramin Bank enjoys the confidence of their large number of clients which form the basis of their popularity among the people. Since 1985 Bank has adopted the Harijan/Girijan colonies under its jurisdiction and drawn up the schemes for their integrated development. Under the programme, 34 Harijan/Girijan colonies have been adopted so far.

The North Malabar Gramin Bank has risen to the expectations of the rural farming folk. But many promises are yet to be fulfilled. □

INDONESIAN TYRES FINDING OVERSEAS MARKETS

Indonesian-manufactured tyres, sold in only a handful of countries a few years ago, are finding ready markets in more countries. Indonesian tyres were sold in more than 20 countries in 1986, including the United Kingdom, Italy, the Netherlands, Belgium, Saudi Arabia, Malaysia, Hong Kong, Singapore and the Philippines. Recent certification of the tyres by the U. S. Department of Transportation opens up the American market and is expected to contribute significantly to overseas sales. In 1986, Indonesian manufacturers produced 4.6 million scooter and moter-cycle tyres-up from 3.9 million a year earlier and 4.9 million automobile tyres-up from 4 million the previous year; The nine tyre manufacturing companies employ about 9000 workers and have the capacity to produce some 7 million auto tyres a year.

More funds will come forth for Maximising Rubber Production

— Union Minister of Commerce

The Union Minister of Commerce and Finance Sri N D Tiwari announced in Bangalore recently that more funds will be allocated for rubber development schemes. He was addressing the National Conference on Rubber convened at Bangalore by the Central Government on 13 December 1987 to review production and productivity of natural rubber.

Action Plan

Various interests connected with the rubber industry such as the Rubber Board, the rubber producers and the rubber manufaturers attended the conference. The Chairman of the Rubber Board Sri P C Cyriac who presented the Action Plan for achieving self-sufficiency in rubber by 2000 AD disclosed that about 50% of Rs. 53.43 crores allocation for development of natural rubber during the VII Plan has been spent during the first two years of the Plan period and that 60% of the target for the whole Plan has been achieved in this period of two years. He pleaded with the Minister to allot at least Rs.85 crores for rubber production programmes during the VII Plan.

The Minister complimented the Rubber Board for the impressive record of performance and said that the Plan allocation had to be kept at a modest figure owing to severe resource constraints. In spite of this the Government would be generous in allocating funds for rubber development as the need of the hour is to attain self-sufficiency and avert the outflow of foreign exchange on rubber import. During 1986/87 the country had imported as much as 40,000 tonnes of natural rubber at a foreign exchange cost of Rs. 40 crores. The gap in supply to this magnitude has been in existence for the past many years and the indications are that it will continue to plague the country unless additional efforts are made to bridge the gap within the shortest time possible. We have to exploit the available natural resources for this. The vast scope for development of rubber plantations in the nontraditional region should be fully tapped to maximise production, he exhorted. Both production and productivity in rubber has to improve. True, India ranks second in the world with a productivity of 930 kg per hectare, next to Malaysia, but we have to forge ahead, catch up with Malaysia and ultimately overtake it.

Problems

The representatives of the planters from Tamilnadu recounted the difficulties encountered in getting old rubber areas replanted as the Tamilnadu Preservation of Private Forests Act stand in the way of cutting down old rubber trees. A lot of applications have been pending with the Tamilnadu Government seeking permission for replantation of old rubber area. The Government does not take any action on the applications. Forest has been defined nowhere in the Tamilnadu Act with the result that the Act can be extended to any tract of land. Though rubber is planted on land which is not part of the forest, the Act prevents one from removing the tree growth for replantation. Only if the entire rubber plantations are brought under the jurisdiction of the Central Government amplifying the preamble to the Rubber Act, 1947, this problem could be solved, they emphasised. Cultivation, production and development of natural rubber should be under the Central Government's purview. For replanting and such other activities' permission from the Rubber Board should suffice, they pleaded.

The grower's representative from Karnataka also pointed out that the position is not different in Karnataka either. However, consequent on relentless representations the State Government have now come forward to enact a legislation exempting rubber from the operation of the Preservation of Tree Act in Karnataka. The Bill has been sent to the Union Government for obtaining the President's assent.

Revision of Price

Representatives of planters from Kerala, M/s Joseph Monipally, Jacob Thomas, George Joseph Mundakal, M K Vidyadharan and James Makil pleaded for revising the fair price band taking into account escalation in cost factors and relating the price band to ungraded rubber, the small growers' produce. The rubber plantation subsidy was fixed at Rs.5000 per hectare in 1980 while the cost of cultivation was Rs.15,000/-per hectare. Today the cost is about Rs. 30,000/-. The rubber producing countries abroad have achieved increase in production by liberally assiting the planters in newplanting and replanting. They subsidise cost of cultivation with liberal cash assistance to meet over 50% of the expenses. India may adopt an equally liberal cash assitance programme since rubber is a long gestation crop in which the growers have to wait without any income during the seven year immaturity period. The rate of agricultural incometax in Kerala is very high-65%, which deprives the planter of funds to plough back into replantation. The Govt. of Kerala has also disallowed the replantation allowance in computing the agricultural income. They wanted that the Commerce Minister may take up these issues with the State Government for a solution.

The Labour representative Sri K Padmanabhan pleaded for improved allocation of funds for labour welfare measures and assisting workers in the unorganised sector to build their own houses. □

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Cover: S. Rajendran

THE RUBBER BOARD
KOTTAYAM 686 001 INDIA

Chairman
PC Cyriac IAS

Rubber Production Commissioner
P Mukundan Menon

Director of Research
Dr. MR Sethuraj

Project Officer
CM George

RUBBER BOARD BULLETIN

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THE QUARTER

The revelation of the Chairman Shri P. C. Cyriac I A S in the Board meeting that impressive progress has been made in respect of the first three years of the Seventh Plan strikes a good note especially at a time when the Rubber Board spares no effort in mobilising its resources to bring up production of natural rubber. The Chairman has also announced a lot of new schemes aimed at the overall improvement of the present position. The prospects are brighter. The rubber growers in the country should also strive hard to cope up with the efforts of the Rubber Board. The old and uneconomic holdings are to be replaced by replanting high yielders on a warfooting which give good returns. The total and dedicated involvement of the rubber growing community would bring forth concrete results for the future. We have to achieve new heights in our targets for the sustained improvement of natural rubber production in the country.

IMPRESSIVE PLAN PERFORMANCE:

Sri. P. C. Cyriac, Chairman of the Rubber Borad announced in Kottayam that the Rubber Board has turned out an impressive performance during the first three years of the VII plan achieving about 80% of the target in physical and financial terms as against 60% originally envisaged within this time frame. He was delivering the the presidential address at the 110th meeting of the Rubber Board held at the council Hall of the Rubber Board at RRII Buildings, Kottayam 9. If this tempo is maintained, he hoped that it would be possible for the Board to implement a plan of about Rs. 75 crores during the VII Plan as against the original target of Rs. 53 crores, and achieve an equally accelerated development in physical terms.

About the demand-supply position of rubber he stated that the Statistics & Import/Export Committee had estimated production and consumption of NR during 1988/89 as 255,000 tonnes and 305,000 tonnes respectively, leaving a gap of 50,000 tonnes to be met by imports. Of this, 30,000 tonnes was recommended for import; at 10,000 each during April, May and June 1988.

He said that the Board has set for itself a challenging task of producing five lakh tonnes natural rubber by 2000 AD. This can be achieved only by planting new areas in the non-traditional regions and by replanting uneconomic plantations in the traditional regions. The target for planting rubber in the north-east was 4000 hectares, against which the achievement was 4500 hectares. During 1988 planting has to take place at 6,000 hectares and at 8,000 hectares during the next two years. Thereafter newplanting has to be stepped up to 12,000 hectares per year and two years after that, 15,000 hectares per year and then to 20,000 hectares from 1994. Though extensive areas are available for planting in the north-east, availability of planting matarial poses problems. Last year about 6 lakhs of budded stumps were transported to the north-east from Kerala. This year it is proposed to transport at least 10 lakhs of budded stumps. In order to locally generate the planting material requirement, six new nurseries are proposed to be started in the region in addition to encouraging the state Farms Corporation of India and the Tripura and Assam Governments to set up rubber nurseries.

Campaign

He said that the Board also plans to mount a campaign to generate enthusiasm among the growers to immediately replant all the old areas and also to increase NR production in the short run by at least 10,000 tonnes employing upward tapping of old trees in association with yield stimulation.

The Rubber Board was reconstituted by the Central Goverment in October 1987.

One of the important steps taken by the Board immediately after it assumed office was organisation of a Research & Development Committee with representatives from a cross section of the various interests including scientists and technologists. This Committee replaced two Committees of the previous Board viz, the Research and Training Committee and the Development and Extension Committee. Apart from three grower members there are two scientists and a technologist on the Committee in addition to the Director of Research and the Rubber Production Commissioner. The Committee has to examine and recommend projects on scientific and technological research, development and extension programmes and their review and periodical evaluation.

Research and development efforts pave the way for inventing innovations, new processes and techniques in any industry. The new Board has rightly given first priority to research and development programmes as industry has matured over the years and is poised for further growth with technological and research backing. In its very first meeting the Committee evolved two schemes, one for strengthening the research programmes in the north-eastern region and the other for starting two new regional research stations in the non-traditional regions, one in Bastar District of Madhya Pradesh and the other in Siliguri of West Bengal. The Committee also made many recommendations of far reaching importance to the NR production industry, some of which are given below.

Recommendations.

1. Experiments may be started with rubber as

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9. Attempts may be made for early evaluation of new clones through yield component analysis.

10. The experiment 'spraying vs. non-spraying' against abnormal leaf fall disease may be conducted at the Institute's Experiment Station.

11. Trials on mushroom raising may be undertaken as a priority item of work in order to popularise mushroom cultivation in small plantations as a source of additional income.

Chairman Spells Out New Schemes

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2. Yield pattern of different clones in the north-east region may be studied to sort out the best suited for the region.

3. Experiments may be initiated in intercropping rubber with shade loving medicinal plants, pepper, tea and coffee varieties with compact canopy and tolerant to the ph factor in rubber growing soils.

4. More paying crops like winged beans and a kind of bean grown in Maharashtra may be tried as intercrop in rubber plantations.

5. Rottan (cane) may be introduced as an intercrop in rubber. Its multiplication may be tried through tissue culture.

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Schemes

Many schemes were evolved by the Board for improving the small holding sector, of which schemes for encouraging bee-keeping and interplanting medicinal herbs in rubber plantations as a source of additional income to the grower are notable for their novelty. Schemes for rendering financial assistance (1) for taking up measures to conserve soil and moisture in rubber plantations in the wake of recurring droughts, 2) for fencing rubber plantations in the non-traditional region to protect rubber plants from the attack of wild animals, 3) supply of Jebong knives at subsidised price for popularisation among small planters to improve efficiency in tapping, (4) supply of latex sieves and paranitrophenol at subsidised rates to rid the field latex of dirt and other impurities and prevent mould growth on rubber sheets, and (5) assisting an R & D unit to undertake trial planting of different varieties of guayule species to generate data on the economics of guayule cultivation were also chalked out. The Board decided to license technically specified rubber processing units in the private sector in view of the increasing demand for TSR.

Fair Price

Maintenance of a fair price for natural rubber without violent fluctuations in recent years is the result of continuous monitoring of the supply and demand situation by the Board through the Statistics and Import/Export Committee. The rubber market used to fluctuate violently as NR is short in supply by about 15% of the demand on an yearly basis, but the fluctuations were almost contained when the supply came to be regulated though operation of a buffer stock linked to a fair price band. The Committee meets as often as necessary; in any case once in three months, to evaluate the production and consumption scenarios and to make recommendations to the Government about the demand and supply position and the likely trends in the near future. If any gap in supply is assessed, recommendations are made to import an equal quantity in order to ensure sufficient flow of the material to the consuming centres. Based on the recommendations the Government authorises the State Trading Corporation to import rubber for distribution when production of the commodity is less than the demand.

Demand and Supply

The new Board reconstituted the Statistics & Import/Export Committee inducting a representative each of the large planters, the small planters and the consuming sector. Organisations of growers and consumers are invited to meetings of the Committee to appreciate their viewpoints. This is a very healthy practice. The Committee gives shape to its recommendations after evaluating the different shades of views. Estimates of demand and supply are prepared in advance. These are reviewed periodically in the light of fresh developments and changes in the actual demand and supply situation.

Labour

Labour is the real work-horse in any productive venture. Workers in the organised sector are eligible for statutorily fixed wages and fringe benefits. But of about 2.5 lakh workers in the rubber plantation sector, nearly 90% lie outside the pale of these provisions as only plantations admeasuring 5 hectares and above and employing 15 workers on any day in a year come under the statute. Others work on daily wages without the backing of any wage awards. Hardly any State or central statute comes to their rescue. In this situation it is praiseworthy that the Board took initiative to start a Group Insurance Scheme for workers in the unorganised sector with insurance cover worth Rs. 10,000 against death, accidents, illness etc. The worker has to pay Rs. 50 per annum for ten years as insurance premia while the Board meets double the amount on remaining part of the premia.

Housing Scheme

A new scheme for assisting house construction in the rubber plantation sector envisaging grant of Rs. 5,000 per new house constructed, was evolved and put into operation. The Board gave a new orientation to the labour welfare measures under which rules and procedures for disbursment of financial aid were simplified, facilitating speedy receipt of benefits by the plantation labour. The educatioal stipend scheme has assisted many a dependent of rubber plantation workers to give shape to their future. There are beneficiaries of the scheme among doctors, engineers, technicians, scientific personnel and successful lawyers and chartered accountants. At least some may beam with pleasant surprise to hear that one of the able administrators of the Kerala cadre borne on the covetable Indian Administrative service was educated with the assistance of the stipend scheme.

— Thomas Ouseph

PERFORMANCE OF A FEW RRII CLONES IN THE ESTATE TRIALS

CK Saraswathy Amma, PJ George and AON Panikkar,
Rubber Research Institute of India, Kottayam-686 009.

Introduction

Commercial cultivation of *Hevea brasiliensis* was started in India in 1902. However, crop improvement programme by breeding and selection was initiated only in 1954, with the inception of the Rubber Research Institute of India. Breeding programmes with a view to evolving planting materials with high production potential and adaptability to regional agro-climatic condition has been the main aim. During the first phase emphasis was given to evolve planting materials with high production potential (Bhaskaran Nair, *et al.* 1975). From the second phase onwards emphasis was also given to secondary attributes like resistance/tolerance to wind damage, disease and drought. This paper presents the performance of selected RRII clones from 1954 and 1956 hand pollinated progenies in the block wise planting in Kulathupuzha, Koothattukalam and Kinalur estates.

Method of Study

Details of the materials planted in the three estates are depicted in Table 1. In Kinalur estate one block, consisting of 300 trees, each of RRII 105, RRII 118, RRII 208 and RRIM 600 has been planted. Nine clones (RRII 105, 107, 109, 113, 114, 116, 118, 203 and 206) along with GT 1 are planted in Kulathupuzha estate of the Rehabilitation Plantations, Punalur. In Koothattukalam estate the clones planted are RRII 105, RRII 203, RRII 208, GT 1 and RRIM 600. Planting was carried out during 1973 in Kulathupuzha. In Koothattukalam two clones namely RRII 105 and RRII 208 were planted during 1973 and one block each of RRII 105, 203, 208, GT 1 and RRII 600 was planted during 1974. In Kinalur estate also planting was carried out during 1974 season.

Annual girth measurements and recording of secondary traits were taken from the fourth year of planting onwards. The trees in two blocks planted in 1973 came into tapping during 1981 and the others in 1982 seasons. The tapping system adopted was S/2 d/3 in Koothattukalam and Kinalur and S/2 d/2 in Kulathupuzha. Rainguards have been provided in all the estates. Yield was recorded on all tapping days. Yield during drought period February to May was considered for ascertaining the relative production during the summer period. The important characters recorded are vigour during immaturity period, girth increment after commencement of tapping, thickness of virgin bark and renewed bark at the sixth year of tapping, annual yield, yield during summer, susceptibility to diseases and proneness to damages caused by wind. Growth vigour during immaturity phase and girth increment after opening were recorded by measuring the girth of the trunk at a height of 150 cm above the bud union. Thickness of bark was measured with a Schleipers gauge. Incidence of pink disease and wind damage was ascertained by counting the number of affected trees. Diseases like abnormal leaf fall and powdery mildew were assessed by visual observations.

Results And Discussion

Mean yield in kilogram per hectare per year for the first five years of tapping at Kulathupuzha is given in Table 2. The overall mean yields per hectare per year over five years of tapping range from 810 Kg for RRII 114 to 1428 Kg for RRII 105. Besides RRII 105, four other clones, RRII 118, RRII 206, RRII 107 and RRII 203 are found to yield above 100kg/ha/yr. All these clones are showing better performance than GT 1 at Kulathupuzha estate. At Koothattukalam estate (Table 3) among the six clones RRII 105 tops the list followed by RRII 208, RRII 203, RRIM 600 and GT 1. Mean yield for first six years of tapping shows that RRII 105 gave 1576 kg, RRII 208, RRII 203, RRIM 600 and GT 1 yielded 1297 kg, 1212 kg, 907 kg and 662 kg respectively per annum during this period. The average annual yield of RRII clones along with that of RRIM 600 at Kinalur estate are given in Table 4. In this estate also

RRII 105 (1533 kg) is the top yielder followed by RRIM 600 (1394 kg) RRII 208 (1047 kg) and RRII 118 (1007kg). All the four clones are exhibiting good performance with regard to yield.

The overall mean yield per hectare per year from the three estates are furnished in Table 5. RRII 105 is the highest yielder (1562 kg). The next higher yielder is RRII 208 (1226 kg), followed by RRII 118 (1145 kg) and RRII 203 (1143 kg). All these four clones are showing better performance with regard to yield when compared to RRIM 600 (1104 kg) and GT 1 (843 kg). All the clones also show rising yield trend. From the first year of tapping onwards RRII 105 shows very good yield, with increasing trend and was superior to all the other clones.

The mean data of the few secondary characteristics observed are tabulated and presented in Table 7. The mean girth at opening ranged from 46.5 cm (RRII 113) to 55.9 cm (RRII 118). RRII 203 (55.8cm) is the second vigorous clone followed by RRII 116 and RRIM 603 both showing 54.4 cm girth. RRII 105 and RRII 208 showed average vigour at opening.

Mean yearly girth increment over first four years of tapping varied from 3.0 cm for RRII, 113 to 6 7 cm for RRII 109. Among the high yileding clones RRII 105 showed 4.2 cm annnal mean girth increment on tapping. RRII 118 and RRII 203 showed 4.7 and 4.0 cm respectively. The girth increment of RRII 208 was average (3.7 cm). RRIM 600 (5.0 cm) showed above average girth increment on tapping.

The response of high yielding clones towards drought shows wide variations. Out of the twelve clones RRII 116 showed comparatively low yield depression during summer months, followed by RRII 203, RRII 208, RRII 118 and RRII 105 in order. The yield drop of RRIM 600 was more pronounced.

There is much difference between clones with regard to bark thickness on virgin and renewed. The virgin bark thickness in the sixth year of tapping ranged from 7.9 mm (GT 1) to 10.5 mm (RRII 116). RRII 118 showed 10.2 mm bark thickness whereas RRII 105, RRII 203, RRII 208 showed 9.8mm, 9.9 mm and 9.2 mm respectively. RRIM 600 showed only 8 9 mm bark thickness. The thickness of reewed bark ranged from 10.7 mm (RRII 116) to 8.5 mm (RRII 208). RRII 203 and RRII 118 showed 11.0 mm bark thickness and RRII 105 has 9.2 mm bark renewal.

All the clones are found to be susceptible to abnormal leaf fall disease caused by *Phytophthora* spp. However RRII 105, 118, 203 and 114 showed comparatively good leaf retention. RRII 208 RRII 206 and GT 1 showed average leaf retention. RRII 208 is susceptible to shoot rot and the tender shoot is affected by the *Phytophthora*. RRIM 600 was found to be highly susceptible to leaf fall disease.

RRII 105 and RRIM 600 are susceptible to Pink disease. The incidence was comparatively low in RRII 118, 203 and 208. The incidence of Oidium was comparatively low in RRIM 600 and RRII 105. RRII 203, 208, 118 and GT 1 showed varying degrees of infection.

Among the clones RRII 105, RRIM 600 and GT 1 are susceptible to brown bast. In the S/2 d/2 system of tapping the incidence of brown bast was found to be more (15%). But when the system of tapping is changed to S/2 d/3 the incidence of brown bast was lesser (7%). RRII 203 showed 4.2% of the trees affected by brown bast whereas RRII 208 showed 3.6%. In RRII 118 the incidence of brown bast was negligible. The incidence of wind damage was highest for RRIM 600 (12%) RRII 105, RRII 208, and GT 1 showed 3.3, 2.4, 2.3% of wind damage respectively.

The performance of RRII clones, RRIM 600 and GT 1 in the three estates shows wide variations. RRII 105 is the highest yielder in all the three estates. The next highest yielder is RRII 208, RRII 203 and RRII 118 are comparable with regard to yield. RRIM 600, is showing very good performance in Kinalur estate. The performance of RRII 208 and 203 at Koothattukalam is good compared to GT 1 and RRIM 600. RRII 118 showed good yield both at Kinalur and at Kulathupuzha. RRII 107 and RRII 206 are showing above thousand kg/ha/year at Kulathupuzha during the first five years of exploitation.

The mean yearly yield of four RRII clones along with that of RRIM 600 and GT 1 is depicted in Table 6. The overall average annual yield for six years of tapping for RRII 105, RRII 208, RRIM 600 and GT 1 and for 5 years tapping for RRII 203 and RRII 118 are shown in Table 5. RRII 105 is the highest yielder followed by RRII 208.

With regard to secondary characters RRII 105 is sturdy, the tree is tall with straight trunk and good branching habit. The canopy is dense. This clone shows branch snap during immaturity period due to thick foliage (George *et al.*, 1980). It has a fair degree of resistance to abnormal leaf fall disease, when the usual prophylactic measures are adopted (Bhaskaran Nair and George, 1968; Bhaskaran Nair *et al.*, 1975). It is comparatively susceptible to brown bast. S/2 d/3 system is preferable. The clone is also susceptible to Pink. Eventhough the summer yield of this clone is satisfactory the response of this clone to physical drought is more. The very high yield of this clone is an outstanding trait.

The clone RRII 208 ranks second in the case of yield. This clone shows susceptibility to *Phytophthora* during young stages. It shows above average resistance to all other diseases. The girth increment on tapping is average for this clone. The thickness of virgin bark is average and renewed bark thickness is below average. Similar characteristic has been reported for RRIM 729, 728 and PB 280 (Ong S.H. 1983). RRII 208 shows good branching with light canopy (Saraswathyamma *et al.*, (1980). RRII 203 and RRII 118 are vigorous clones, showing above average yield. Both these clones are showing above average resistance to almost all the diseases. The clone RRII 203 showed wind damage and brown bast in the small scale trial but these were not severe in the estate trials. In Kulathupuzha RRII 107 and RRII 206 are showing above thousand kg/ha/year (mean over five years of tapping). The clone GT 1 shows wind damage in Koothattukalam even though this clone is reported to be resistant to wind damage (Ong S.H., 1983). Incidence of Powdery mildew caused by *Oidium* is noted in GT 1. RRIM 600 is however reported to show resistance to *Oidium* (Anonymous, 1983). Incidence of Pink disease is reported for RRIM 600 Anonymous, 1980) and this clone is susceptible to Pink disease also. The yield of GT 1 is generally not very good. But this clone ranks second in Kulathupuzha.

Results discussed above indicate that the clones show region wise response with regard to yield and secondary attributes. So the evaluation

Table-1

Clone	Parentage
RRII 105	Tjir 1xGl 1
RRII 107	Tjir 1 x Mil 3/2
RRII 109	Tjir 1 x Mil 3/2
RRII 113	Mil 3/2 x Hil 28
RRII 114	Mil 3/2 x Hil 28
RRII 116	Mil 3/2 x Hil 28
RRII 118	Mil 3/2 x Hil 28
RRII 203	PB 86 x Mil 3/2
RRII 206	Mil 3/2 x AVROS 255
RRII 208	Mil 3/2 x AVROS 255
RRIM 600	Tjir 1 x PB 86
GT 1	Primary clone

Table-2

Mean yield (in kg / ha / year) of clones at Kulathupuzha

Clone	First year	Second year	Third year	Fourth year	Fifth year	Mean over 5 years
RRII 105	1163	1577	1487	1178	1737	1428
RRII 107	820	1419	1297	927	933	1079
RRII 109	633	720	796	1057	1204	882
RRII 113	549	912	1067	880	1373	958
RRII 114	605	776	889	894	896	810
RRII 116	588	796	964	1048	1208	921
RRII 118	773	1123	1515	1319	1683	1283
RRII 203	594	1022	1249	902	1408	1035
RRII 206	645	914	1140	1420	1399	1104
GT 1	718	816	1183	1144	1081	988

of planting materials at different environs is necessary.

Acknowledgements

The authors are thankful to Dr. M.R. Sethuraj, Director of Research and Shri. P. N. Radhakrishna Pillai, Joint Director for guidance and helpful comments. They are also grateful to Shri. V. K. Bhaskaran Nair, former Director of Research for the guidance in the initial stages of experimentation. The sincere and whole-hearted assistance rendered by the supporting staff of the Botany Division is appreciated. The co-operation of managers and staff of the estates in conducting the trials is gratefully acknowledged.

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Table-3

Mean yield (in kg/ha/year) of clones at Koothattukalam

Clone	Year of tapping 1	2	3	4	5	6	Mean
RRII 105	982	1317	1645	1905	1687	1917	1576
RRII 203	809	1160	1407	1474	...	....	1212
RRII 208	832	1148	1147	1429	1526	1698	1297
RRIM600	749	823	703	849	1054	1266	907
GT 1	466	390	496	686	731	1202	662

Table-4

Mean yield (in kg/ha/year) of clones at Kinalur

Clone	Year of tapping 1	2	3	4	5	Mean
RRII 105	1277	1352	1682	1859	1494	1533
RRII 118	804	865	1057	1192	1118	1007
RRII 208	790	954	1140	1208	1144	1047
RRIM 600	1378	1341	1464	1392	—	1394

Table-5

Yield performance of clones

Clone	Mean yield (5 years) kg/ha/year
RRII 105	1562 * (3)
RRII 208	1226 * (2)
RRII 203	1143 (2)
RRII 118	1145 (2)
RRII 206	1104 (1)
RRII 107	1079 (1)
RRII 113	958 (1)
RRII 116	921 (1)
RRII 109	882 (1)
GT 1	843 * (2)
RRIM 600	1104 * (2)

* Mean over 6 years.

Figures within bracket indicate number of estates.

Table-6
Overall yield performance of a few clones (kg/ha/yr)

Clone	Year of tapping					
	1	2	3	4	5	6
RRII 105	1140	1415	1605	1647	1639	1917
RRII 118	789	994	1286	1256	1401	----
RRII 203	702	1091	1328	1188	1408	----
RRII 208	811	1051	1144	1319	1335	1698
RRIM 600	1063	1082	1084	1029	1099	1266
GT 1	592	603	840	915	906	1202

Table-7
Some important secondary traits

Clone	Vigour at opening (cm)	Girth increment on tapping (cm)	Percentage yield depression during summer	Virgin bark thickness (mm)	Mean thickness of 5 years renewed bark (mm)
RRII 105	52.8	4.2	43.6	9.8	9.2
RRII 118	55.9	4.7	39.8	10.2	11.2
RRII 203	55.8	4.0	27.4	9.9	11.2
RRII 208	53.0	3.7	36.7	9.2	8.5
RRII 206	53.5	5.0	21.6	8.8	9.5
RRII 107	49.5	6.1	42.8	10.1	9.7
RRII 109	48.8	6.7	33.7	8.6	10.8
RRII 113	46.5	3.0	29.3	10.1	10.0
RRII 114	53.0	3.5	36.4	9.0	9.2
RRII 116	54.4	4.1	13.0	10.5	10.7
RRII 600	54.4	5.0	51.1	8.9	9.5
GT 1	49.7	4.0	43.0	7.9	10.2

of planting materials at different environs is necessary.

Acknowledgements

The authors are thankful to Dr. M.R. Sethuraj, Director of Research and Shri. P. N. Radhakrishna Pillai, Joint Director for guidance and helpful comments. They are also grateful to Shri. V. K. Bhaskaran Nair, former Director of Research for the guidance in the initial stages of experimentation. The sincere and whole-hearted assistance rendered by the supporting staff of the Botany Division is appreciated. The co-operation of managers and staff of the estates in conducting the trials is gratefully acknowledged.

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Table-3

Mean yield (in kg/ha/year) of clones at Koothattukalam

Clone	Year of tapping 1	2	3	4	5	6	Mean
RRII 105	982	1317	1645	1905	1687	1917	1576
RRII 203	809	1160	1407	1474	...	....	1212
RRII 208	832	1148	1147	1429	1526	1698	1297
RRIM600	749	823	703	849	1054	1266	907
GT 1	466	390	496	686	731	1202	662

Table-4

Mean yield (in kg/ha/year) of clones at Kinalur

Clone	Year of tapping 1	2	3	4	5	Mean
RRII 105	1277	1352	1682	1859	1494	1533
RRII 118	804	865	1057	1192	1118	1007
RRII 208	790	954	1140	1208	1144	1047
RRIM 600	1378	1341	1464	1392	—	1394

Table-5

Yield performance of clones

Clone	Mean yield (5 years) kg/ha/year
RRII 105	1562 * (3)
RRII 208	1226 * (2)
RRII 203	1143 (2)
RRII 118	1145 (2)
RRII 206	1104 (1)
RRII 107	1079 (1)
RRII 113	958 (1)
RRII 116	921 (1)
RRII 109	882 (1)
GT 1	843 * (2)
RRIM 600	1104 * (2)

* Mean over 6 years.

Figures within bracket indicate number of estates.

Table-6
Overall yield performance of a few clones (kg/ha/yr)

Clone	Year of tapping 1	2	3	4	5	6
RRII 105	1140	1415	1605	1647	1639	1917
RRII 118	789	994	1286	1256	1401	...
RRII 203	702	1091	1328	1188	1408	...
RRII 208	811	1051	1144	1319	1335	1698
RRIM 600	1063	1082	1084	1029	1099	1266
GT 1	592	603	840	915	906	1202

Table-7
Some important secondary traits

Clone	Vigour at opening (cm)	Girth increment on tapping (cm)	Percentage yield depression during summer	Virgin bark thickness (mm)	Mean thickness of 5 years renewed bark (mm)
RRII 105	52.8	4.2	43.6	9.8	9.2
RRII 118	55.9	4.7	39.8	10.2	11.2
RRII 203	55.8	4.0	27.4	9.9	11.2
RRII 208	53.0	3.7	36.7	9.2	8.5
RRII 206	53.5	5.0	21.6	8.8	9.5
RRII 107	49.5	6.1	42.8	10.1	9.7
RRII 109	48.8	6.7	33.7	8.6	10.8
RRII 113	46.5	3.0	29.3	10.1	10.0
RRII 114	53.0	3.5	36.4	9.0	9.2
RRII 116	54.4	4.1	13.0	10.5	10.7
RRII 600	54.4	5.0	51.1	8.9	9.5
GT 1	49.7	4.0	43.0	7.9	10.2

Early Performance of a few Sri Lanka Clones in India

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Introduction

Among the various methods adopted by the RRII for making available improved planting materials to the rubber planters of our country, introduction of clones from other countries is an important one. Clones reported to be better are regularly being imported to India from Malaysia, Indonesia, Thailand, Sri Lanka, China etc. Under this programme we had obtained 10 clones from Sri Lanka In 1972 in exchange for seven RRII clones. Among these ten clones one could not be established in our country due to complete budding failure. Remaining nine clones were established and multiplied further. For assessing the performance of these clones under the agroclimatic conditions prevalent in our country they are now being evaluated in clone trials in different parts of this country. The observations recorded from the first trial during the first ten years of planting are presented in this paper.

Method of Study

The clones evaluated are RRIC 7, RRIC 36, RRIC 45, RRIC 52, RRIC 100, RRIC 102, RRIC 104, RRIC 105 and Nab 17. A Popular clone, GT 1 is used as control. Some of these clones are developed from estate selections (Anonymous 1970, De Silva 1960) while others are produced by hybridisation (Fernando 1971 b). The details are given in table 1. The trial is being conducted at the Central Experiment Station of the RRII, which is situated in a typical rubber growing region of our country. Design adopted is randomised block with three replications. The number of plants per plot is 25 and the planting distance 5x5m (Anonymous 1980). Observations were carried out for ten years, seven years before tapping, and three years after opening for tapping. Growth vigour before and after tapping, thickness of virgin bark and renewed bark, latex vessel rings in the virgin bark, yield during the first three years of tapping, yield depression during summer, susceptibility to diseases and damages caused by wind were studied. Growth vigour has been assessed by measuring the girth of the trunk at a hight of 150 cm above the bud union. The trees were tapped on S/2 d/2 system and the yield potential was recorded by cup coagulation techniue. Yield depression during summer was assessed by computing the yield per tree per tap during the period. February to May as the percentage of the annual yield per tree per tap. Thickness of virgin bark was measured at the time of opening with a Schleipers gauge at a height of 150 cm. (Bhaskaran Nair and Joseph 1981). Thickness of renewed bark was measured after three years regeneration. The number of the latex vessel rings were counted by microscopical observations of thin sections of the bark samples, collected from a height of 150 cm, after appropriate staining. Diseases like pink, bark rot and brown bast as well as incidence of wind damage were recorded by counting the number of affected trees. Diseases such as secondary leaf fall and powdery mildew were assessed by visual observations.

Results and Discussion

The clones under evaluation showed very wide variation with regard to their various characteristics (table 2 A, 2B, 2C & 2D). While the clones like RRIC 104, RRIC 52 and RRIC 100 exhibited outstanding growth vigour during the immaturity period, growth of RRIC 36, RRIC 7 and RRIC 45 was very poor. Girth increment after commencement of tapping was high in RRIC 52 and RRIC 104, but low in RRIC 105. Reports from Sri Lanka indicate that the above three clones are vigorous in that country also (Fernando 1971 a, b: (Fernando and Wijesinghe 1970) RRIC 100 and RRIC 36 were found to be the highest yielders whereas the lowest yields were obtained from RRIC 52 and

RRIC 105. Similar performance is reported from Sri-Lanka also (Chandrasekaran 1972, Fernando 1971 a). Yield drop during summer was very pronounced in RRIC 105. Clones like RRIC 52 did not show this trend. RRIC 102 surpassed all other clones with respect to the thickness of virgin bark, whereas RRIC 45 was found lagging behind all other clones in this aspect. The number of latex vessel rings present in the virgin bark also varied widely from clone to clone. High yielding clones like RRIC 36 and RRIC 100 recorded high numbers of latex vessel rows while their number was lowest in RRIC 52, the lowest yielder. The rate of bark renewal, as indicated by the thickness of renewed bark was found to be more in RRIC 104 while it was very low in the case of RRIC 45. Clone to clone variation was very evident regarding their tolerance to the various, maladies affecting them. Abnormal leaf fall due to *Phytophthora* spp. was high in a few clones like Nab 17, average in certain others such as RRIC 45 and RRIC 52 and comparatively low in the case of RRIC 100, RRIC 105 etc. Susceptibility of Nab 17 to this disease has been observed in other countries also (Anonymous 1971). All clones were found affected by pink disease to varying degrees, RRIC 36, RRIC 45 etc. being highly prone and clones like RRIC 102 being comparatively less affected. All the clones were found affected by powdery mildew also though their degree of susceptibility varied. While the clones like RRIC 105 and Nab 17 were highly susceptible it was low in RRIC 52, RRIC 102 etc. A few other clones like RRIC 7 showed average resistance to this disease. RRIC 52 and RRIC 102 are reported to be resistant to this disease in Sri Lanka also (Chandrasekara 1972, Fernando 1971 a). Bark rot was noticed only in RRIC 7, RRIC 36 and RRIC 104 and the infection was less than two persent of the trees. Reports from Sri Lanka also confirm the susceptibility of RRIC 36 to this disease (Chandrasekara 1972). Trees of five clones were found developing symptoms of brown bast during this short period of exploitation. However their number was less than two percent in all, without much variation among the different clones. All clones were found affected by wind to varying extent. The damage was highest in RRIC 45 and lowest in RRIC 7. Eventhough all three major types of damage occurred uprooting and trunk breaking were most common.

The Sri Lanka clones imported to India were found to possess some good secondary characters like vigorous growth and tolerance to certain diseases. Their yield during the first three years of exploitation was found promising compared to GT 1.

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The authors are very much thankful to Dr. A.O.N. Panickar (Deputy Director, Botany Division) for the highly valuable suggestions and encouragements rendered in the conducting of the trial as well as the preparation of this paper. They are also thankful to Dr. M.R. Sethuraj (Director) and Mr. P. N. Radhakrishna Pillai (Joint Director) for providing the facilities to conduct this trial. The sincere assistance rendered by the supporting staff of Botany Division in the collection of data is gratefully acknowledged.

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Table–1. Parentage of clones in the trial

Clone	Parentage
RRIC 7	Primary
RRIC 36	PB 86 x PR 107
RRIC 45	RRIC 8 x Tjir 1
RRIC 52	Primary
RRIC 100	RRIC 52 x PB 86
RRIC 102	RRIC 52 x RRIC 7
RRIC 104	RRIC 52 x Tjir 1
RRIC 105	RRIC 52 x Tjir 1
Nab 17	Primary
GT 1	Primary

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Table 2 A. Performance of clones in the trial

Clone	Mean yield over three years (g/tree/tap)	Yield depression during summer as percentage of mean yield	Mean girth at opening (cm)	Mean annual girth increment after opening (cm)
RRIC 7	28.79	33	47·04	4.42
RRIC 36	34.99	14	45.21	3.96
RRIC 45	29.32	39	48.98	4.06
RRIC 52	21.34	32	58.31	5.63
RRIC 100	37.41	31	57.48	3.85
RRIC 102	33.94	44	54.56	3.66
RRIC 104	32.05	28	64.49	4.52
RRIC 105	26.00	49	56.49	3.03
Nab 17	34.00	36	51.01	3.32
GT 1	28.12	42	52.48	3.74

Table-2. B. Performance of clones in the trial

Clone	Mean thickness of virgin bark (mm)	Latex vessel rings in virgin bark	Mean thickness of three year renewed bark (mm)	Abnormal leaf fall
RRIC 7	6.75	10.00	7.65	Severe
RRIC 36	7.28	100.78	7.71	Severe
RRIC 45	6.60	7.28	5.02	Moderate
RRIC 52	9.03	6.04	7.72	Moderate
RRIC 100	9.01	7.98	7.43	Light
RRIC 102	8.14	10.00	7.14	Light
RRIC 104	9.26	9.52	8.29	Light
RRIC 105	8.15	7.15	7.34	Light
Nab 17	7.46	8.50	8.13	Severe
GT 1	7.81	8.30	6.88	Moderate

Table-2 C. Performance of clodes in the trial

Clone		Pink disease percentage incidence	Brown bast percentage incidence	Bark rot percentage incidence	Powdery mildew
RRIC	7	4.69	Nil	1.56	Moderate
RRIC	36	17-74	Nil	1.61	Light
RRIC	45	15.79	1.75	Nil	Light
RRIC	52	9.84	Nil	Nil	Light
RRIC	100	14.75	1.65	Nil	Light
RRIC	102	1.75	Nil	Nil	Light
RRIC	104	12.90	1.61	1.61	Moderate
RRIC	105	8.82	1.47	Nil	Severe
Nab	17	8.20	1.64	Nil	Severe
GT	1	6.90	Nil	Nil	Severe

Table 2 D. Performance of clones in the trial

Clone		Uprooting percentage incidence	Trunk snap percentage incidence	Branch snap percentage incidence	Total wind damage percentage incidence
RRIC	7	3.13	1.56	Nil	4.69
RRIC	36	3.23	3.23	Nil	6.46
RRIC	45	10.53	10.53	Nil	21.06
RRIC	52	8·20	Nil	Nil	8.20
RRIC	100	9.84	3.28	1.64	14.76
RRIC	102	1.75	8.77	Nil	10.52
RRIC	104	6.45	4.84	3.23	14.52
RRIC	105	2.94	41,4	Nil	7.35
Nab	17	8.20	3.28	1.64	13.12
GT	1	Nil	5.17	5.17	10.34

Glimpses on Performance of Clones RRIM 600, PB 28/59 and GT I in Kanyakumari District*

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The national average yield of rubber per hectare per year is about 900 kg in India. In the Estate Sector, it may be easily above 1000 kg per hectare. Malaysian scientists report that they have clones under small scale experiments with yield potential of 5000kg per hectare.

In this paper an attempt is made to assess the performance of clones RRIM 600, PB 28/59 and GT-1 in Kanyakumari District. The yield levels in Paalali and New Ambadi estates have been analysed. The Preliminary discussions in this context have already resulted in the craze for clone RRIM 600 in Kanyakumari District. As regards Paalali Estate, two significant points are seen. Clone RRIM 600 has registered the highest yield per hectare in its seventh year of tapping (2631 kg/ha) at S/2 d/2 system. Clone PB 28/59 have 818 kg per hectare per year, in the first year of tapping on S/2 d/3 system. Paalali Estate, flanked on either side by Pechiparai and Chittar dams, has rich water resources and is naturally endowed with a favourable hydrologic cycle and comes under Class I soil. Soil is deep, well drained, can be easily worked and holds water very well and is well responsive to fertilizer application. Clone PB 28/59 registered an yield of 1287 kg/hectare in the second year of tapping on S/2 d/3 system of tapping as against 1364 kg/hectare in RRIM 600 in its second year of tapping on S/2 d/2 system. Surprisingly, clone GT I also gave 818 kg/hectare in its first year of tapping on S/2 d/2. The average yield per tapper per day for clones PB 28/59 and GT I on Paalali Estate, in their first year of tapping could be seen in Table I.

Besides the objective statement of yield potential of the clones, their secondary characters, though subjective were assessed. RRIM 600 got yield incidence of Phytophthora attack in 1987 June/July (after a lapse of 5/6 years); PB 28/59 in the next field was not affected. RRIM 600 has better resistance to powdery mildew than PB 28/59.

The secondary characteristics of clones under study in terms of agro-climatic suitability, wind and disease resistance, wintering, branching, seed production, latex quality, timber out-turn and most significantly drought resistance are stated in Table-2. Economic return on investiment, early high yields, present net worth of future earnings and sustained hight yields are some economic criteria to decide clonal suitability.

Whereas evaluation of clonal yield is objective, secondary characteristics are subjective and by a process of generalisation, a set of favourable secondary characters are preferred to another, with reference to a particular location. Growth and yield characteristics of trees are genetically inherited. But, the habit of a tree is influenced by spacing, climate, location, age and soil type. Wide branches adhering to the main trunk at large angles, with well distributed branches without concentration on top of the crown will be desirable. Uniform, smooth and thick bark but soft with quick renewal are also desirable. Clones with less latex precoagulation tendencies and without late-dripping are preferred, but with crumb processing facility higher yields with even late drip is acceptable. Resistance to diseases is of greater significance especially in critical times when attention is minimum, due to lack of man power, financial constraints or labour strikes. Higher pod setting yields more rubber seeds; but enhances the rate of *Phytophthora* attack in Kerala and hence is not prferable in areas prone to higher degree of *Phytophthora* attack. In the context of energy crisis the requirement for rubber wood with multiplicity of uses may assume significance. Hence a clone with a good

* The views expressed by the author are his own and do not reflect the official opinion of the Rubber Board.

Table-1

Paalali Estate: Average yield (Kg) per tapper per day for clones PB 28 59 and GT I in the I st and 2nd years of tapping

	PB 28/59		GTI	
Clone	PB 28/59		GTI	
Year of planting	1977		1977	
Area-Hectares	9.47		3.24	
Number of trees	3312		1402	
Tapping system	S/2 d/3		S/2 d/2	

Month	Ist Year		2nd Year	
	PB 28/58	GT I	PB 28/59	GT 1
April ...	1.402	1.136	6.864	4.140
May ...	2.181	1.187	10 479	6 414
June ...	2.062	1.111	11.200	6.529
July ...	7.308	1.658	19.324	9.555
August ...	8.472	6.309	21.656	10.485
September ...	11.800	6.348	23.130	9.833
October ...	12.045	5.600	14.493	7.127
November ...	19.515	9.945	6.906	5.973
December ...	18.083	10.121	21.102	8.540
January ...	16.914	8.437	21.655	8.380
February ...	12 683	8.977	15.000	8.160
	9.951	6 530	15.619	7.740 Kg
Average yield per tree per year	2.338	1.791	3.681	2.462 Kg
Yield per hectare per year	818	775	1.287	1,065 Kg

Table–2
Secondary characters of clones

Character		RRIM 600	PB 28 59	GT I
1. Agro climatic suitability	:	Good	Good	Good
2 Wind resistance	:	Good	Good	Very good
3. Disease resistance	:			
a) Pink disease	:	More susceptible	Susceptible	Less susceptible
b) Root disease	:	Nil	Nil	Nil
c) Oidium	:	More susceptible	Susceptible	Less susceptible
d) Phytophthora	:	* Susceptible	Not affected	Not affected
e) Brown Bast	:	Not prone to BB	Prone to BB	Not prone to BB
4. Wintering	:	Early	Late	Late
5. Branching	:	Heavy	Balanced	Balanced
6. Seed production	:	High	Sparse	High
7. Latex quality	:			
a) Stability	:	Less	Good	Good
b) Colour	:	White	Yellow	White
8. Timber out-turn	:	Average	Low	Good
9. Drought Resistance	:			
a) Immature phase	:	Average	Low	Good
b) Mature phase	:	Low	Resistance	Low
10 Bark:				
a) Virgin Bark	:	Below average	Average	Average
b) Renewal	:	Above average	Average	Below Average

* On about 50 trees of RRIM 600, Phytophthora attack was found in June 1987; it is understood that almost in the same location, this was found in 1982 June also.

timber out turn with all the earlier requirements may be quite good for the 21st century. Taking into consideration the irregular pattern of expected earings due to changing variables of inputs, the time lapse between investments and earnings and the expected economic life of the rubber tree, future earnings have to be discounted to current values at the rate of interest prevailing. Since monetary returns in the early years are worth more than the same in later years, early high yielders are preferred if the decline is not much in later years.

The declining trend of crop in later years could be tackled in clones which respond favourably to yield stimulation. Improved techniques of controlled upward tapping after panel C, or, after 15 years of tapping further assures steady high yield during the last phase of economic exploitation prior to replanting.

The interaction of genetic characters with climatic, edaphic, biotic, physiographic and anthropic factors (environmental factors) in different locations is so unique and distinct, thereby, proposing a clone as 'ideal' within a radius of 10 km could be difficult. Climate as determined by precipitation, temperature, atmospheric humidity, solar radiation and wind velocity is probably the most important factor. The edaphic factor in terms ofdifferent soil factors is as important as the physiographic factors of geological strata and topography. Typically, this is an area where human ingenuity will be at its best and documentation at its lowest ebb, for the simple reason that the cumulative effect of the multitude of interactive factors will vitiate exact scientific concepts.

Strategy to be considered in the larger context:

i Soil types to be classified in terms of morphological descriptions in each geographical location.

ii Rainfall pattern to be analysed and classified in terms of its quantum, distribution etc.

iii Performance of clones in different (Physical and Chemical) soil types in the context of particular rainfall patterns to be analysed to suggest most suitable clones.

Conclusion:

Human ingenuity will play its role decisively in the choice of clone for a particular location, in as much as, it is impracticable to correlate all variable factors to properly prophess an ideal clone. For Kanyakumari conditions, clones RRIM 600 at S/2 d/2 system of tapping and PB 28/59 at S/2 d/3 will be generally rewarding. The loss of about 15% in yield per hectare at S/2 d/3 compared to S/2 d/2 will be made good by the reduced cost of tapping and decreased overheads with the lesser man-power requirement at S/2 d/3.

Clone GT 1 will be undoubtedly a choice along with RRII 105 for drier tracts in Kanyakumari District. The recent trend to plant RRIM 600 in all parts of Kanyakumari District may not be economically rewarding.

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WORLD GENE BANK FOR SERICULTURE MOOTED

The idea of setting up a world gene bank in sericulture for assembling together a genetic reservoir of mulberry and silkworm was suggested by the eminent agricultural scientist Dr. M.S. Swaminathan. India, he said would be ideally suited for the maintenance of the gene bank because of the diversity of conditions, for the propagation and preservation of the germ plasm, available in the country.

Delivering the key-note address at the inauguration of the international congress on "tropical sericulture practices" Dr Swaminathan said that India should set itself the targets of achieving a total raw silk output of 50,000 tonnes, raising the number of sericulture villages in the country to 100,000 and launching a dynamic silk technology research programme within the next two decades. This according to him could be done only with the development of high yielding bivoltine races tolerant to high temperature and humidity conditions with the help of genetic engineering techniques. The new strains developed he felt should be capable of good performance under less sophisticated rearing conditions than required at present.

PROSPECTS OF CHEMICAL WEEDING IN RUBBER PLANTATIONS

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Introduction

Weed control is one of the most important cultural practices in rubber plantations especially during the immature phase. Weeds compete with rubber for light in the initial years and for moisture and nutrients throughout the immaturity period. It has been reported that budded rubber under grass cover took upto seven months more and seedlings under *Mikania* sp took 11 months more to attain tappable girth compared to those under legume cover (1). Therefore, it is necessary to control weeds to reduce the immaturity period. Weeds may also serve as alternate host for pathogenic fungi and pests. They may cause fire hazard during the dry summer months. Uncontrolled growth of weeds will hinder cultural operations. Conventionally, manual weeding is adopted in rubber plantations. The cost of manually controlling weeds amounts upto 34% of the total cost of cultivation in the immature phase of rubber making it the most costly component. In fact, the weed control costs during the entire immaturity period (taken as 7 years) is upto 13% more than the entire cost of fertilizers and manures plus application charges and is 55% more than the plant protection costs during the same period. The present study was taken up to evaluate the possibilities of chemical weed control.

Strategy for weed control

Our objective is to integrate cultural, bilogical and chemical control measures to evolve an integrated weed management system which is cost effective cause reduction in immaturity, period and is ecologically safe.

To achieve the above goal a systematic research approach has been initiated at RRII. It involves research into screening of cost effective and environmentally safe herbicide combinations, more efficient and cheaper herbicide applicators, biological control of noxious weeds, cultural practices based on zero tillage and plastic mulches. A brief outline of the ongoing projects is enumerated here.

Herbicide Research

Currently we have screened 10 new herbicides of which three are pre-emergent and seven are post emergent. The pre-emergent herbicides are aimed for nursery weed control. Of the post emergent herbicides, Glyphosate has been found effective and hence recommended (2). Another herbicide Dicamba has been found to give excellent control of broadleaf weeds upto 3 months. Unfortunately this herbicide is not yet marketed in India. Research has been initiated into screening various herbicide combinations with different low cost additives to increase the efficiency in total weed control and in substantially reducing the costs. The effect of herbicides on beneficial soil microbes is also being investigated.

Applicator Research

Two new herbicide applicators have been tested and found to be superior in operational efficiency with Glyphosate and Dalapon compared to the conventional weedicide sprayers. Among these Aspee CDA, which is battery operated and currently available in India has been recommended with certain modifications and precautions for large plantations. Birky CDA which is manually operated was found suitable for small holders but is yet to be marketed in India (3). The CDA's require only 2.5 to 10% of water compared to the quantity used in common sprayers and they require only ¼th man days to spray one hectare whereas conventional sprayers need 2 or more man days. Thus there is a tremendous saving in water used for spraying especially in steep terrain where haulage is a problem and water is scarce.

Efforts are underway to fabricate a low cost direct contact applicator using the wiper concept. These herbicide applicators are expected to cost only around Rs. 100/-. No drift hazard is expected with these sprayers and it will be possible to applying herbicides selectively even in areas with cover crop.

Spray shields have been found to be useful in reducing side drift hazard with the conventional sprayers thus minimising the risk to rubber plants and cover crop when non selective herbicides are used.

Bio-control research

The larvae of Parcuchaetus pseudoinsulatee was found to be promising for the control of *Chromoliene oderata* (Eupo orium). Further evaluations on large area are underway. If found effective these larvae could be used to check the spread of C. orderata.

Integration of weed, moisture and nutrient management in rubber seedling nurseries has been initiated with the use of plastic mulches and subsurface irrigation systems including perto-drip and leaky pipe techniques.

Recommendation

The strategy based on the results of field experimentation is to control weeds in the entire planting area and to establish legume cover crop which, by itself can smoother weeds. The plant basins are to be kept under mulch. These efforts will substantially reduce weed control costs. Clean weeding the planting strips by scraping with mammntty is to be avoided to reduce soil erosion and damage to the feeder roots of rubber. Slash weeding is not very effective in controlling weeds in the rainy season and since the fertilizer application coincides with this season, there will be considerable uptake of nutrients by the slashed weeds as their roots are intact.

An integrated weed management system based on zero tillage, using plant basin mulches, legume cover crops and judicious use of herbicides is therefore recommended. This integrated approach will help in soil moisture and nutrient conservation and reduce damage to feeder roots, thereby increasing the growth rate of rubber.

The herbicide combinations recommended are based on type of weed flora which is predominant.

Conclusions

A herbicide based integrated weed management system could replace the conventional manual weed control followed in rubber plantations. The adoption of this new system can save upto 28.6% of the weeding costs. Moreover, the fertilizer use efficiency could be substantially increased by keeping the fertilizer patches completely weed free with herbicide. This system may also help conserve soil and moisture in rubber plantations. However utmost caution is necessary while spraying young clearing with these herbicides against drift. It is also necessary to use trained workers. The workers should wear spray protectives. While it is a boon to labour short areas for effecting timely operations, the sudden shift to herbicide may cause some socioeconomic problems. The saving on labour on this account could be utilised for much needed soil conservation practices like silt pit and contour bund maintenance.

The recommendations given are generalised and are only intended as guideline. The type of herbicide combinations for specific areas should be selected on the basis of specific weed species present.

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Programme for herbicide based weed control in the planting strips and manual weeding (slashing) in the inter-row areas : (Area of planting strips alone in 1 hectare of planted area = 0.20 hectare)

HERBICIDE COMBINATION (A)

	Planting strip = Area = 0.20 hectare				Interrow areas					
Year of planting ing	Herbicide combination and rate	spray schedule	Target weeds	(1) Total cost per year Herbicide cost + application charge Conventional sprayer	(2) Manual weeding (*Slashing and mulching*) No. of workers	Cost	Total Cost per ha. (1) + (2)	Cost of manual weeding alone -in planting strips & interrows	Saving in Rs when herbicide based weed control in planting strips and slashing in interrow areas for I ha. of rubber	% saving
1st year	Gramaxone 0.51 + Fernoxone = 0.25 kg Tank mix in 120 1 of water	First Round May-June	Broad leaf dominated areas		10	250				
		Second Round July-Aug		Rs.73 per pound	10	250				
		Third Round Sept-Oct			10	250				
		Fourth Round Nov Dec.			10	250				
	Cost for Ist year			Rs 292.00	40	1,000	1292.00			
2nd to 7th year	Same as above			1,752.00	104	2,600	4352.00			
	TOTAL FOR 7 YEARS						Rs. 5644.00	7900.00	2256.00	28.6

HERBICIDE COMBINATION (B)

Year of planting	Herbicide combination and rate	spray schedule	Target weeds	(1) Total cost per year (Herbicide cost + application charge) Conventional sprayer	Interrow areas: (2) Manual weeding (slashing and mulching) — No. of workers	Interrow areas: (2) Manual weeding (slashing and mulching) — Cost	Total cost per ha. (1) + (2)	Cost of manual weeding alone in planting strips & interrows	Saving in Rs. when herbicide based weed control in planting strips and slashing in interrow areas for 1 ha. of rubber	% savings
	Planting strip = Area = 0.20 hectare									
Ist year	Dalapon = 1Kg followed after 10 days by Gramaxone = 0.41 in 1201. of water	1st Round May-June 2nd Round September 3rd Round (Optional) Nov-Dece.	Narrow leaf dominated areas	Rs. 130/- per pound	Ist round 10 2nd round 10 3rd round 10 4th round 10	250.00 250.00 250.00 250.00				
				390		1,000.00	1,390.00			
2nd year to 4th year	Same as above			2,340/-	104	2,600,00	4,940 00			
TOTAL FOR 7 YEARS							6,330.00	7,900.00	1,570.00	20

Programme for herbicide based weed control in the planting strips and manual weeding (slashing) in the inter-row areas : (Area of planting strips alone in 1 hectare of planted area = 0.20 hectare)

HERBICIDE COMBINATION (A)

Year of planting	Planting strip = Area = 0.20 hectare: Herbicide combination and rate	spray schedule	Target weeds	(1) Total cost per year Herbicide cost + application charge Conventional sprayer	Interrow areas: (2) Manual weeding (*Slashing and mulching*) No. of workers	Cost	Total Cost per ha. (1) + (2)	Cost of manual weeding alone - in planting strips & interrows	Saving in Rs when herbicide based weed control in planting strips and slashing in interrow areas for I ha. of rubber	% saving
1st year	Gramaxone 0.51 + Fernoxone = 0.25 kg Tank mix in 120 1 of water	First Round May-June	Broad leaf dominated areas		10	250				
		Second Round July-Aug		Rs.73 per pound	10	250				
		Third Round Sept-Oct			10	250				
		Fourth Round Nov Dec.			10	250				
	Cost for Ist year			Rs 292.00	40	1,000	1292.00			
2nd to 7th year	Same as above			1,752.00	104	2,600	4352.00			
TOTAL FOR 7 YEARS							Rs. 5644.00	7900.00	2256.00	28.6

HERBICIDE COMBINATION (B)

Planting strip=Area=0.20 hectare					Interrow areas					
Year of planting	Herbicide combination and rate	spray schedule	Target weeds	(1) Total cost per year (Herbicide cost + application charge) Conventional sprayer	(2) Manual weeding (slashing and mulching) No. of workers	Cost	Total cost per ha. (1) + (2)	Cost of manual weeding alone in planting strips & interrows	Saving in Rs. when herbicide based weed control in planting strips and slashing in interrow areas for 1 ha. of rubber	% savings
Ist year	Dalapon =1Kg followed after 10 days by Gramaxone =0.41 in 1201. of water	1st Round May-June; 2nd Round September; 3rd Round (Optional) Nov-Dece.	Narrow leaf dominated areas	Rs. 130/- per pound	Ist round 10	250.00				
					2nd round 10	250.00				
					3rd round 10	250.00				
					4th round 10	250.00				
				390		1,000.00	1,390.00			
2nd year to 4th year	Same as above			2,340/-	104	2,600.00	4,940 00			
TOTAL FOR 7 YEARS							6,330.00	7,900.00	1,570.00	20

HERB'CIDE COMBINATION (C)

Planting strip _ Area = 0.20 hectare					Interrow areas					
Year of planting	Herbicide combination and rate	Spray schedule	Target weeds	(1) Total cost per year (Herbicide cost application charge) conventional sprayer	(2) Manual weeding (slashing and mulching) No. of workers	cost	Total Cost per ha. (1) + (2)	Cost of manual weeding along in planting strips & inter-rows	saving in Rs. when herbicide based weed control in planting strips and slashing in interrow areas for I ha. of rubber	saving
1st year	Glycel on weedaff 0.41 in solution of water	Ist round May-June	Both broad-leaf & narrow leaf	150.00	4 rounds @ 10 workers per round	1,000				
	Gramaxone 0.51 + Fernoxone = 0.25 kg Tank mix in 96 lits. of water	2nd round Aug-Sept.	Predominantly broad-leaf	75.00 per round						
	Glycel or weedaff 0.41 in 80 lits. of water	3rd round Nov-Dece.	Both broad leaf ond narrow leaf weeds	150.00						
	Cost in Ist year			373.00	40	1,000/-	1,373.00			
2nd year to 7th yr.	Same as above			2238.00	104	2,600/-	4,838.00			
	TOTAL FOR 7 YEARS						6,211.00	7,900.00	1,689.00	21

SYSTEM-1 Herbicide based weed control system in planting strips & manual weeding in the inter row areas	TOTAL COST FOR ENTIRE IMMATURITY PERIOD 7 YEARS	TOTAL COST OF MANUAL WEEDING ALONE IN PLANTING STRIPS + INTERROW AREAS	AMOUNT SAVED BY ADOPTING SYSTEM 1	% OF SAVINGS
BASED ON HERBICIDE COMBINATION–A	Rs. 5644.00	Rs. 7900.00	Rs. 2256.00	28.6
BASED ON HERBICIDE COMBINATION-B	Rs. 6330.00	Rs. 7900.00	Rs. 1570.00	20
BASED ON HERBICIDE COMBINATION-C	Rs. 6211.00	Rs. 7900.00	Rs. 1689.00	21

Prophylactic Spraying Against Abnormal Leaf Fall Disease: Essential or Not

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INTRODUCTION

Abnormal leaf fall disease caused by *Phytophthora* spp is the most important and distructive desease of rubber in India. This disease was first noticed in 1905 in Sri-Lanka and in 1910 at Palapilly area of Trichur District in India. The symptoms of the disease are pod rot, leaf fall, shoot rot, die back of twigs and drying of branches. The pathogen also causes bark rot (boak stripe) and patch canker. Leaf fall has been noticed yearly in all high rainfall rubber areas in India and also in some parts of Sri Lanka, Burma and Tropical Central and South America. Only pod rot and mild leaf fall has been recorded in Java, Sumatra, and Tropical Africa. In low rainfall areas like Kanyakumari District of Tamilnadu both pod rot and leaf fall occurred occasionally in 1961, 1982 and 1987. In Malaysia also an outbreak of this disease was noticed in 1966 and 1967 (Chee, 1969) and in some subsequent years (Radziah, (1985). Severe leaf fall, necessitating control measures every year, occurs only in India in rhe states of Kerala and Karnataka.

History of control of the diseases

Mc Rae (1919) was the pioneer to study this disease in detail. He identified the causative organism and also made some studies on its control. According to him, the initial inoculum for the spread of this disease came from died back twigs, fruit stalks and mummified pods, which harbour oospores. Inoculum potential is created by infection in dods and presence of large number of pods increased the inlensity and spread of the disease. Ramakrishnan and Radhakrishna Pillai (1961) identified a number of perennial, wild and cultivated, host plants harbouring the pathogen and also made detailed investigations on the disease. Petch (1912) was of the view that the disease can be reduced by preventing the formation of fruits.

Studies on the control of this disease in India were initiated by Mc Rae in 1917. Dead branches and fruits were removed from a 40 ha. area and marked difference was noticed with the untreated area. He also tried spraying copper sulphate solution for deblossoming to reduce fruit formation, but found it impracticable due to scarcity of water. Eventhough 30 years elapsed then, since Bordeaux mixture was discovered, Mc Rae did not recommend this versatile fungicide. Ashplant (1928) first recommended spraying Bordeaux mixture 0.75 to 0.8 percent against this disease in India, by using high volume pressure sprayers and power sprayers. 4 0 m long bamboo lances were used and the maximum height reached was 9.0 to 12 m when the height of trees were 25 to 30 m. Ramakrishnan and Radhakrishna Pillai (1961) tried removal of dried pods and died back twigs and got a leaf retention of 25 to 30 percent compared to 84-90 percent in areas sprayed with 1 percent Bordeaux mixture. Adding 0.2 percent zinc sulphate to Bordeaux mixture increased the efficacy. They also tried deblossoming the trees with chemicals like maleicacid (0.1 percent), E. W. 400 (0.4 percent) and in 2, 4-4-D (15 ppm) solution and found them to be ineffactive, as flowering in Hevea is irregular and repeated spraying were required. But, peries (1965) stated that hand picking of pods caused significant reduction in the incidence of the disease in Sri Lanka. In India one round of spraying 1 percent Bordeoux mixture before the onset of monsoon was recommended and is being continued to combat this disease even today. Sherples (1936) stated that spraying with urea or application of sodium nitrate or ammonium sulphate increased leaf retention. This was confirmed later in India with NPK mixture application by Ramakrishnan and Radhakrishna Pillai (1961). They found Bordeaux mixture to be superior to copper fungicides and organic fungicide like Phytolan, Dithane Z 78 etc. Old stocks of copper oxychloride fungicides were phytotoxic. Dusting copper fungicides such as Cuprosan 6, 12, 24%, Copper sandoz 25% etc. using power duster was tested and leaf retention was found to be lower compared to that with Bordeaux spraying. Due to disadvantages of high volume spraying they introduced spraying of oil based copper oxychloride fungicide in diluent spray oil through Micron 420 operated from the ground. They found 4.5 kg of actual copper per hectare to be sufficient to give 70 to 80 percent leaf retention. The particles could reach upto 24 m. During the same period Kershaw (1962) pioneered aerial spraying of rubber with fixed wing aircraft and helicopter. Using oil based copper fungicide and spray oil he could achieve 87 percent leaf retention. Later only helicopters were found suitable. A lighter sprayer. Minimicron 77 was introduced, susbequently, but this could reach a height of only about 16 m. In 1973 Shaw Duster cum sprayer was introduced, which was lighter in weight and could reach 24 m. More efficient and lighter sprayers, like Shaw Microspray power 400 and Aspee Turblow were developed in 1983 and 1985 respectively with technical collaboration of RRII. During 1980-'85 newer application machines like tractor mounted sprayer and fogging machines were tested and the former was found unsuitable. The latter was suitable for low rainfall areas but had fire hazard and frequent break downs. During 1973, 56% oil dispersible copper oxychloride powder and 72 USR indigenous spray oil were introduced. Fifty six percent COC has very good shelf life. It is easy to transport and mix. Use of indigenous spray oil effected considerable saving of foreign exchange. Introduction of oil based copper fungicides and low volume ground and aerial application resulted in considerable reduction in cost of control operations. Sethuraj and Kothandaraman (1973) found adequate evidence for the formation of ethylene in the abscission caused by *Phytophthora*. In laboratory experiments they could present leaf fall by spraying 2, 4-D at 100 and 200 ppm. At the present rates of inputs the cost for Bordeaux, aerial and micron spraying are Rs. 1700, 937 and 807 respectively.

In recent years (1982-83) specific fungicides for *Phytophthora*, like Aliette and Ridomyl, were tested and found ineffective. Crown budding of tolerant clones is proved to be a good technique for preventing the disease, but poor bud success preclude its wide spread use. Tree injection of fungicides and antibiotics are also being experimented Oil based formulations of newer fungicides may be useful, but are not available. Radziah (1985) state that in Malaysia aerial spraying of copper oxychloride in oil and fogging of the same fungicide or Captafol in oil is recommended against this disease.

Eventhough consistent and enormous efforts have been put in right from the year 1910 upto this day by many research workers, planters pesticide, spray oil and sprayer manufactures a report appeared recently in national malayalam daily that protecting rubber trees against this disease is a wasteful cultural practice. The arguments put forth was that the crop loss due to the disease is not adequate to warrant costly ontrol measures and some amount of leaf fall is only beneficial. This has caused considerable confusion among the planters, especially the small holders.

Crop loss

A cursory study on crop loss was made by MC Rae (1919). From the discussions with planters, he found that a loss of 30 to 40 kg of dry rubber per hectare per year due to the disease. He was of the opinion that the loss involved was so large that it is practicable to spend money on preventive measures. Later Ramakrishnan and Radhakrishna Pillai (1961) recorded yield in areas protected and not protected with Bordeaux mixture. An yield loss of 37.68 to 50.46% was recorded in clones BD 5, Tjir land G 11. Planters themselves realised the benefits of spraying and widely adopted the prophylactic control measures. The main constraint for conducting further crop loss study was that well managed estates declined to spare areas for the experiment, fearing irrepairable damage to their trees. For the experiment, a minimum of 4 ha area has to be left unsprayed for at least 5 years, correct record of yield has to be maintained for the treatment and control plot of a minimum of 4 ha each of the same clone and age and as far as possible tappers in the experimental area should not be changed. Steady increase in the cost of

Table 1. DETAILS OF CROP LOSS EXPERIMENT

Sl. No.	Location	Treatment plot area (ha)	Clone	Age (Yr.)	Crop Loss %	85-'86 Dry rubber kg/ha	Crop Loss %	86-87** Dry rubber kg/ha
1	Ranni	0.5	RRIM 600	10	9.27*	—	—	—
2	Kumbazha	4.0	RRIM 600	15	9.57	199.69	14.57	160.63
3	Mundakayam	4.0	PB 86	25	15.75	239.36	17.98	215.25

* Based on yield by cup_coagulation method

** Unprotected plots of 1985-86 were also sprayed.

control of the disease necessitated a re evaluation of the benefits of spraying Radhakrishna Pillai *et al.* (1974) artificially defoliated mature GI 1 trees by clipping off 25, 50, 75 and 100% leaves and reported a crop loss of 0, 22.79, 30.60 and 24.14% respectively. There was total refoliation in 100% defoliated trees in two months. Since the experimental trees were well protected by aerial spraying serious consequences of the disease such as shoot rot, die back and drying of branches were not noticed. Again concerted effort was made in 1984 to obtain area for this experiment, with the offer to compensate the losses. M/s Harrisons Malayalam kindly offered areas for the experiment at Kumbazha and Mundakayam. Simultaneously the area raised for this experiment at the Central Experiment Station of RRII near Ranni came into tapping. The experiment was started in all these three areas and in 1985 the treatment plots were left unsprayed. Eventhough the experiments were planned to continue for 5 years, the experiments at Kumbazha and Mundakayam were abandoned due to the request of the management, as the vitality of the trees left unsprayed was considerably affected. At Ranni, 31 trees in the unsprayed and 13 trees in sprayed plots were uprooted due to wind between April and July 1985 and the unsprayed plot was oversprayed while aerial spraying in 1986 and 1987. Hence, the data obtained from the experiment at Ranni was rendered useless.

The results of the experiments are furnished in Table 1 and these indicate considerable loss in the year after leaving the areas unsprayed and also in the next year, when the unsprayed areas were protected. In the first year after leaving the area unprotected the percentage of loss was more in older area. But in the subsequent year with protection the percentage of loss increased in younger area compared to older area. At the present cost of aerial spraying and price of rubber, even a loss of 50 kg. of dry rubber per hectare can justify protection against the disease. The recommended dosage of 4.5 kg. of actual copper per hectare in low volume spraynig provides only optimum leaf retention of 70-80% in normal mossoon.

Factors affecting yield loss

It is known to all the planters that the yield drop during refoliation after wintering in the month of February is high, when compared to average yield and peak yield in October-November. This is due to the absence of leaves, very low soil moisture and natural physiological factors. But *Phytophthora* leaf fall occurs when the soil moisture is very high. Hence sudden yield depression in previously protected areas is not noticed. Moreover, the real effect of the disease does not occur in unsprayed experimental plot due to drift of fungicide from adjacent sprayed area. Only when the experiment is continued at least for five years, the full effect on yield could be obtained.

Climatic regimes of the disease

The optimum climatic regimes for triggering the leaf fall were identified by various workers with improvements in parameters and narrowing down the limits. These are furnished in Table-II. For sustained spread of infection the rains must continue.

Table II

COMPARISON OF FORECASTING FORMULAE OF PHYTOPHTHORA

	Weather parameter	Peries, 1969	Pillai *et. al.* 1980	Jayarathnam *et. al* 1987
a	Rainfall			
	per day (mm)	2.5	—	1.0
	total (mm)	—	250-300	112 or more
	duration (day)	4.0	7—10	5.0
b	Temperature (°C)			
	max	—	26-30	29-31
	min.	—	22-25	22-23
	mean	29	—	29-27
c	R. Humidity (%)			
	mean	80	—	80
	max	—	98	93
d	Sunshine (Hr/d)			
	mean	3.0	without intermittent hot sunshine	2-4
	min.	—	—	0.1
e	Forecast	within 14 days	mark the commencement	9-15 days from the overcast day

The suitable climatic regimes for initiating the disease occur in the month of May, June and July and the number of their occurrences is furnished in Table-III

Table III. NUMBER OF OCCURRENCE OF SUITABLE CLIMATIC REGIME

Year	Months			Onset of the monsoon
	May	June	July	
1983	–	—	8	Late and weak
1984	–	3	–	Normal and active
1985	6	2	—	Early and active
1986	—	6	—	Late and weak
1987	—	2	–	Normal and weak

CONCLUSION

These observations indicate that the disease can appear even in years when monsoon fall, but intensity may not be severe. Considering the damage done to the trees such as leaf fall, die back of twigs and drying of branches which result in the loss of vitality of the tree and also the crop loss; protecting the trees against the ravages of this disease is essential for a tree crop like rubber, having an economic life span of 30 years. Unprotected trees will be more prone to bark rot. (black stripe) and patch canker. Sparse canopy permits more light and encourage weed growth, resulting in increased weeding cost. Moderately tolerant clones like RRII 105, GI 1, PB 217 and GT 1 are likely to get protection with lower dosages of fungicide according to rainfall pattern of the region concerned, but experimental evidences are required on this aspect.

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CROP HARVEST

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Introduction

I intend to share my views, observations and the difficulties encountered during my limited experience as a rubber planter with you to see if we can evolve some better methods and systems to increase the yield per unit area. It is evident that the subject we are dealing with is mostly an administrative matter and not mainly concerned with recent developments, if any, on scientific research contributing to improvement in the crop from our existing yielding areas. Of course, I would request the distinguished scientists present here at this Conference to advise the planters on what, according to them, would be a pragmatic approach to maximise the harvest of crop with the minimum expenditure, taking into account the cost-benefit ratio on the method or measures we adopt. I personally view it as the most important function on an estate. The main purpose of this paper is to generate some discussion so that there is a useful exchange of ideas.

Tapping

It is a well known fact that the commencement of tapping early in the morning is the single most important factor in contributing to a direct increase in crop. I do not feel it is necessary to dwell upon the phenomenon of high-turgor-pressure in the latex vessels before sun-rise and the adverse effect of the increase in the atmospheric temperature. I gather that on many rubber estates in this state there is a long established system of starting tapping even earlier than 6' clock in the morning. There is also a tapping muster at around 5.45 A.M., when spare/kali tappers are deputed to tap the blocks of regular tappers absenting from work. This is, obviously, quite necessary as otherwise a block untapped (vacant block) results in direct loss of crop. Surprisingly enough, some estates do not seem to have this system of absenting tappers informing the division authorities and consequently tapping blocks are left untapped. They make up the number of vacant block-days by cross tapping on Saturdays or the day prior to a holiday. As a result, certain blocks are tapped on consecutive days or out of turn.

In one of our estates, we found that the tappers were commencing tapping late and leaving several trees untapped. Needless to say, there is no alternative to physical effective supervision : checking individual blocks to ensure that all the tappable trees are tapped. Although it sounds native, this is actually a serious administrative problem in many estates. A series of strict measures were adopted and stern disciplinary action taken against a few tappers. The situation gradually Improved resulting in a marked increase in the crop harvested, when the tapping commenced early and all the trees were tapped properly.

Another important aspect is the layout of the tapping blocks. In steep terrain it is absolutely necessary to ensure that one tapping block does not extend from the top of the field to the bottom. It would be more advantageous to have a tapping block extending horizontally across the hill, so that it facilitates the faster movement of the tappers with minimum strain. As far as possible, a tapping block should not extend over both sides of deep ravines/drains or streams, since they hamper the fast movement of the tappers. An extensive network of footpath is required for the tappers to carry the harvested crop without any hindrance.

Scrap Percentage

High scrap percentage has been worrying us for some time. No matter how much we delay the collection of latex, due to several reasons a considerable amount of crop, as a result of late dripping, is left to be collected as scrap during the next tapping day. I have heard of one estate, where the tappers themselves go again to their tapping blocks in the afternoon to collect the latex without claiming any additional remuneration over and above the over-kilo incentive normally paid. This, of course, is an exception than the general pattern. Whenever any attempt

*The views expressed by the author are his own and do not reflect the official opinion of the Rubber Board.

is made to engage additional workers to collect the latex, the doubt crops up whether it would be profitable. Moreover the tappers claim their share of the over-kilo incentive on the scrap, which they would lose if this method is adopted. I would request the members among the delegates present here to enlighten us on this method, if adopted by them, the mode of collection, payment and the result of the cost benefit-ratio from the study, if any. I am inclined to believe that any system which would cost upto a maximum of Rs. 3/-per kg of latex D R.C. inclusive of all payments, weighing and transport to the factory might be profitable, but the industrywide repercussions, the possible ill effects, if any and a precedent which could have harmful ramifications on the management of estates are the deterring factors.

Expenditure on a new weighing centre during first year

Building and latex collection tank	: Rs.	10,000.00
Metrolac	: ,,	80.00
Spring balance	: ,,	600.00
Implements	: ,,	200.00
Weighing Supervisor, 150 tapping days @ Rs. 30/-	: ,,	4,500.00
Weighing assistant, 150 tapping days @ Rs. 22/-	: ,,	3,300.00
Tractor running 10 kms per day for 150 days at Rs. 3/-per km.	: ,,	4,500.00
	Rs.	23,180 00

Additional benefit.

20 Tappers @ 3 kg x 150=9000 kg	: Rs.	54,000.00
@ Rs. 6/- (Margin of profit for latex over scrap) (Field latex processed as centrifuged latex and shell scrap processed as crumb rubber)		
Profit in one year	: Rs.	30,820.00

It is noticed that the distance of the crop weighing centre from the blocks have a direct bearing on the crop harvested in latex form, which has a premium in the market over the scrap rubber. The shorter the distance to the weighing centre, the more the tapper is inclined to collect latex, even if it involves walking from the block to the weighing centre two or three times. The time wasted on walking long distances could be usefully utilised by the tappers to bring in a higher percentage of latex. It is also noticed that the harvest of crop actually increases, as a nearer weighing point is tantamount to an incentive. The additional expenditure incurred in putting up a shed, providing a tank and engaging a worker is off-set by the higher price obtained for latex, as shown below:-

During the subsequent years, the profitability would obviously be more.

One suggestion is to persuade the tappers to carry an anti-coagulant, like ammonia solution, and put a couple of drops in the shell just before tapping the tree. This would prevent the formation of the film of coagulam on top of the latex in the shells and contribute to a slight reduction in the scrap percentage. I understand that some estates have adopted this practice, but the tapping task is only 300 trees or so, instead of 400 trees on other estates. Is it worthwhile to reduce the tapping task by 25 to 50 trees to adopt this method. Is it advisable in the long-term interests of the Industry to lower the accepted task of tapping 400trees in one block? Is it possible to incorporate the adding of the anti-coagulant in the shells in the tappers' normal work-schedule, in the next wage-settlement at the P.L.C. level?

Collection cups

Plastic cups are being marketed these days professing that the scrap percentage could be reduced considerably by using them. On an experiment conducted in one block with 200 plastic cups and the balance trees with conventional coconut shells, a reduction of scrap of 13 to 14% was observed as a result of using the plastic cups. On a large scale, we could presume a reduction of 10% in scrap to work out the economic viability of using plastic cups. Taking into account an average estate codition with 350 trees per hectare and the yield per year as 1200 kgs, the profitability is worked out as follows:-

Yield from 350 trees	:	1200 kg
Yield per tree	:	3.43 kg
Using coconut shells	Latex 65% 2.23 kg	Scrap 35% 1.20 kg
Using plastic cups	Latex 75% 2.57 kg	Scrap 25% 0.86 kg
Reduction in scrap	:	0.34 kg per tree
Extra over-kilo incentive	:	0.34xRs. 0/55=0.19
Additional cost of mfg. latex	:	0.34xRs. 0/50=0 17
Benefit by using plastic cup 0.34x Rs. 6/- (premium on Centrifuged Latex over Crumb Rubber)	:	2.04
LESS, Addl. expenditure	:	0.36
Benefit	:	Rs. 1.68 per tree per year.

Expenditure

		Cost per tree per year Rs.
1.	Plastic cup @ Rs. 1/60 (presuming it can be used for 2 years, though suppliers' claim is 5 years)	0.80
	Wire cup holder	0.40
	Coir string	0.05
	Labour for tying	0.06
		1.31
2.	Coconut shell	0.20
	Wire cup holder	0.15
	Coir string	0.05
	Labour for tying	0.06
		0.46

Additional expenditure incurred per tree by using plastic cups = 0.85

Net profit per tree by using plastic cups = 1.68 - 0.85 = 0.83

Profit per hectare is = Rs. 290/50 per year

This is only a projection of what we can anticipate. This has to be corroborated by the actual experience of the planters

Acknowledgements

I am indeed very grateful to the Travancore Rubber & Tea Company Ltd., my Employers for nominating me to present this paper. I also wish to place on rocord my gratitude to the Rubber Board for this opportunity to express my views and share my experience with such a distinguished gathering of rubber planters and scientists. □

Rubber Subsidy for more items

The Union government has extended the natural rubber subsidy scheme to a number of new rubber-based engineering export items having rubber content ranging from 50 percent to 100 percent. The subsidy will be effective from January 27 when the Ministry of Commerce sent a notification to the Chemicals and Allied products Export Promotion Council (Capexil) according to an official release issued.

The new items eligible for subsidy are: rubber bush; rubber and metal bonded parts; rubber scraps; exhaust suspension rubber; fan belts; rubber beading for doors, windows, windshield, rear glass and also in bonnet and dicky, etc; oil seals; and rubber pads for clutch, brake and accelerator pedal pads.

Hitherto, the subsidy scheme was applicable to auto tyres bicycle tyres, auto and bicycle tubes, rubber and canvas footwear, gun boots, rubber hoses, hot water bottles, air mattresses, insertion sheets hospital sheets, rubber rings, surgical gloves, rubber mats, railway pads and rubber sheets and stoppers.

The terms, conditions and procedures regarding operation of the subsidy scheme will remain the same as notified by the ministry on June 10, 1983.

However, as for obtaining input-output norms vis-a-vis determining the percentage of rubber content in an item, the exporters would have to approach the DGTD for the same before applying for grant of subsidy under the scheme, the notification stated.

Thermoplastic natural rubber blends

Thermoplastic natural rubber (TPNR) blends are a family of materials prepared by blending natural rubber and polyolefins, particularly polypropylene, in varying proportions. As the composition of the blend varies, materials with a wide range of properties are obtained, and the family is most easily considered as having two distinct members. At high rubber contents the blends are themoplastic elastomers, whilst semi-rigid' rubber-modified polypropylenes are obtained at low rubber contents- Over the last two to three years there have been considerable improvements in the properties of both types of TPNR blends.

Soft blends

The soft grades of TPNR blends fall into the olefinic class of thermoplastic elastomers. There have been improvements in the crosslinking system used for partial dynamic crosslinking of the natural rubber phase during blending. This has led to improved weathering resistance and improvements in some physical properties. The development of better antidegradant systems has given a substantial increase in resistance to heat ageing. The processability of the blends, particularly in respect of extrusion, has also been improved.

The soft grades of TPNR blends, which can be classed as thermoplastic elastomers. have hardnesses in the range 55 to 95 Shore A. The strength and recovery properties compare favourably with those of similar types of thermoplastic elastomer based on synthetic rubber. Although the resistance to swelling by oils is somewhat better than that given by general-purpose rubber vulcanisates, the TPNR blends are not oil-resistant materials.

Thermoplastics rather than rubber processing machinery is required to injection mould or extrude TPNR: the material is not suitable for compression moulding. The viscosity is strongly dependent on shear rate, but the temperature dependence is less marked.

For processing TPNR, 180°C should be regarded as the minimum melt temperature. Higher temperatures than those quoted do not give any significant benefit and, for fast mould filling and minimum part distortion, it is more important to use sufficiently generous gates and runners and a high injection pressure followed by hold pressure of about 70 percent of the injection pressure. The mould temperature affects mould filling and the finish of the part; both are better at the higher end of the quoted rate.

Scrap and reject mouldings can be granulated and recycled. The good resistance of TPNR to heat ageing noted above is also apparent in the ability to withstand multiple reprocessing. Moulding, granulating, and reprocessing up to five times causes no significant change in the tensile strength of a TPNR blend and only a small reduction in modulus and increase in elongation at break. Nonetheless, TPNR should not be held in the cylinder for more than about 20 minutes, and purging with polypropylene or polyethlene is recommended at the end of a run. □

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THE QUARTER

There have been only few instances in the past, when the price of rubber in the international market ruled high above the indigenous price line. But quite unexpectedly it has happened again when the international price went ahead to touch Rs. 20/-per kg in place of the indigenous price of Rs. 18/-per kg. In the changed circumstances import of rubber will result in enhanced outflow of foreign exchange. Dependence on synthetic rubber is not advisable because of its high cost of production. India requires more rubber than we produce at present. Chairman Rubber Board in one of his articles (published elsewhere in this issue) subscribes to the idea that from our country's point of view, it is the natural rubber production that is to be stepped up and not the Synthetic Rubber production. More than a million acres are available in the non-traditional area for planting rubber. Let us hope that the present efforts of the Rubber Board together with the due participation of the planting community would achieve the target.

TISSUE CULTURE IN RUBBER

Over the past few years, tissue culture has emerged as one of the major research tools in biology and medicine. It has presently reached a level of sophistication where its adaptation to large scale use has become possible in some areas of agriculture, horticulture and drug manufacturing. The term "tissue culture" was coined in the days when the technique was mainly restricted to the culture of pieces of tissue. However, over the years the term has become somewhat a misnomer because presently not only tissue pieces but also free cells, protoplasts, organs, embryos etc are cultured.

Now let us look into one of the basic applications of tissue culture, namely cloning or clonal propagation or rapid multiplication of specific genotype using tissue culture technique. If one collects a small piece of a particular tissue or cells from a plant and cultures it in appropriate naturient medium in a test tube, the tissue/cells can be induced to grow into rooted plant(s). Many plant tissues have this ability. By supplying or holding back certain chemicals we can manipulate the growth of such plants in the test tube. One of the most important characteristics of this process is that, from a small piece of of tissue, we could induce to produce several plants instead of one plant and keep on multiplying them as long as we keep supplying them adequate chemical nutrients.

We have recently developed at the Rubber Research Institute of India a tissue culture system for the propagation of rubber. Normally, rubber clones are propagated by grafting desired clonal buds on open pollinated seedlings. However, trees derived from this technique have a few drawbacks. One is the tree to tree variable yield caused by root-stock-scion interaction. This can be circumvented by eliminating the use of grafted two-part plants and substituting tissue cultured plants which grow on own roots. Another drawback of grafted trees is their comparatively leaner trunk growth. Tissue culture derived plants, on the other hand, can have growth behaviour similar to that of seedling plants. The consequent increased girth can probably impart better wind resistance and higher yield potential, not to speak of high timber output.

In all rubber producing countries, all tissue culture procedures are kept secret in view of the critical commercial value of the crop and trade competition between them. The Rubber Research Institute of India has developed a tissue culture system which involves relatively less time and which can be cost effective when applied commercially.

The Institute already is in a position to plant tissue cultured plants in about one hectare at its Experiment Station this year. Further field planting can follow next year. These will be kept under close observations. On the basis of the results obtained, the Rubber Board could adopt a policy for distribution of tissue cultured plants to growers on a trial basis. If such plants reach the growers as quickly as possible, it will contribute to the rapid development of the rubber plantation industry in India. ●

BHASKARA PILLAY RETIRED

Shri V. Bhaskara Pillay retired from the services of the Rubber Board on 31st December 1987 after holding the post of Secretary for 13 years. He joined the services of the Board in 1957 and held many positions including Cost Accounts Officer. As Cost Accounts Officer he studied the various cost elements in natural rubber and built up a case before the Tariff Commission and the Cost Accounts Branch of the Ministry of Finance for revision of rubber prices based on the variations of input costs from time to time. He was appointed as Secretary in 1974. As Secretary, his contributions included efficient coordination of the administrative functions of all departments. He was known for his impartiality and devotion to duty. He always talked less and did much.

He was given a warm send off by the Officers and Staff of the Rubber Board. Shri P. C. Cyriac, Chairman, Rubber Board presided over the meeting. Representatives of the various service organisations spoke on the occasion. The other speakers included all the Heads of Departments of the Rubber Board. The speakers profusely complimented the services rendered by Shri Bhaskara Pillay and wished him a happy retired life.

Do we need Special Purpose Synthetic Rubbers?

AIDS, the latest communicable disease confronted by man has already assumed edidemic proportions. It is considered to be a real scourge by today's Western World. But the fear of this disease has brought in a bonanza for the small farmers growing rubber in South East Asia. The three countries of Malaysia, Indonesia and Thailand which together account for about 75 per cent of World's natural rubber had little to cheer about during the recent past. In fact during the last few years a pall of gloom had descended upon them as the rubber prices continued to rule at very low and unremunerative levels. The farmers had begun switching over to other crops like oil palm. People had started talking about the rubber plantation industry as a sun-set industry with no future. Malaysia's production levels were showing no improvement. New investments in research and development too started going down.

AIDS Scare

But suddenly the AIDS scare has changed all this. It was found that the use of rubber-made inspection gloves and examination gloves would prevent direct humun contact with AIDS Virus-contaminated objects and thus save them from contracting the deadly and dreaded disease. A sudden spurt in the demand for rubber gloves manufactured by dipping the moulds into concentrated rubber latex followed. New factories sprang up in Malaysia and Thailand for manufacturing the concentrated latex and gloves. But the biggest gainers have been South Korea and Taiwan who have set up a large number of units which produced in millions these gloves and condoms for the booming export markets in America. All these feverish activities increased the demand for latex and the prices started going up from last December. As more rubber was consumed as latex, the rubber sheet production came down and the sheet prices too began soaring. Today the rubber prices in major international markets in Singapore, Tokyo, London and New York rule much above the Indian domestic prices which have been fairly stable during the last three or four years. While the Indian prices were around Rs. 17.50 per kg., the Singapore price for the same grade had crossed Rs. 20/-, but now appears to have become somewhat steady around the level of Rs.18/-per kg. When all this was happening, it was amusing to find the Indian manufacturing industry merrily going on with their advertisement campaign in the Press about the 'high NR prices' in India!

The chances of the Singapore prices coming down very much are dim since the AIDS induced latex boom is continuing without any let up. In India we import about 40,000 tonnes of rubber a year mostly from Malaysia/Singapore. The new situation in the international markets will mean a higher ohtflow of foreign exchange for us. What is to done to reduce this drain of foreign exchange? Of course, by increasing the production within the country and reducing the imports. But how far is this possible, eapecially since the booming Indian rubber manufacturing industry is steadily increasing its consumption of rubber? Though natural rubber production also has been steadily increasing, the growing demand has been outstripping it. It is also true that not much area is left in Kerala, our major rubber growing State, for expanding the cultivation. Therefore, instead of relying on NR, will it not be worthwhile to set up a few synthetic rubber factories to produce SR indigenously and avoid import of rubber and plug the foreign exchange outflow? Particularly so, when we use synthetic rubber to the tune of 22 percent of our total rubber consumption only and can do with more of the same? Is this line of argument not very logical and sound?

Synthetic rubbers and Problems

Yes, the argument appears to be very sound prima facie, i. e. at the first look. But, let us take a second look. What are the synthetic rubbers and what are the problems involved in setting up big manufacturing facilities for them? Till the Second World War, the bulk of the rubber requirements of the industry the World over was met by natural rubber. But during the war, most of the rubber producing areas of South East Asia were overrun by the all-conquerring forces of the Japanese General Tojo and the Allies were deprived of their rubber supplies. Germany also was short of rubber required badly for the war effort. Intensive research efforts conducted round the clock in laboratories in U. S. and Germany simultaneously were crowned with success and then began the massive manufacturing of many rubber-like polymers. Soon natural rubber was to be dethroned from the pride of place by synthetic rubber. Today Synthetic Rubber accounts for the two-thirds of total World consumption of rubber. But in India, even today natural rubber enjoys more than three-fourths of the total market. One of the main reasons for this has been the price of natural rubber here, which is much lower than the price of the synthetic rubber produced in our factories. Even the general purpose synthetic rubbers like SBR (Styrene Butadiene Rubber) and BR (Polybutadiene Rubber) are about 50 per cent costlier than its counterpart produced by nature. The SR's are made from downstream products after naphtha cracking and like all other petrochemical products, these also are very costly.

Capital Investment

It is estimated that the capital investment required for producing SR is at least three times the investment needed to produce the same quantity of NR. The process of producing SR consumes a lot of energy, while NR production requires no energy input as the photosynthetic action of the plant using solar energy results in production of rubber. In fact the NR plantation creates energy as it produces timber as a by-product. Again, the highly capital intensive SR factories do not create many jobs. But the NR plantations provide a large number of unskilled rural jobs which are badly needed. What about the effect on environment and ecology? The SR production is associated with the accumulation of a large quantity of effluents which have to be treated at great cost, to avoid pollution. But the NR plantations which release oxygen into the atmosphere during the photosynthetic action, purifies the environment. Since very effective soil conservation measures are being adopted in NR plantations, including the rearing of nitrogen fixing cover crops, ecology and environment get significantly improved by them. Thus on every count SR loses out. It is clear that from our country's point of view, for meeting the rubber shortage, it is the natural rubber production which is to be stepped up and not the SR production.

Enough lands

But have we got the land to grow rubber? Yes, in India, in the new non-traditional areas we have more than a million hectares fit for rubber growing. These areas have been broadly identified and nurseries for generating the planting materials have been set up and the committed extension workers of the Rubber Board have already started spreading the message of rubber. The North Eastern States of Tripura, Meghalaya and Assam are taking to rubber in a big way. This year, in that region alone, at least 6000 hectares will get newly planted with rubber. We are sure that the planting tempo in these States will pick up more momentum in the next few years. By the turn of the century, we shall be getting at least a hundred thousand tonnes of rubber from the North East alone. In the traditional rubber growing areas of Kerala also, the productivity climate has set in. Massive extension efforts have been launched to improve the pace of replanting of the old areas with new high yielding varieties, to popularise better tapping and processing techniques, to improve the cultural practices and to renovate the marketing arrangements. All these efforts will not go fruitless. Over four hundred thousand tonnes of rubber will come from Kerala by 2000 AD. So what is the point in investing our scarce resources to produce general purpose synthetic rubbers just to replace natural rubber?

And if this is the shape of things to come, is there no room at all for further expansion of synthetic rubber capacity in our country? Though there is no justification for setting up plants to manufacture general purpose syntehtic rubbers like SBR & BR (Styrene Butadiene Rubber and Polybutadiene Rubber), there is a good case to create facilities and produce special purpose synthetic rubbers like butyl rubber. These special purpose rubbers are essential to impart certain desirable properties to our rubber products and thus improve their quality. India which is on the verge of a great leapforward in exporting rubber products has to work hard and improve the quality of the rubber products. It is certainly advantageous if we have the facility for making these special purpose SR's in our country itself. When we think of synthetic rubbers, let us think of these special purpose SR's alone, instead of the general purpose SR's the demand for which may be satisfied by increasing the natural rubber production; for which our country is better-endowed.

— P C CYRIAC,
Chairman,
Rubber Board.

Table-1

Raw Rubber Properties (Crepe)

Property	Control	5 Days	10 Days	*15 Days	20 Days
Dirt content %	0.010	0.020	0.019	0.013	0.012
Volatile matter %	0.42	0.71	0.66	0.57	0.59
Nitrogen %	0.42	0.45	0.43	0.44	0.42
Ash %	0.14	0.44	0.34	0.32	0.40
Po	58	63	62	60	65
PRI	76	78	68	68	66
Acetone extrect %	2.26	2.14	2.19	2.17	2.22
Mooney viscosity ML (1+4) at 100° C	91	105	105	98	97

stock recipe as per BIS formulation (3) which is given in Table III. The vulcanisate properties were also measured as per the relevent BIS methods (4) and the results are given in Tables IV and V.

Results and Discussion

The raw rubber properties of the polybag collected rubber which was processed as crepe are given in Table 1.

Dirt content of the polybag collected rubber was found to be not much different from that of the control. The same is the case with volatile matter and nitrogen content However, ash content is found to be more in the case of polybag collected rubber. In the normal method of latex coagulation, chances for the removal of mineral matter are more because of dilution and serum separation. As these steps are absent in the polybag collection method, most of the mineral matter present in the original latex goes into the processed rubber. It is worth noting here that ash content upto about 0.5% as observed in the present case does not have any adverse effect in most of the applications of rubber except in certain specific products requiring very low levels of water absorption. It may also be noted that the ash content of the polybag collected rubber is within the limits specified. The initial plasticity and the Mooney viscosity were also found to be higher in the case of polybag collected rubber. This is evidently owing to maturation of the coagulum which results in a higher gel content. The plasticity retention index, which is a measure of the oxidation resistance of rubber, is found to be lower in the case of polybag collected rubber. But an analysis of the results show that this reduction in oxidation resistance is only an apparent one, as it is contributed by the higher initial plasticity of the rubber. This was reported by earlier workers also (1). It is also worth noting that the raw rubber properties of the polybag collected rubber are within the limits specified for ISNR-5.

A trial was also conducted to process the polybag collected rubber in block form. However, in this case, the collections were limited to 5 and 10 tapping days only. Results of the study are given in Table II.

Studies on Polybag Collection of Latex

N. RADHAKRISHNAN NAIR, LEELAMMA VARGHESE and N. M. MATHEW
Rubber Research Institute of India, Kottayam-686 009.

Introduction

Tapping and collection accounts for a major part of the cost of natural rubber production. In our country, it is estimated to be around 40% of the total cost. Therefore, less labour intensive methods of harvesting is one among the various methods available to reduce the cost of production. The present work on polybag collection was thought of in this connection.

The idea of collecting natural rubber latex in polyethylene bags is not new. In Malaysia, it was studied as early as in 1969 (1) and a workable method suggested. They have reported that its implementation would depend largely on local circumstances governing each case. In our country, the method has not been practised so far. As a preliminary step , a study was conducted at the RRII to assess the feasibility of this method. Emphasis was given to study the influence of the method of crop collection on the quality of rubber.

In the case of tapping, the task assigned to a tapper is 300-400 trees per day and normally he completes the tapping in 2 to 3 hours. Subsequently the tapper collects the latex and transports it to the collection centre/factory. If the latex is not collected daily but only once in a month or so, the task size per tapper can be considerably increased.

When latex is collected in polybags and allowed to remain on the tree it undergoes spontaneous coagulation to form a lump. The latex from subsequent tappings also gets collected and coagulated in the bag itself. The lump thus formed in the bag can be periodically collected and processed into crepe or block rubber. As the bags are almost completely sealed chances for contamination are minimum. The coagulum collected can be processed into a fairly top quality rubber.

Method of Study

The collection bags were made of polyethylene and easily fabricated by heat sealing. Lay flat heat sealed bags of 35 mm x 25 mm manufactured out of 200 gauge sheets, readily available in the market were made use of. The bags could conveniently hold up to 4 litres of latex and had enough strength to bear the weight of the latex. The open sides of the bags were sealed using a heat sealer and holes were provided by cutting the top corners for insertion of a wire stirrup. A circular perforation of 15 mm diameter to insert a spout to carry latex into the bag was provided at about 50 mm below the top edge of the bag. On the tree a helical spring was tied around between the tapping pannel and the spout under sufficient tension so as not to be displaced due to the weight of latex in the bag.

The bag with the wire stirrup was hung on the circular spring with the spout leading into the bag. Rain water seeping into the bags during rainy season need be prevented. Both the conventional skirt type polythylene rain guards and tapping shades were used for the above purpose.

On the first tapping day latex gets collected in the bag and slowly undergoes spontaneous coagulation. In all cases coagulation was found to be complete by the next day. Once spontaneous coagulation sets in, the bacterial population in the bag would be much higher and therefore latex from the subsequent tappings got coagulated much faster. After a definite number of tappings ranging from 5 to 20 tappings, the bags containing the coagulum were collected and brought to the factory and soaked in water. The polythene bags were stripped off manually and the rubber coagulum was processed as crepe and dried at room temperature. Processing of the coagulum as block rubber was also attempted. A control sample was also prepared by coagulation of freshly collected latex from the same field using formic acid.

The raw rubber properties of the samples were measured as per the relevant BIS test methods (2). The results are given in Tables I and II. Curing characteristics of the rubber samples were assessed in a gum

Table-II

Raw Rubber Properties (Crumb)

Property	Control	5 Days	10 Days	2 P-Acid-Treated 5 Days	10 Days
Dirt content %	0.010	0.010	0.013	0.019	0.012
Volatile matter %	0.203	0.52	0.38	0.45	0.32
Nitrogen %	0.44	0.31	0.35	0.25	0.25
Ash %	0.16	0.25	0.28	0.30	0.36
Po	43	57	63	52	56
PRI	67	77	59	77	77
Mooney viscosity ML (1+4) at 100°C	80	102	105	100	105
Acetone extract %	2.61	2.46	2.48	2.28	2.21

It is again seen that dirt content and volatile matter of the polybag collected rubber are more or less comparable to those of the control. Nitrogen content is found to decrease slightly. Although a progressive reduction in nitrogen content was expected as the number of tapping days for collection was increased, this was not observed in the first trial (Table 1). A reduction in nitrogen content is attributed to the bacterial decomposition of proteins into soluble products. Here also ash content, plasticity and Mooney viscosity of the polybag collected rubber are found to be higher than those of the control samples. Although the reduction in PRI is only an apparent one, as indicated above, an attempt was made to improve PRI by soaking the crumbs in 0.5% phosphoric acid solution for 2 hours.

The treatment is found to improve PRI as seen in Table II. Acetone extract of the sample is found to be not influenced by the method of collection. The curing characteristics of the compounds prepared from polybag collectad rubber (formulation given in Table III) and the physical properties of the vulcanisates prepared are given in Tables IV and V.

Table-III

Gum Stock Recipe

(IS 7449-1981)

Natural rubber	100
Stearic acid	0.5
Zinc oxide	6
MBT	0.5
Sulphur	3.5

Table IV

Properties of the Compounds

Property	Control	5 Days	10 Days	15 Days	20 Days
Mooney scorch at 120° C (Min)	12.25	7.00	7.00	8.50	7.75
Optimum cure time at 150°C (Min)	14.5	10.50	10.00	10.00	9.50
Modulus at 300% elongation (MPa)	1.71	1.88	1.73	1.65	1.75
Tensile strength (MPa)	15.1	17.2	17.0	1.69	17.3
Elongation at break %	762	807	871	886	903
Tear strength (kN/m)	26.7	28.4	27.9	28.3	27.7

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When latex is collected in polybags and allowed to remain on the tree it undergoes spontaneous coagulation to form a lump. The latex from subsequent tappings also gets collected and coagulated in the bag itself. The lump thus formed in the bag can be periodically collected and processed into crepe or block rubber. As the bags are almost completely sealed chances for contamination are minimum. The coagulum collected can be processed into a fairly top quality rubber.

Method of Study

The collection bags were made of polyethylene and easily fabricated by heat sealing. Lay flat heat sealed bags of 35 mm x 25 mm manufactured out of 200 gauge sheets, readily available in the market were made use of. The bags could conveniently hold up to 4 litres of latex and had enough strength to bear the weight of the latex. The open sides of the bags were sealed using a heat sealer and holes were provided by cutting the top corners for insertion of a wire stirrup. A circular perforation of 15 mm diameter to insert a spout to carry latex into the bag was provided at about 50 mm below the top edge of the bag. On the tree a helical spring was tied around between the tapping pannel and the spout under sufficient tension so as not to be displaced due to the weight of latex in the bag.

The bag with the wire stirrup was hung on the circular spring with the spout leading into the bag. Rain water sceping into the bags during rainy season need be prevented. Both the conventional skirt type polythylene rain guards and tapping shades were used for the above purpose.

On the first tapping day latex gets collected in the bag and slowly undergoes spontaneous coagulation. In all cases coagulation was found to be complete by the next day. Once spontaneous coagulation sets in, the bacterial population in the bag would be much higher and therefore latex from the subsequent tappings got coagulated much faster. After a definite number of tappings ranging from 5 to 20 tappings, the bags containing the coagulum were collected and brought to the factory and soaked in water. The polythene bags were stripped off manually and the rubber coagulum was processed as crepe and dried at room temperature. Processing of the coagulum as block rubber was also attempted. A control sample was also prepared by coagulation of freshly collected latex from the same field using formic acid.

The raw rubber properties of the samples were measured as per the relevant BIS test methods (2). The results are given in Tables I and II. Curing characteristics of the rubber samples were assessed in a gum

Table-II

Raw Rubber Properties (Crumb)

Property	Control	5 Days	10 Days	2 P-Acid-Treated 5 Days	2 P-Acid-Treated 10 Days
Dirt content %	0.010	0.010	0.013	0.019	0.012
Volatile matter %	0.203	0.52	0.38	0.45	0.32
Nitrogen %	0.44	0.31	0.35	0.25	0.25
Ash %	0.16	0.25	0.28	0.30	0.36
Po	43	57	63	52	56
PRI	67	77	59	77	77
Mooney viscosity ML (1+4) at 100°C	80	102	105	100	105
Acetone extract %	2.61	2.46	2.48	2.28	2.21

It is again seen that dirt content and volatile matter of the polybag collected rubber are more or less comparable to those of the control. Nitrogen content is found to decrease slightly. Although a progressive reduction in nitrogen content was expected as the number of tapping days for collection was increased, this was not observed in the first trial (Table 1). A reduction in nitrogen content is attributed to the bacterial decomposition of proteins into soluble products. Here also ash content, plasticity and Mooney viscosity of the polybag collected rubber are found to be higher than those of the control samples. Although the reduction in PRI is only an apparent one, as indicated above, an attempt was made to improve PRI by soaking the crumbs in 0.5% phosphoric acid solution for 2 hours.

The treatment is found to improve PRI as seen in Table II. Acetone extract of the sample is found to be not influenced by the method of collection. The curing characteristics of the compounds prepared from polybag collectad rubber (formulation given in Table III) and the physical properties of the vulcanisates prepared are given in Tables IV and V.

Table-III

Gum Stock Recipe

(IS 7449-1981)

Natural rubber	100
Stearic acid	0.5
Zinc oxide	6
MBT	0.5
Sulphur	3.5

Table IV

Properties of the Compounds

Property	Control	5 Days	10 Days	15 Days	20 Days
Mooney scorch at 120° C (Min)	12.25	7.00	7.00	8.50	7.75
Optimum cure time at 150°C (Min)	14.5	10.50	10.00	10.00	9.50
Modulus at 300% elongation (MPa)	1.71	1.88	1.73	1.65	1.75
Tensile strength (MPa)	15.1	17.2	17.0	1.69	17.3
Elongation at break %	762	807	871	886	903
Tear strength (kN/m)	26.7	28.4	27.9	28.3	27.7

Table V
Percent Changes in Tensile properties after Ageing
(Aged at 70" c for 96 Hrs)

Property	Control	5 Days	10 Days	15 Days	20 Days
Modulus at 300 % elongation	+ 32	+17	+31	+45	+42
Tensile strength	— 26.5	33.5	−15.2	—17.8	12.3
Elongation at break	— 4	−20	—4	24	—26

It is observed that the polybag collected rubber is faster curing than the control. Both Mooney scorch and optimum cure time are found to be lower in the case of the polybag collected rubber. The faster curing behaviour of the polybag collected rubber is also evident from the rheographs. It is believed that some of the protein decomposition products in the rubber act as vulcanisation accelerators thereby making the rubber faster curing when the same recipe is used. This situation could be advantageously used for reducing the accelarator dosage if the vulcanisation behaviour of the rubber is made known to the compounder. The tensile strength of the polybag rubber vulcanisate is found to be slightly better than that of the control. The other properties of the vnlcanisate are found not influenced much by the method of collection of latex.

Acknowledgements

We are thankful to Dr. M. R. Sethuraj, Director for examining the paper critically and offering valuable comments.

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SWASTIK RUBBER FINANCES TO BE RESTRUCTURED

The Board for Industrial and Financial Reconstruction (BIFR), after considering the proposal to restructure the sick unit of Swastik Rubber Products Ltd (SRPL) has declajed after two sittings that it is in the 'public interest to restructure the finances of SRPL'.

Disclosing this Mr Ashok Muthanna, the Managing Director of SRPL informed that despite improvement in production and turnover, the unit was not showing any sign of earning a profit because of the huge interest burden. Turnover had touched Rs. 8.5 crores for March ending this year. The company also had enough orders on hand to keep production going for the next 10 months. But even then the company would not be able to either declare a dividend or repay the deposit and debenture holders because of the huge interest payment which formed up to 12 per cent of the income leaving no surplus with which to pay the other claimants.

In the circumstances the company had approached BIFR to consider its restructuring so that its liabilities are ruduced. The Industrial Development Bank of India (IDBI) which had been entrusted with the task of preparing a package of reliefs will be submitting its report to BIFR which if approved will be communicated to all parties concerned for their views and comments. The package will be finalised after 60 days of hearing the views. 'By September 1988 there should be some good news for all connected with SRPL' Mr. Muthanna said.

Adoption of Improved Planting Materials in Rubber Small Holdings: An Analysis

VIJU IPE C. and V. HARIDASAN

Optimal investment decisions are important tools in farm business management to achieve the long-run objective of maximum continuous profits. In enterprise selection, the farm manager has to decide the various crop combinations which will yield maximum continuous net returns over a period of time. Once a particular crop enterprise is selected, the selection of the best variety assumes prime importance. This is more important in the case of perennial crops like rubber involving substantial amounts of initial fixed investments and an extended period of output resulting from it.

Being a commercial crop with the whole produce being marketed (Market economy), the object of rubber grower is to maximise profits from a unit area. With the introduction of high yielding clones, growers were found shifting on a large scale from traditional varieties to improved clones like RRII 105, RRIM 600, GT 1 and PB clones. RRII 105 is an improved clone developed by the Rubber Research Institute of India. Eversince its release for commercial planting, the area under this variety has been fast increasing. The large scale adoption of this variety has been due to its high yielding capacity. Its mean yield in experimental plantation has been estimated at 2880 kg per hectare per year, in small scale trials during 15 years of tapping. So the present study attempts to analyse the coverage of different clones among thc areas planted during 1984 in small holdings with special emphasis on RRII105.

Methods

Data on the extent of area planted with different planting materials during 1934 were collected from all the Rubber Board Regional Offices in Kerala, Tamil Nadu and Karnataka states. Data thus collected were tabulated for different varieties and their distribution according to size. The analysis followed the tabular methods of analysis.

Results

Table 1 shows the extent of area planted with the different varieties in small holdings in Kerala, Tamil Nadu and Karnataka during 1984. The total area planted was 13313.08 hectares in 21070 units. Out of which 11842.84 ha was with RRII 105 in 19525 units. Relating to the totals RRII 105 alone accounted for 88.96 percent of the total area planted and 92.67 percent of the total number of units. RRII 105 has also been found to be planted along with other clones in mixed plantings which accounted for 6.85 per cent of the total area and 4.15 percent of the total number of units. This practice of growing more than one variety in mixtures can be viewed as a measure to avoid risk associated with spacific varieties. Thus rubber producers were found to resort to diversification within an enterprise using different varieties. RRII 105 alone and RRII 105 along with other varieties together accounted for 95.81 percent of the total area and 96.82 percent of the total number of units. This shows the wide popularity and the consequent large scale adoption of RRII 105 in the small holdings.

Table 1 : Extent of area planted with RRII 105 and other clones during 1984 in Kerala, Tamil Nadu and Karnataka.

Variety	No. of units	Area (Hect)
1. RRII 105 sub total (a)	19525 (92.67)	11842.84 (88.96)
2. RRII 105 along with other clones in mixtures:		
a. RRII 105 and GT 1	420 (1.99)	399.13 3.00
b. RRII 105 and RRIM 600	102 (0 48)	110.27 (0.82)
c. RRII 105, RRIM 600 and GT 1	31 (0.14)	71.97 (0 54)
d. RRII 105 and PB 235	160 (0.75)	130 19 (0.97)
e. RRII 105 and PB 5/51	10 (0.04)	9.74 (0.08)
f. RRII 105, PB 28/59	26 (0.12)	14.88 (0.11)
g. RRII 105, PB 28/59 and GT 1	16 (0.07)	9.43 (0.07)
h. RRII 105, GT 1 and PB 235	14 0 06	25 39 (0.19)
i. RRII 105, RRII 118 and GT 1	10 (0.04)	18.60 (0.14)
j. RRII 105 plus other clones not mentioned above	84 (0.39)	123.21 (0.93)
Sub total (b)	873 (4.15)	912.86 (6 85)
3 Other clones		
a. PB 235	126 (0.59)	87 98 (0.66)
b. GT 1	207 (0.98)	154,19 (1.16)
c. PB 28/59	3 (0.01)	2.41 (0.02)
d. RRIM 600	47 (0 22)	43.87 (0.33)
e. PB 5/51	15 (0 07)	16.17 (0.12)
f. PB 311	13 (0.06)	16.45 (0.13)
g. PB 215+217	5 (0.02)	1.63 (0 01)
h. Poly clonal	30 (0.14)	24.55 (0.18)
i. Unselected	226 (1·07)	210.13 (1.58)
Sub total (c)	672 (3 18)	557.38 (4 19)
Grand total (a)+(b)+(c)	21070 (100)	13313.08 (100)

(Figures in parentheses are percentages to the total)

Table 3: Distribution of area planted with RRII 105 according to size during 1984 in the different rubber growing regions. (Figures in parentheses are percentages to the total)

Region	Size classes											
	Upto 5 ha		0.5 ha to 1 ha		1 to 2 ha		2 to 4 ha		Above 4 ha		Total	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
I. 1. Kerala:												
Southern Kerala	2331 (64.52)	699.79 (34.70)	963 (26.10)	723.75 (35.89)	274 (7.43)	363.27 (18.02)	61 (1.65)	157.37 (7.8)	11 (0.30)	72.3 (3.59)	3690 (100)	2016.48 (100)
2. Central Kerala	4800 (60.79)	1500.85 (34.73)	2346 (29.72)	1580.29 (36.57)	629 (7.97)	823.01 (19.04)	105 (1.33)	270.90 (6.27)	15 (0.19)	146.76 (3.39)	7895 (100)	4321.81 (100)
3. Northern Kerala	4193 (55.85)	1369.9 (27.81)	2052 (27.33)	1410.76 (28.64)	979 (13.04)	1322.62 (26.85)	252 (3.36)	658.41 (13.37)	32 (.43)	164.16 (3.33)	7508 100)	4925.85 (100)
Kerala-Total	11374 (59.57)	3570.54 31.70)	5361 (28.08)	3714.8 (32.98)	1882 (9.86)	2508.9 (22.27)	418 (2.19)	1086.68 (9.65)	58 (0.30)	383.22 (3.40)	19093 (100)	11264.14 (100)
II. Karnataka	64 (16.89)	20.91 (3.95)	110 (29.02)	79.31 (14.97)	133 (35.0)	194.08 (36.64)	57 (15.04)	162.09 (30.6)	15 (3.96)	73.36 (13.85)	379 (100)	529.75 (100)
III. Tamil Nadu	30 (56.6)	9.53 (19.47)	6 (11.32)	3.9 (7.97)	14 (26.42)	21.13 (43.17)	1 (1.89)	3.1 (6.33)	2 (3.77)	11.29 (23.06)	53 (100)	48.95 (100)
Grand total	11468 (58.74)	3600.98 (30.41)	5477 (28.05)	3798.01 (32.07)	2029 (10.39)	2724.11 (23.0)	476 (2.43)	1251.87 (10.56)	75 (0.38)	467.87 (3.95)	19525 (100)	11842.84 (100)

Note: 1. Southern Kerala: Areas under the Regional office of the Rubber Board at Trivandrum, Punalur and Pathanamthitta.
2. Central Kerala : ,, Changanacherry, Kottayam, Palai, Kanjirappaily, Moovattupuzha, Thodupuzha, Ernakulam and Trichur.
3. Northern Kerala: ,, Palghat, Calicut, Nilambur, Tellicherry, Taliparamba and Kanhangad.

There has been a gradual shift in the distribution of rubber holdings towards smaller size classes over the last two decades.[1] To analyse the distribution of areas planted with all varieties during 1984, the holdings were classified into five size groups viz., upto 0.5 ha, 0.5-1 ha, 1-2-ha, 2-4 ha and above 4 ha and the results are presented in table-2. Relating to the total area, the second size class (0.5-1ha) recorded the highest percentage followed by the first. The first and the second size classes (holdings with size less than 1 ha) accounted for 60 percent and 85·8 percent of the total area and number of units respectively. Holdings with size above 2 ha accounted only 16.71 percent of the total area, and 3.19 percent of the total number of units. The above results are in line with earlier studies by Haridasan (1980)[1] and Ipe (1987)[2]

Table 2: Distribution of area planted with all varieties during 1984 in Kerala, Tamil Nadu and Karnataka according to size.

No.	Size class	Number	Area (Ha)	(Average holding size (Ha)
1.	Upto 0.5 ha	12120 (57.62)	3826.04 (28.74)	0.3157
2.	0.5 to 1 ha	5981 (28.39)	4165.45 (31.29)	0.6964
3.	1 to 2 ha	2294 (10.89)	3096.55 (23·26)	1.3498
4.	2 to 4 ha	555 (2.63)	1468.03 (11.03)	2.645
5.	Above 4	120 (0.57)	757.01 (5.68)	6.3084
	Total	21070 (100)	13313.08 (100)	0.6318

(Figures in parentheses are Percentages to the total)

Table 3 shows the distribution of areas planted in 1984 with RRII 105 according to size in the different rubber growing regions. In all the three regions in Kerala, the second size group ranked first in area as a percentage of the total area. Notably, in Northern Kerala, the third size group (1-2 ha) shared a higher percentage of the total area as compared to central and south Kerala. This is only to be expected since the size of land holdings are in general larger in northern Kerala than those in southern and central Kerala. In Tamil Nadu and Karnataka the third size class was the largest in respect of the proportionate area.

The large scale adoption of RRII 105 as the planting material may be due to its superior yield performance. Thus the study reveals that rubber growers in India are rational in their decision as to the choice of planting materials with the object of maximising returns from a unit area under this crop.

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"...NEVER THE TWAIN SHALL MEET"?

P. C. CYRIAC

The All India Rubber Industries Association has unleashed a series of propaganda through their advertisements and press releases being published in leading newspapers in India. Their propaganda is mainly based on the plea that the rubber prices are ruling high in the market. What is the basis of this much publicised argument?

Dr. Sekhar who is a well known authority on rubber during the course of his observations on the cost of production, has arrived at the conclusion that the Natural Rubber Industry in India could be developed into a cost efficient sector. Regarding manufacturing sector sky is the limit for its growth as defined by him. Explaining the background of the contraversy Dr. Sekhar has written a letter to the Chairman. In a very reasonable and realistic manner, Shri P. C. Cyriac IAS, Chairman Rubber Board exhorts both the sectors to be impartial in developing an outlook quite congenial to their growth and development.

The arena is once again alive. The combatants are back in right earnest with renewed vigour. I am not referring to any of the battlefronts in West Asia or somewhere else. The unnecessary exchanges going on between the two wings of the Indian Rubber Industry is what I am speaking about. India is one of the major producers of natural rubber; it is also one of the major consumers. In fact both the Rubber producing industry and the Rubber manufacturing industry have displayed excellent achievements. While the rate of increase of natural rubber production and productivity has been higher than thatof any other crop in India for the last several years the growth rate of the Rubber Manufacturing Industry has been higher than that of any other industry during the last year. Both the sectors can grow and prosper rn future also, if only they cooperate with each other. But unfortunately one finds certain ill-advised moves being made by both the sides.

A new controversy has been sparked off by a series of advertisements and press releases issued by the AIRIA. The theme of their present campaign is that the Indian Natural Rubber prices are very high; in fact the highest in the World, that the cost of production of Natural Rubber in India is only less than Rs. 10 a kg, that the international prices are much lower etc. etc.

Some organisations of Rubber Growers have started responding to this campaign with equal enthusiasm demanding rubber prices to be raised to the level of Rs 22 per kg. from the current level of about Rs 17.50 per kg. It is painful to see one section of the industry maligning the other in the process. It is necessary that the issues are examined dispassionately and the facts placed before the public. An attempt in this direction is being made here.

Has the Indian Rubber Prices been Stable?

The following figures will answer this question:

Year	Average price in Rs/Quintal in Kottayam for RMA -4 grade
1983-84	1752
1084-85	1655
1985-86	1732
1986-87	1660
1987-88	1791

It is clear from the above figures that Natural Rubber prices have not gone up much during the last few years. There are not many other industrial raw materials whose prices have exhibited such stability. This amount of stability has been achieved mainly by using the releasing of imported rubber as the tool to moderate the market forces. When the price tended to go above the predetermined price band, judicious doses of imported rubber were released into the market to restore the equilibrium. Similarly, when the prices were about to go below the floor level, procurement from the market also was made to defend the floor price. The experience gained in this operation during the last two years conclusively proved that stability can be ensured by the same approach in future also, even in this sensitive market. But, to be fair to the producers the price band has to be revised at least once in a year taking into account the cost of production updated annually. That takes us to the next question.

What is the Indian cost of Production?

The Cost Accounts Branch of the Finance Ministry conducted detailed investigations and field studies and assessed the cost of production of Natural Rubber in the country one year and a half ago. On the basis of their recommendation, the Government of India fixed the fair price of natural rubber as Rs.17.00 a kg. and the price band as Rs. 16.50 to Rs.17.50 a kg. This cost exercise has been a thorough one and included conducting of field level surveys of both the small grower and estate sectors and field visits by the experts. There is no point in questioning the bonafides of the Finance Ministry's Cost Accounts Branch. However, confusion has been created by the AIRIA's making use of certain observations made by Dr. B.C. Sekhar, renowned Natural Rubber Expert from Malaysia, who was commissioned by them to undertake a study of the 'Natural Rubber Supply in India-Scenario upto 2000 AD'. The AIRIA claims that Dr. Sekhar has assessed the cost of production of Natural Rubber in India as between Rs.9 to Rs. 10 per kg. Has Dr. Sekhar studied the cost of production?

What Exactly was the Subject of the study done by Dr. Sekhar?

His study was not at all on the cost of production of Natural Rubber. He has examined three available projections of demand and supply of rubber for the period upto 2000 AD, and given his views on the likely demand figure and supply figure. He has examined the possibilities of successful production of rubber in the non-traditional areas of India like the North East. He has arrived at the conclusion that the Indian natural rubber producing industry can be developed in to a cost efficient sector capable of producing nearly five hundred thousand tonnes of rubber by the turn of the century, provided the present plans of the Rubber Board are continued to be implemented with enthusiasm and commitment. He has also pointed out that sky is the limit for the growth of the manufacturing sector in India with good prospects of profitable export of rubber products. He brought direct cost into the picture in his attempt to assess the comparitive cost efficiency of the Indian plantation industry. He has also stated in his report that the indirect costs vary significantly from country to country and are complicated to assess in view of the differing nature of taxes, land costs, lease rents, opportunity costs for capital, land and product mix, etc. However, the AIRIA has unfortunately confused themselves between direct costs, indirect costs and total costs. In fact, I had an occasion to contact Dr. Sekhar himself about this and seek his clarification on this aspect. He has confirmed in a letter, last week, that what he has given is only an indicative figure of the direct cost of production. To quote him, "the important conclusion relating to direct cost that was made is that the Indian rubber producing industry is cost-efficient relative to other producing areas and certainly in relation to the Indian Synthetic Rubber Industry. Policy considerations in meeting future requirements should take this into account". Dr. Sekhar has also recalled in his letter to me that his report had suggested very clearly that for a detailed appreciation of costs, the study of the Finance Ministry of the Government of India should be referred to. He has further commented that 'the real meat of the report is being sidelined by the comments' he has read. He has been saddened, according to him, of 'the distortions and the liberties taken to use phrases and comments out of their context'.

Is the Indian Rubber Price The Highest in the world?

The answer is no. The Indian prices now are Rs. 17.75 for RMA-4 rubber and Rs. 17.00 for RMA-5. The international price of rubber has been steadily going up and it is now Rs 20 per kg. for equivalent grades. Therefore, the Indian prices are below the international prices. The rubber prices in countries like China, Brazil and Nigeria are much higher than even the international price. The AIRIA's statement is incorrect.

Should not the Rubber Prices be based on the Cost of Production?

Yes, It should be certainly based on the cost of production only. At last, I am able to find an area of agreement. If the prices are not reasonable with reference to the cost of production, the growers will lose enthusiasm and the production will suffer in the coming years. The history of the growth of Natural Rubber Production in India itself proves this. During the 1970's when the price levels were at unremunerative levels, no fresh investment went into the industry; with the result the production did not increase significantly for a whole decade. The import of rubber of the order of around 35,000 to 40,000 tonnes which we make every year now, has been necessitated only by the lack of newplanting efforts during the 1970's. From 1979 onwards the prices began to show gradual improvement and this gave the necessary incentive for newplanting activity from that year onwards. All these areas newly planted from 1979 have started yielding rubber now. It is only in the light of this experience that Rubber Board has been pleading for stable rubber prices at a level, which is remunerative with respect to the cost of production and affordable to the manufacturing industry as well.

The Government have accepted this view and early in 1986, the buffer stocking scheme was introduced. The result is the achievement of price stability in the industry for the first time in its history. So, what is the problem?

The manufacturing industry wants prices to be based on cost of production. The Rubber Board endorses this. The growers also realise that it is in their interest to have price stability, especially, when it is at a level giving them a reasonable margin. If everybody is agreed on this, where is the problem? The problem is this: Who is to study the cost of production?

Who is To Study The Cost of Production?

A year and a half ago, the Government of India asked the Cost Accounts Branch of its Finance Ministry to study the cost of production of natural rubber in India. This is an agency with professional competence and it can be expected to be impartial. They did a professional job, collected data from the field and submitted their report and the fai rprice and the desired price band are all fixed on the basis of this study only. If the growers can believe in the impartiality of this professional Government agency, the manufacturers also can do so. I am unable to indicate a a better equipped agency with credibility to do this exercise.

What are The Growers asking For Now?

They point to the increasing costs of inputs like wages, fertilizers, fungicides and processing aids like formic acid. And ask why the prices they realise by selling the rubber they produce are pegged to the levels which prevailed 2 years ago? They ask why the Government is buying rubber at a higher price from international market and release the same to the industry here at Rs. 17.00 per kg. Some over enthusiastic leaders have demanded a new price of Rs 22 per kg. This seems to have provoked the AIRIA and the manufacturing industry. True, the grower leaders should not have claimed Rs. 22.00. But one has to admit that the input prices have gone up during the last two years. And the cost of production figure has to be got updated and price band revised. In fact this exercise of updating should be done every year, if the concept of price stability has to find acceptance. In fact, this is what the growers and their organisations should demand annual updating of cost of production and refixing of prices, and not, arbitrary demands like Rs. 21.00 or Rs. 22.00. The manufacturing industry need not worry that this will result in a runaway price rise. Along with reckoning of the increase in input prices, the productivity increase obtained also will be assessed while updating the cost. And impressive improvement in productivity is being secured from year to year in our plantations, both small and large. Though the Natural Rubber producing sector here has an established track record, it would be forced to stretch itself fully both in expanding the area of cultivation into the non-traditional and less hospitable North East, Konkan Region of Maharashtra and Orissa, and in improving the productivity in the traditional tract along the South West Coast, only when it is assured that stability does not mean stagnation. It is really a challenging task to lift the production to the level of 500,000 tonnes by 2000 AD from the present level of 235,000 tonnes. Luckily, suitable land is available in non-traditional areas. Potential for productivity improvement also is high. A committed work forced is also in the field to take advantage of these favourable factors and produce results. Similarly, sky is the limit for the manufacturing sector as well. New uses of rubber are coming up within the country. New markets for products are opening up in overseas countries. If only both the wings of industry – producing sector and the manufacturing sector – coopperate, exciting and rewarding results are there for the entire rubber industry. The Rubber Board is trying to make both the sectors understand that there is enough potential for both to grow and prosper once there is co-operation and appreciation of each other's problems properly. The Rubber Board is hopeful that the groups who demand a price of Rs. 22.00 a kg. and the AIRIA which has called for lowering of price to Rs. 13.00 a kg. will see reason. I have no doubt that Kipling is wrong. The twain shall certainly meet. □

System of planting licence dispensed with

The Rubber Board has decided at its 110th meeting to dispense with the system of licensing newplanting and replanting of rubber. This follows a recommendation by the Internal Work Study Unit of the Ministry of Commerce which undertook a study of the Board's Rubber Production Department and examined the licensing activity, to do away with licensing system as encouragement of maximum planting/replanting is the present day need and not restriction of planting activity as in the pre-war days, when marketing difficulties were mainly responsible for bringing in regulation on planting. According to the Board's decision, the licensing system stands cancelled from 1.4.1988.

TSR units to be licensed in private sector

Acting upon a recommendation of the Marketing Development Committee, the Rubber Board has decided to issue licences for establishment of technically specified rubber processing units in the private commercial sector. But new units will be allowed only outside 10 km circumference of the existing units. The decision comes in the wake of increased demand for technically specified rubber from the consumers. Though India produces about 235,000 tonnes of natural rubber per annum, the quatum processed according to technical specifications hardly comes to 5%.

Reclaim rubber from latex waste superior

Studies conducted at the Rubber Research Institute of India have indicated that rubber reclaimed out of latex waste was having better properties as compared to whole tyre reclaim. Talc is more effective than clay in reducing tackiness of the reclaimed latex waste, it was also observed.

Ozone resistence of NR blends

Studies at the Rubber Research Institute of India on the ozone resistance of blends containing different proportions of NR and 1, 2 polybutadiene showed that critical stress values had a correlation with ozone resistance of blends as observed by the visual comparison method, whereas critical elastic stored energy density did not show any such correlation. It was also observed that the technological properties of the blends could be improved by adding Ultrasil VN_3 and that small quantities of 1,2 polybutadiene decreased the ozone resistance of NR, but with higher proportions there is definite improvement in ozone resistance of NR.

WHY NR COST IS MORE IN INDIA?

THOMAS OUSEPH

The production cost of natural rubber has been a subject of debate between growers and manufacturers for many years. A section of the growers feel that the present price of Rs. 17.50 to 18.00 per kg of RMA-4 grade rubber is low and that the buffer stock mechanism was devised to pin down the price to a particular level. Obviously they are not happy about the buffer stock operation which is designed to regulate the supply by meeting the deficit through imports. According to them the fair price band is due for revision taking into account increases in various cost elements.

On the other hand, consumers feel that growers are extracting a hign price through market exploitation in a situation of short supply. They argue that the cost of production will not come anywhere near the market price. A report recently prepared by Dr B. C. Sekhar, former Rubber Controller of Malaysia and at present Secretary-General, International Rubber Study Group, has come in handy for them to drive home their point. They have taken the indicative direct cost of natural rubber (NR) production for total cost and ask: Making some allowance for India's lower productivity of 930kg/ha/year as against Malaysia's 1100, why can't India produce NR at around Rs 10 per kg while it could be produced in Malaysia at Rs 9 per kg? Though the question is directed against the militant section amongst the growers, the argument leaves many things unsaid. The price of a commodity consists of direct and indirect costs. Along with direct cost, factors like interest on borrowed capital, lease rent on land, bonus and fringe benefits to workers, depreciation on civil works, return on capital etc have to be taken into account in any systematic cost exercise.

Such an exercise made by the government in 1986 through the Ministry of Finance indicated that the fair price would be Rs. 17 per kg for RMA-4 grade rubber. But there have been cost escalations subsequently, which remains to be compensated.

Increase in cost

Wage elements generally account for about 60% of the production cost of rubber. On 1.4.1987 the wage of a rubber plantation worker was Rs 21.68 a day. This rose to Rs. 22.68 in December 1987, resulting in an increase of 60 ps per day. The rate of increase works out to 2.76%. Expenses on fertilisers roughly account for 24% of the production cost. In the matter of formic acid, plant protection chemicals, agricultural impiements etc the share would come to 16%. The increase in these components are given elsewhere.

These increases, if adjusted to the production cost in the ratio of 60:24:16 (wages: fertiliser: other factors) would result in an overall escalation of 4.69% (1.65%+0.46%+2.58%) in the production cost till December 1987. Subsequent wage rises which are allowed by the tripartite Plantation Labour Committee at 3 months' interval in 1988 and the rise in input cost consequent on budgetary levy of State and Central Govts remain to be accounted. 'What about the consumers' complaint about high price of NR in India? Obviously, they have not examined why production cost is high in the country. Merely citing the Malaysian example is not enough. There are many reasons for the higher cost in India. Of these, factors emanating from climatic varitions are important.

Rubber requires fairly humid conditions with temperature ranging from 21° to 35°C and a distributed annual rainfall of about 200 cm for its optimum growth. These are obtained in Malaysia.

Only a small portion of the Indian sub continent meets these requirements, namely the Kanyakumari District in Tamil Nadu. Here the rubber area is only about 17,000 hectares out of an overall four lakh hectares in the country. Temperature in other parts varies considerably, sometimes going below and beyond the 21°-35°C range. The rains are not distributed; they come in torrents during the monsoon season when the rainfall averages about 500 to 600 cm a month. A dry spell follows the monsoon.

The increase in cost elements

	Dec. 86 Rs.	Dec. 87 Rs.	Increase %
Fertiliser NPK 17:17:17 (per tonne)	2611.25	2662.00	1.94
Copper oxychloride (per litre)	52.35	60.00	14.61
Formic acid	34.37	36.33	5.70
Tapping knife	24.17	31.00	28.25

extending to about four months. Towards the north it lingers longer, to about six months. Moderate to severe drought conditions occur almost every year.

The climatic variations bring about constraints in production. Most important is the decrease in yield caused by abnormal leaf fall disease. No rubber land is free from this disease in India when it is absent in Malaysia. The disease occurs again and again every year with the onset of monsoon. The pathogen thrives well in humid conditions.

The farmer has to spend about Rs 1000 per hectare on micron spraying to control it. Otherwise the pathogen will attack peteoles resulting in massive shedding of foliage. Though new flushes may appear later, the premature leaf shedding brings about considerable crop loss, about 16% of the annual production on the average.

Labour saving factors

Rubber cultivation is labour intensive. Since employment generation for the rural poor is one of the prime objectives of the country, we have not attempted mechanisation of farming operations to any significant extent. On the other hand mechanisation has been in vogue in countries like Malaysia in the matter of pitting, weeding, polybag planting and uprooting of old trees before replantation. Labour saving devices like collection of the crop in polyethylene bags once in a week or two, use of mechanised tapping tool etc. have recently been introduced in Malaysia. It is common knowledge that mechanisation generally brings down the cost of farming operations.

Rubber is cultivated in India predominantly on hills and slopes. As against this, most of the lands in Malaysia are flat to undulating. Slopes are exposed to heavy soil erosion and leaching. High microbiological activities result in depletion of the humus which is very essential to plant growth. All these necessitate adoption of costly soil protection works in India in the form of countour terraces(edakkayyalas), silt pits and plant terraces to check soil run off and help the rainwater seep down the soil layers. Top soil is the fertile portion of the earth. If it is washed away by rainwater, soil fertility will be considerably reduced. A rough calculation indicates that expenses on soil protection would come to about Rs 4,000 per hectare, which is over 10 % of the per hectare cultivation expenses.

Uncontrolled rains

Heavy rains in place of the distributed rainfall results in many limitations in rubber production. They cause portion of the applied fertilisers to be lost through leaching necessitating application of fertilisers in higher dosage. This hikes the cost on manuring. During heavy rains the plant growth is slowed down. After the monsoon we have a temperate climate for about five months, which is followed by the hot summer. In summer the growth retards again as soil moisture is considerably reduced through evaporation. The impact of heavy rains as well as of the scorching summer results in tardy growth of rubber plants. Rains are moderate and distributed in Malaysia, where the plants grow evenly and reach the yielding stage early. The slow growth in India prolongs the pre-bearing period of rubber plant by about two years.

The sloping terrain also adds to the wage bill. Rubber happened to be cultivated on the slopes of hills since meadows and valleys had been almost utilised for cultivation of other crops, when it appeared on the Indian horizon at the start of the present century. Harvesting of rubber is done through a process of controlled wounding of the tree's bark called tapping.

A worker taps a day about 300 trees. In Malaysia the tapping task is over 500. While it is easy and quick for the tapper in Malaysia to go from tree to tree as the land is almost flat, the tapper has to climb up the hilly tracts in India for reaching up to each tree. This primarily results in a lower tapping task. Inadequate infrastructural facilities like good linkage of roads and communication facilities as compared to Malaysia further add to the diseconomies in India.

Direct and indirect cost elements contribute commendably to the cost incidence in the Indian environment. A hectare of land in the traditional region costs about Rs 1 lakh. Expenditure on planting and cultural operations for the seven year immaturity period per hectare has been worked out at Rs 30,000. This may be a little more in the case of large plantations where additional outgo on installation of plant and machinery for processing, construction of labour lines etc. have to be met. If rubber is cultivated on an area extending over five hectares in the traditional region, no kind of cash assistance is available in India. Malaysia encourages planting on a large scale with financial assistance amounting to about 60% of the total cost. This large scale planting helps to reap the benefits of economy of scale operation. They advocate consolidation of small holdings whereas in India fragmentation is the order of the day as land ceiling legislations are progressively extended to the whole of the country. □

Advanced Rubber Planting Materials Do they Shorten Immaturity Consistent with Longevity?

P. P. CHERIAN

At the recent planters' Conference organised by the Rubber Research Institute, a paper presented by the Group Manager of a large company estate on "Advanced Planting Materials-A Comparative Cost and Benefit Study" evoked sustained interest (1). But during discussions, an enquiry emanated as to whether 1½ to 2-year old stumped buddings reach normal tappability earlier than the conventional field budding. Could not the former become replantable earlier by the corresponding duration was not taken up for elucidation. Apparently, the doubt might have appeared trivial or misunderstood. However, it raises intriguing aspects. Analogously, will the life span of a baby brought out by caesarean about three months earlier than the normal nine months of gestation be enhanced by a matching period andwhether the post natal rearing of the infant in theincubator worthwhile? Older experimental data in other rubber producing countries indicate a general evening out of both growth and yield of all nursery materials with doubtful economic gain in the long run, though their advantages for particular purposes and occasions remain undisputed.

A classic Ceylon trial

A 16-year 10- acre trial from 1936 by the Rubber Research Scheme with stumped budgrafts, brown budded stumps and field buddings summarised from its Annual Reports in Table A discloses that after the ninth year of planting, both the growth and yield of stumped budgrafts and conventional budded stumps had practically evened out. The field buddings lagged behind as the budding had taken place about 1½ years after planting of stumped budgrafts and stock seedlingsin the field The experiment was discontinued nine years after tapping. The conclusion arrived at being that the gain in the crop during the first three years of tapping would hardly compensate for the high initial cost of planting of stumped budgrafts but could be very useful as late supplies in 2 year plantations.

TABLE A

Year	Stumped budgrafts		Budded stumps		Field buddings	
	Yield in gr. per tree per tapping	Girth (cm)	yield in gr. per treeper tapping	Girth (cm)	Yield in gr. per treeper tapping	Girth (cm)
1938	–	21.7	–	15.8	–	–
1939	–	30.1	–	23.4	–	12.4
1940	–	38.9	–	32.4	–	20 1
1941	–	48.4	–	42.1	–	29.6
1942	10.0	55.4	9.5	50.1	–	38.8
1943	14.3	59.3	11.8	55.7	9.8	45.4
1944	17 9	67.2	14.3	60.2	12.2	51 8
1945	18.7	67.4	17.0	64.5	11.3	56.5
1946	23 0	71.8	21.2	69.7	16.0	61.5
1947	24.5	76.5	23 2	74 4	17.5	66.4
1948	29.0	77.9	27.5	76.6	21.9	68.9
1949	30 7 (1182)	79.0	29.1(1111)	79.7	22.5 (886)	70.3
1950	21.8 (858)	79.7	24.4(939)	79.7	20 2 (777)	70.8
1651	26.3 (1021)	81.4	26.1(1006)	81.0	21.1 (810)	72.0

(Figures in brackets indicate the yield per k/h based on 156 tapping days as in 1948)

Malayan trial

According to the published Annual Report (1952) of the RRI Malaya, a planting experiment of 56 acres compared the performance of the same clones (a) budded in the field out of planting of germinated seeds at-stake and (b) on seedling stumps against nursery budding and transplanting to the field as (c) budded stumps and (d) stumped budgrafts. Here too, the early advantages of the nursery prepared materials had not been maintained and the results of the fourth year tapping showed no significant differences between any of the methods summarised in Table B.

mentioned at the outset with the latest clones since published 1) though differed from the statistically laid out experiments, provide valuable data for comparative study. Here the 1981 planting of 925 GT 1 stumped budgrafts reached 91.89 per cent tappability in 55 months with 98.49 percent survivality along with extra crop over poly bags and budded stumps matured later with varying percentage of success. It is claimed that the additional expenditure for planting of stumped buddings and polybag plants is recoverable from the earlier crop realised over budded stump planting of the same year. The results suffer from the real comparative value in that planting of budded stumps

Statistical trial in India

The RRII's 1976 experiment at the Central Experiment Station, Chetackal with regard to planting of (a) seed-at-stake followed by field budding (b) polybag green budded stumps (c) brown buddings and (d) stumped budgrafts with the same clone RRII 105 in 1.8 ha along with replications in 24 plots indicated the highest initial yield for polybag green budded stumps over stumped budgrafts and brown buddings as under (2):—

Mean yield per tapping during October, November and December 1983 (G)

(a) 28.36
(b) 36.89
(c) 36 13
(d) 32.15

TABLE B

Material	Yield k/h (first tapping year)	Yield k/h 4th tapping year)	Girth (cm) 12th year
(a) Sprouted Seeds	794	1215	60.0
(b) Seedling stumps	1003	1246	63.2
(c) Budded stumps	1166	1240	64.5
(d) Stumped budgrafts	1231	1206	66.6

Both the Ceylon and Malayan trials were statistically laid out in randomised plots with replications. In Ceylon, the then prevailing clones AV 49, PB 25, SR 9 and R 393 while in Malaya later varieties TJIR 1 & 16, GL 1, PB 86 etc. were utilised. How far the development of precocious clones with better growth and yield has had impact on the maturity especially after the advent of green buddings and polybag planting are of immense practical benefits.

Shaliacary trials

The estate trials in India

of the same clone in the same year was not available for direct comparison. Nor was the same made with polybag plants of GT 1 of the same year separately. The question emanated as to whether or not the growth and yield will be evened out eventually and whether the highest girth of the stumped budgrafts at the initial tapping is attributable or not to the original girth at the time of planting against nil for budded stumps and insignificent for poly bag plants remained unelucidated.

The yield for any complete year since 1983 has not been released. Mean girth published in 1980 (3) disclosed polybag green buddings with 28 6 cm compared with 24.9 for budded stumps and 14.9 for seed-at-stake field buddings in 1977. The girth of the stumped buddings was not given. During a visit to the plot in 1984, the trees of different methods of planting looked so alike with uniform growth that the planting practice adopted could not be identified from visual appearance.

Despite better growth claimed for stumped buddings in some

Malaysian trials over green and brown buddings in field, green buddings in bags, budded stumps in bags and reduction of mortality due to unfavourable weather conditions during and after planting by previous pollarding, root tailing and irrigation along with the utilisation of horomones, this method is not reported to be widely accepted commercially (4) though well known over 50 years. The main doubt as to whether stumped budgrafts reduce immaturity consistent with longevity persists. In India, polybag green buddings appear to be becoming popular among some groups of large estates as well as small growers suiting the seed fall and climatic conditions for planting.

References

1) Advanced Planting Materials: A Comparative Cost & Benefit study –M. S. Abraham-Group Manager, Shaliacary Estate since published in the Rubber Board Bulletin April-June1987.

2) From the Rubber Board vide letter No. 1/JD/RES/85 dated 25.9.85.

3) Rubber Board Bulletin-July 1980.

4) A preliminary Report on Investigations to Improve Establishment Success of Stumped Buddings in Hevea, published in "Planter", Malaysia, and reproduced in the Rubber Board Bulletin Vol 21 1985.

Editor's note.

The comments of the Director of Research and the Rubber Production Commissioner on the points raised by Sri. P. P. Cherian are furnished below.

One has to consider the basic scientific aspects in the use of planting materials of advanced growth. In contrast with budded stumps which when planted in the field takes several weeks to establish polybagged plants at the time of transfer to the field are well past that stage and have already gained further growth of a few months in the case of mini polybag plants and of several months in the case of maxi polybag plants. If properly reared and planted, there will be negligible casualties amongst polybagged plants in the field whereas for budded stumps 5 to 10 per cent failure is common. Polybagged plants are subjected to a selection before transfer to field. This ensures uniformity of growth characters in the field. There is an initial advantage of growth for polybagged plants derived from substantial leaf area available for photosynthesis and established root system helpful for uptake of water and nutrients. Once the budded stumps start putting forth shoot and root growth, these advantages may progressively become less apparent unless the initial differences in growth factors are continuously maintained. It is observed that polybagged plants sometimes do not branch in time with the result that progressive expansion of leaf area and girthing of trunk are affected. This in turn causes loss of initial growth advantage. It is therefore important to monitor all aspects and to give proper maintenance through appropriate agronomic practices. The advantage of stumped buddings, more especially the the maxi stumped buddings, is to be ascribed to the enormous reserve food already available at the time of planting in the field. Adverse turns of weather at the time of field planting can result in substantial casulties in the case of budded stumps and stumped buddings. Polybagged plants are less susceptible to losses on this count. In the matter of cost of production of planting material and planting, polybagged plants are definitely more expensive than others.

The total economic life period cannot be varying for the different types of planting materials. The difference sought to be made is in the immaturity period in the field. While the total immaturity period also remains the same for all planting materials the time taken by planting materials of advanced growth is longer in the nursery and more or less correspondingly less in the field. Attainment of maturity earlier in the field naturally means completion of the period of economic production equally sooner. Either way, the duration of productive phase should remain the same.

The better uniformity of growth and earlier completion of pre-bearing period in the field are both important for any plantation. The former enhances the percentage of tappable trees in the first year. Both ensure early returns and consequently quicker attainment of break-even point.

It is true that initial cost of planting of planting materials of advanced growth is comparatively high. However, this gets almost fully compensated by savings on casualty rаplacement, provision of tree guards and reduction of immaturity period in the field. The real advantage is the realisation of early yields and higher initial yields. Considering the latter alone, an increase in the first year yield by 200 kg means a higher gross realisation of Rs. 3.200 to Rs. 3,400 (at present prices) during a crucial period of reckoning. Evening out of growth or yield between conventional planting material and planting material of advanced growth at a subsequent stage is immaterial so far as overall economic benefits are concerned.

While drawing conclusion from experiments and trials, the relevant critical factors involved should also be given due consideration. Statistical layout alone cannot free the results of errors. Other considerations such as percentage of casualties, impact of climatic factors on relative subsequent development, percentage of tappable trees in initial mature phase, comparative realisation of yields in initial years of tapping are all of importance for a meaningful study. The experiment laid out at Central Experiment Station, Chethackal had, for instance, suffered infirmity for the reason that stumped buddings had not given rise to proper branching due to unfavourable weather conditions during the year of planting.

A detailed techno-economic study taking all relevant aspects into consideration has yet to be undertaken in this country. The RRII has already initiated action in this regard.□

OBITUARY

P. N. RADHAKRISHNA PILLAY

We report with deep sorrow the sudden demise of P. N. Radhakrishna Pillay, Joint Director (Training) Rubber Board who died of heart attack at his residence in Kottayam on 28th February 1988. Cremation took place at his ancestral home in Mannar on the same day. He was 56.

Radhakrishna Pillay joined the services of the Rubber Board in 1957. In 1968 he was appointed as Dy. Director (Pathology Division). He became the Joint Director of Research in the year 1982. Later on when he was shifted to the Department of Training as Jt. Director, he organised the training programmes in a systematic manner. New programmes were also introduced. He served as chief editor of the "Hand book of Natural Rubber Production in India". His contribution to the research on control measures of the diseases and pests of rubber in rubber plantations is significant. He had written a number of papers on the subject.

He is survived by his wife Smt. Santhakumari.

Solar dryer

Studies on the effectiveness of solar dryer for drying sheet rubber have given interesting results. Small scale trials using 30-40 sheets per day indicated that drying could be completed in four days with firewood backing and with solar energy alone, sheets took 7-11 days. Large scale trials using 125 to 150 sheets per day with firewood backing indicated that sheets could be dried in five days. There was a saving of firewood to the tune of 70%.

Cut off point in high elevation

Studies undertaken by the Research complex of the RRII for the North Eastern Region with its base in Guwahati indicated that growth of rubber plants in general was satisfactory in the north east except in the farm located at Darachickgre (Meghalaya), at an altitude of 1100 m MSL. At Ganolgre (Tura) farm situated at 600 m MSL, the constraints due to high altitude situations were not evident. This observation suggests that the cut off point in suitability for rubber cultivation may be in between these two elevations.

Rubber Goods Manufactured from Natural Rubber Latex*

Dr. E. V. THOMAS
Jt. Director (Training) Rubber Board

Introduction:

Natural rubber latex is the main crop harvested from rubber plantations. This is an important industrial raw material. A number of rubber industries use latex as their principal raw material. The primary processing in rubber latex goods manufacture is preservation. Most popular preservative used is Ammonia. Latex is required in concentrated form in many types of products manufacture. This is done by using a centrifuge machine or by creaming process. Latex can also be concentrated by evaporation or by electro-decantation. Concentration by centrifuging is most popular among plantations in India. Creaming process is also used by some of the processing units. Themost important raw material of latex based industry is ammonia preserved concentrated natural rubber latex. In India total production of ammonia preserved concentrated latex was 25000 tonnes in 1987-88. There are 27 producers of centrifugally concentrated latex in the country. Creamed latex is produced in five units. But the quantity produced is below 1000 tonnes per year.

Types of concentrated natural lattices available and their specifications:

Types of ammonia preserved concentrated lattices and their specifications under IS.5430 of the Bureau of Indian Standards are given in ANNEXURE-1. Concentrated latex is marketed with ISI mark under licence from the Bureau of Indian Standards by 12 units in the country. List of producers of certified quality preserved natural rubber latex is given in Annexure-II. Concentrated rubber latex is a costly item today. Its price in the Indian market is around Rs. 30/per kg. as against around Rs. 38/- in the international market. Price of latex has gone up very high in the international market in recent years mainly because of the expanded market for disposable gloves in different countries. This industry expanded so quickly because of the fear for the dreaded disease "AIDS" in developed countries. In many countries in the west millions of pairs of disposable gloves are needed every day by different public utility services. Since latex is a costly material, it will be in the interest of the consumers to procure and use centrified quality lattices. This will help them to escape from marketing malparctices of traders and consequent losses.

Important latex based rubber industries:

Important products manufactured from latex are:

a) Foam rubber
b) Dipped rubber products.
c) Cast rubber products
d) Extruded rubber threads and tubes
e) Other latex products

A short account of the principles involved in manufacture of the products is given below.

a) Foam rubber from Latex:

The process of manufacture of foam rubber from latex consists of expansion of a suitably compounded latex to a desired volume, setting the rubber particles and then vulcanising it. Expanded and sponge rubber normally denote cellular products made from dry rubber. Sponge cells are open and inter-connected while expandeg rubber cells are closed and non-inter communicating. Foam rubber cells are open and innter-connecting. Most of the latex concentrates is used in foam rubber manufacture. There are two main processes for the manufacture of foam rubbber, namely, the Dunlop process and (2) the Talalay process. In India practically all the manufactures are using the Dunlop process in foam rubber production. The steps involved in this process are:

1) Componding of latex.
2) Maturation of the compound.
3) Foaming of the compound to required level of expansion.

* Paper presented at the Seminar-cum Exhibition on "New Business opportunities for Rubber Industries" at the Taj Coromandel Hotel, Madras.

4) Gellation ad consolidation of shape.

5) Vulcanisation.

6) Washing, squeezing and drying.

7) Testing, grading and packing.

properties of the foam produced. Over maturing should be avoided. Period of maturation is standardised by each factory according to the environmental conditions prevailing at the location of the factory.

A typical formulation for manufacture of foam products is given below:

Ingredients	Wet weight
Natural rubber latex	167.00
Post: oleate 20%	7.50
Precipitated calcium carbonate dispersion 50%	40.00
Sulphur dispersion 50%	5.00
Zinc oxide dispersion 40%	8.00
Zinc diethyl dithio-carbamate dispersion 50%	1.6
Zinc mercapto benzthiazole dispersion 50%	0.8
Diphenyl gnanidine dispersion 50%	1.2
Anti: oxidant dispersion 50%	3.0
Sodium Silico fluoride slurry 20%	10.0

Order of addition of ingredients is important in foam rubber production. Primary and secondary gelling agents are held back till expansion of latex is completed. These are then added and gellation allowed to take place.

Compounding:-

If high ammonia latex is used, it should be de-ammoniated before mixing other compounding ingredients. Ammonia level should perferably be brought down to around 0.2% on volume of latex. A small amount is some times added to avoid risk of coagulation while de ammoniating. De-ammoniation might take 8 to 24 hrs **Sulphur, accelerator**, antioxidant and fillers (in the form of dispersions or emulsions) are then added to the deamm- niated latex taken in mixing tank fitted with a slow speed stirring for a period of over 12 hrs. Maturation of latex is found to improve the

Foaming is done by the batch process in most factories in this country. A planetary mixer is used for this purpose. Required quantity of latex is taken in the bowl of the mixer and soap solution is added at the required level. By mechanical agitation latex is expanded. This is effected in 15- 20 minutes. Volume increase is generally from 4 to 6 times for cushions and upto 10 times for soft products.

After the desired volume increase has taken place zinc oxide, with secondary gelling agent, is added followed by sodium silico fluoride. The speed of beating is reduced at this stage to refine the foam or to reduce the size of rubbles. This is continued to ensure uniform distribution of the chemicals. Usually the time of stirring after addition of gelling agents will be below three minutes The formed compound is then transfered to moulds and

closed with lid. The mould is then transferred to autoclave for bringing about vulcanisation.

After vulcanisation the foam produced is stripped from the mould and washed in water to remove the water soluables like soap etc. The product is then dried in an oven at 60°-80°C.

The product is now ready for packing and marketing. There is an IS specification for foam rubber (IS 1741). Many manufactcures are marketing foam rubber with BIS licence. Necessary guidance on this will be available to interested manufaturers from the nearest office of BIS or from the Rubber Board, Kottayam 686 009.

b) Dipped Rubber Products:

Products like baloons, rubber bands, gloves, condoms, nipples etc. are produced by dipping formers is compounded latex. Thin walled products are produced by straight dipping. Coagulant dipping is employed when thicker articles are to be produced. Heat sensitised dipping procedure is also used for the production of some thicker products.

In coagulant dipping process, it is advisable to immerse the former first in latex before it is immersed in coagulant. This will ensure formation of a more uniform film deposit on the former. Formers may be given a dwell time while they are immersed in latex. This will help in obtaining desired thickness with minimum number of dips. Dwell times of the order I to 5 minutes are common for the production of some latex goods.

The formers used for dipping should be absolutely clear. The speed of immersion should be sufficiently slow to prevent air being drawn to the bath with the former. Immersion speed of the order of 3 to 6 ft. per minute is usually found to be acceptable. Withdrawal speed recommended in coagulant dipping process is of the order of the 1 to 2 feet per minute. Leaching is an important step in dipped goods production. This is done to remove water soluable serum ingredients, residual coagulant and surface active agents. Warm water or hot water is recommended for leaching. If water soluble accelerators are used for leaching, this step may be avoided. Dusting is done on unvulcanised films to prevent sticking of surfaces.

Most important dipped product of this decade is rubber latex gloves like surgeons gloves, disposable gloves and household gloves. It is estimated that 2 billion pieces of disposable gloves will be used in developed countries annually by the turn of this centuary. India is also slowly entering the gloves export market. Around ten plants with facilities for automatic dipping are coming up in the export promotion zones to Madras and Cochin together for disposable gloves manufacture.

c) Cast rubber products

In cast toy manufacture the important processing step is production of moulds for casting. Plaster of Paris is used for mould making in most small industrial units. Light alloys of metals are also used in mould making. When latex is poured to plaster of Paris mould the following changes are believed to occur.

1) Plaster is porous and so it absorbs water. 2) The calcium iones of plaster destabilise latex and hasten film formation. In casting conditions of rotations of moulds, temperature of moulds during casting etc. are important When heat sensitised latex is used for casting, the excess latex poured out of moulds may be cooled. The number of useful mouldings that can be taken from a plaster mould depends on several factors like hardness of plaster from which it is obtained and degree of sharpness required in the product. It is reported that an average number of 25 to 30 castings can be taken from one plaster mould.

Prevulcanised latex is specially suitable for producing cast rubber product as it avoids need for a curing operation. The level of filler addition determines the hardness and flexibility of the product. Generally two levels of filler loading are used, those with upto 30 phr filler and those upto 250 phr filler. The former is the level used in flexible products such as toys, while the latter is used in hard products.

Slush moulding:

In slush moulding metal moulds are used for casting. Aluminium alloys are mostly used. The alloy used should be free from harmful metallic impurities like copper, Mn, or cobalt. The moulding process is simple. The moulds are cleaned well and lubricated, eg: with a solution of paraffin wax and stearic acid in organic solvent. The mould pieces are brought together and heated to the desired temperature The mould cavity is then filled with latex compound and allowed to stand for production of a film of the required thickness. The mould is then opened and the film vulcanised.

Latex thread:

Latex thread is produced by allowing a latex compound to flow through capillary tubes into an acid bath followed by washing and drying of the resultant coagulam. The process is known as extrusion. The important steps involved in production of latex thread are:

a) Compound design
b) Thread extrusion
c) Vulcanisation
d) Testing
e) Packing and marketing

Latex thread can be produced either from creamed or centrifugally concentrated latex. For production of high count threads, centrifugally concentrated latex is found to give better results. A typical formulation for producing rubber latex thread is given below:

	Wet weight
1. 60% Latex	167
2. 10% Potassium Hydroxide solution	3
3. 20% Potassium laurate solution	2.5
4. 50% Sulphur dispersion	3.5
5. 50% ZMBT	2.0
6. 50% ZDC	1.0
7. 50% Antioxidant dispersion	3.0
8. 50% Titanium dioxide dispersion	4.10
9. 50% Zinc Oxide dispersion	0.6

The compound has to be matured 3 to 5 days before production starts under stirring in a closed tank. Air bubbles should be removed by applying mild suction for 6 to 10 hrs., if facilities are available. In small units this is achieved by keeping the compound undistrubed for overnight followed by removal of the froath by kneading. Latex is then seived through 80 mesh seive or through voil cloth. Latex properties like total solids, viscosity, degree of maturation, and mechanical stability are then determined. The compound may be brought to 50+2 T.S. for good quality thread extrusion.

Extrusion:

The Latex compound standardised as described above is stored in a header tank. From the header tank the latex passes to a manifold extruding head which distributes the mix to the capillaries through flexible tubes. In a small scale unit the extrusion head usually contains 20-60 capillaries. The level of the head in the manifold must be kept constant to ensure constant rate of extrusion and size of the thread. The nozzle is immersed in the coagulant. The depth of nozzle immersion has an influence on the diameter of the thread produced. In common practice the rate of extrusion is 30 to 40 ft. per minute. The orifice of the nozzle is round and size varies from 0.5 to 1 mm. The length of coagulation bath is around 10 ft. and the width varies depending on number of threads extruded. Strength of acid used also depends on factors like speed of extrusion, number of threads extruded, diameter of threads etc. Weak solutions are used for larger diameter threads. The threads are washed in bath of 6 to 10 ft. long. Cold or warm water can be used for this purpose. At this stage all residual acid will be removed. The thread is then dried in an oven at 85 to 90° C. The thread moves over a conveyor through the drying chamber. When it leaves the dryer, moisture content will be below 5 percent. It is then coated with talc and spooled over mandrels. Some degree of stretching is given to the thread between the extruding nozzles and winding. This wll improve modules of the thread and reduce its permanent set.

Vulcanisation of threads is completed by heating the talced thread in water at 80° to 85°C for 4 to 6 hrs.

e) Other Latex products

Other latex products are coated fabrics, adhesives, latex backed carpets, fibre foam etc.

Latex spreading:

Latex compounds prepared in suitable formulations can be spread over textiles using doctor blade or spreading bar. These devices help in applying uniform coating of latex compound over textiles. Proofed fabrics can be produced using this procedure. The latex compound used for this purpose should have the desired viscosity. Only when the viscosity of the compound is in the desired range penetration of the compound to textiles will be proper. Two textile coated fabrics can be pressed together at the coated surface to obtain doubled fabric.

Latex carpet backing:

The most popular method for latex application in carpets is by lickroll method. Here also a doctor blade is used to control the thickness of the coating. Latex carpet backing is also produced by spreading and in some factories spraying procedure is used.

Latex based adhesives:

Apart from latex a latex adhesive may contain adhesion modifiers, tackifiers, plasticisers curatives, fillers, thickeners and other special additives. For bonding non-polar substances to those which are polar, a second component of mixed polarity is added as an adhesion modifier. Thus in the bonding of rubber to textiles as in the cord, resins are used to promote adhesion. Tackifiers are used to increase tack properties and to confer what is popularly called 'quick grab' to the adhesive, that is the ability of the adhesive to develop rapidly an amount of initial strength, sufficient to hold the adherents in place while the main bond strength develops. Tackifiers promote wetting and adhesion and contributes flexibility. The substances used as tackifiers are resinuous in nature. Cooked starch is used extensively in paper adhesives. Uncooked starch is used in heat sensitive latex adhesive. Plasticisers are used in adhesives when bond flexibility is a desirable property. Curatives improve the ageing properties of the bond. A typical adhesive formulation is given below:

NR latex	167.00
Sodium silicate 25% dispersion	20.00
Casein 10% solution	20.00
Carbon tetrachloride 50% emulsion	10.00
Zinc oxide 50 % dispersion	1.00
Sulphur 50% dispersion	2.00
ZDC 50% dispersion	1.00

Rubberised fibre Products:

Latex bonded fibres are different from latex bonded nonwoven fabrics. In fibre coated rubber, usually the rubber content will be around 30 to 40 percent. These products have good resilience and this property is derived mostly from the fibre quality. Latex is used here only as a bonding agent. Most popular product under this category is fibre foam. In India coir fibre is used for the production of this product. Certain animal hairs are also used for this application in some countries. Suitably compounded latex is applied on well arranged fibre pads using a spray gum. The product is then dried, cured, laminated, shaped and marketed.

ANNEXURE-1

Concentrated Latex Specifications as per IS 5430

1.1 Description

Concentrated latex is produced mainly by centrifuging field latex. During centrifuging a low proportion of rubber particles of smaller dimensions, a major portion of the non-rubber materials and a part of water are removed from field latex.

1.2 Grades

Three grades of ammonia preserved concentrated lattices are available.

1.2.1. High-Ammonia (HA) Type

Centrifuged natural rubber latex preserved with ammonia only or by formaldehyde followed by ammonia with an alkalinity of atleast 0.6%

1.2.2. Medium-Ammonia (MA) Type

Centrifuged natural rubber latex preserved with ammonia and other preservatives as agreed to between the purchaser and the supplier with an alkalinity level between 0.3% and 0.6%.

1.2.3. Low-Ammonia (LA) Type

Centrifuged natural rubber latex preserved with ammonia and other preservatives as agreed to between the purchaser and the supplier with an alkalinity level less than 0.3%.

1.3. Specifications for for concentrated latex

1.3.1. Colour

	HA-type	MA-type	LA-type
	All the three types of latices shall not have pronounced blue or grey colour.		

1.3.2. Odour

	HA-type	MA-type	LA-type
	All the three types of latices shall not have any pronounced odour of putrefaction after neutralisation with boric acid.		
1.3.3. Dry Rubber Content, percent by mass (Min)	60.0	60.0	60.0
1.3.5 Non-rubber solids, percent by mass (Max)	2.0	2.0	2.0
1.3.5 Coagulum content, percent by mass (Max)	0.05	0.05	005
1.3.6. Sludge content, percent by mass (Max)	0.10	0.10	0.10
1.3.7 Alkalinity as ammonia, percent by mass of latex (M in)	0.60	Above 0.3 but below 0.6	0.3 (max)
1.3.8. KOH number (Max)	1.0	1.0	1.0
1.3.9. Mechanical stability, Sec. (Min)*	475	475	475
1.3.10 Volatile Fatty Acid Number (Max)	0.15	0.15	0.15
1.3.11. Copper content, ppm of total solids (Max)	8	8	8
1.3.12. Manganese content, ppm of total solids	8	8	8

1.4. Packing

Latex shall be packed in drums so that each drum contains 200+5 litres. The inside surface of the drums shall be painted with ammonia resistant paint. The drums shall have the following marking.

1 Name of the producer or trade mark, if any
2 Type of latex
3 Net and gross weight in kg. and volume in litres
4 Dry rubber content
5 Date of packing

* Test for mechanical stability shall be carried out at least after 20 days of the packing of rubber latex.

ANNEXURE-II

List of Latex Centrifuging Units With ISI Licence

1 M/s. Cochin Malabar Estates & Industries, Chemoni Estate, Palippally P.O., Via. Alagappa Nagar, Trichur, Kerala

2 M/s. Cochin Malabar Estates & Industries, Kinalur Estate, Balusseri P.O., Calicut 673 612, Kerala.

3 M/s. Rajagiri Rubber & Produce Co. Ltd., Shalicarry Estate, Shalicarry P. O., Punalur, Quilon Dist., Kerala.

4 M/s. Thiruambadi Rubber Co. Ltd., Thiruambadi Estate, Mukom P. O. Calicut Dist , Kerala.

5 M/s. Pullengode Rubber & Produce Co. Ltd., Pullengode Estate, Pullengode P.O., Via, Kalikavu, Malappuram, Kerala.

6 M/s. Plantation Corporation of Kerala Ltd., (Chanadanapally Estate), Kottayam Dist., Pin-686 004, Kerala.

7 M/s. Travancore Rubber & Tea Co. Ltd., Kuppakayam Estate, TC No.12/114, Pattom Palace P.O., Trivandrum-695 004, Kerala.

8 M/s. Vaikundam Rubber Co. 7/55 Fathima Compound, Pattom Palace P.O., Trivandrum, Pin: 695 004, Kerala.

9 Karnataka Forest Plantation Corporation Ltd., Medinaduka Factory, Sullia Division, Sullia, D. K. Karnataka State.

10 M/s. Rehabilitation Plantations Ltd., Thalicode, Punalur-691 33, Kerala.

11 M/s. Padinjarakara Agencies (Pvt) Ltd., Kodimatha, Kottayam, Kerala.

12 Glenview Rubber Co. Ltd., Pangh P O., Kolathoor Via, Malappuram Dist., Kerala. □

Hottest decade

The world is passing through the hottest decade of the century.
According to British and U.S. experts, the 1980s' has so far been the warmest decade in the past 127 years with 1987 as the hottest on record.

The unusual warmth of the 1980s' is most evident in the southern hemisphere where seven of the eight warmest years recorded so far have occurred during this decade, reports American journal.' 'Scientific American.'

Latest investigations show that the average global temperature has increased by about 0.5 degree Celsius since the earliest reliable records, which date back to 1861.

The persistent warming of the present period could indicate the consequences of increased concentration of carbon dioxide (CO_2) and other radiatively active gases in the atmosphere, the experts feel. These gases absorb thermal radiation emitted by the earth and prevent its escape into space, thereby warming the lower atmosphere.

The concentration of atmospheric carbon dioxide is now 23 percent higher than it was before the industrial revolution and is increasing at a rate of 0.4 percent per year, the monthly says.

According to atmospheric scientists, the continuing increase in the amount of carbon dioxide and other gases like methane and nitrous oxide in the atmosphere is likely to cause a detectable global warming over the next few years.

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THE RUBBER BOARD
KOTTAYAM 686 001 INDIA

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THE QUARTER

As part of the efforts for expansion of rubber cultivation in non traditional areas, the Board has now drawn up proposals for large scale planting in Andhra Pradesh. The agro-climatic conditions obtaining in certain tribal tracts of the northern coastal districts of East Godavari, Vishakapatanam, Vizianagaram and Srikakulam of Andhra Pradesh appears to offer good prospects for rubber cultivation. Girijan Co-operative Coffee Development Corporation and certain other local agencies have offered to take up the work on the advice of the Rubber Board. Shri P. Mukundan Menon, Rubber Production Commissioner is of the view that under Maredumille conditions, rubber cultivation would be quite successful. Also, similar conditions are to be obtained in other areas proposed. The agricultural development cost and maintaining cost up to maturity would be only Rs. 25,000 per hectare. It is believed that more areas could be brought under rubber in Andhra Pradesh in the years to come.

PROPOSAL FOR LARGE SCALE RUBBER

To discuss the first proposal for large scale rubber planting in Andhra Pradesh, a meeting of the Project Officers and Project Agricultural Officers, Representatives of various banks and Officers of the Rubber Board was held at Vishakapatanam. Shri P. Mukundan Menon, Rubber Production Commissioner presided over the meeting. The participants of the mee ing included S/Shri Sambasiva Rao, IAS. Director, Rural Development Agency, Vishakapatanam, L. V. Subramaniyam IAS, Project Officer, ITDA, Paderu, V. M. Manohara Prasad IAS, Officer on Special Duty, Girijan Co-operative Coffee Development Corporation Ltd., Vishakapatanam, Sambasiva Rao IAS, Sub-Collector, Paderu, Venkiteswara Rao, Project Agricultural Officer, ITDA, Seethampetta, Srikakulam, B. S. Prakash Rao, Project Agricultural Officer, ITDA, Paderu, Shastry, Estate Manager, ITDA, Paderu, M. Sathyanarayana, Project Manager, Union Bank (Girijan Vikas Kendra), Vinayak Rao, Agricultural officer, Union Bank, Vishakapatanam, Appa Rao, Agricultural Officer, Rural Development Bank, Vishakapatanam, P. Rajendran, Dy. Rubber Production Commissioner, P. G. Salimkumar, Assistant Development Officer, Maredumille and K. N. Haridas, Field Officer, Maredumille.

Shri. V. M. Manohara Prasad, Officer on Special Duty, Girijan Co-operative Coffee Development Corporation Ltd., Visakhapatnam briefly explained the purpose of the meeting and said that the agro-climatic conditions obtaining in certain tribal tracts of the northern coastal districts of East Godavari, Visakhapatanam, Vizianagaram and Srikakulam of Andhara Pradesh appeared to offer good scope for rubber cultivation and desired that the Rubber Board which has already opened an extension centre at Maredumille in East Godavari District might consider development of rubber plantations as a measure for rural and tribal welfare in the non-traditional area for the crop. He added that his Corporation as well as the ITDAs functioning in these areas could take up the work on receiving advice and assistance from the Rubber Board.

Large Scale Planting

Shri P. Mukundan Menon, Rubber Production Commissioner at the outset welcomed the proposal for large scale rubber planting in Andhra Pradesh. He exlpained that the rubber tree grows and yields best in areas experiencing annual rainfall ranging from 2,000 to 3,000 mm, well distributed over a period of eight or more months. However, the tree could put up very well even under conditions of marginal deficits, especially so if dry season irrigation to a limited extent could be provided. Although an equable warm temperature is ideal, fluctuations upto a minimum of 10°c and a maximum of 40°c could be tolerated by the tree. The plantations should be located at elevations from Mean Sea Level upto around 350 metres above. Soil reaction should be on the acidic range at PH 3.5 to 6.5. A minimum soil depth of one metre is also essential. Shri. Menon stated that the areas proposed for rubber planting in Andhra Pradesh do not satisfy the above criteria fully but could be considered as marginal. The annual rainfall appeared to range from 1,000 to 2,000 mm with pronounced year to year variations. The particulars of month-wise distribution were not available and being of critical value need to be collected for a period of at least last ten years. The Board had studied the pattern in East Godavari District around Maredumille and found it to be well below 2,000 mm per annum but fairly distributed over seven months. The State Forest Department had been assisted 20 years ago to raise a few trial plantations there. The first one planted with seedling rubber in about 2 hectares had come up exceedingly well. Continued trial plantations undertaken with budgrafted varieties had however failed just for the reasons that those were not properly maintained and cared for. Shri. Menon was of the firm view that under Maredumille conditions, rubber cultivation would be quite successful. As compared with Kerala where rainfall is over abundant, the area around Maredumille could enjoy the additional advantage of freedom from the usual fungal diseases

PLANTING IN ANDRA PRADESH

that ravage rubber plants under high rainfall situations. If more or less similar conditions could be obtained in other are as proposed, large scale plantation development could be planned.

Lands available

It was clarified by the other participants that extensive fallow lands belonging to tribals are available in the areas. The lands are mostly flat or gently undulating but those in Visakhapatanam District are covered by hills and are hence slopy. The rainfall is generally from 1,200 to 1,700 mm. The rainfall season is from early July to mid October with occasional light spell over to a few more months before and after. The ground water potential is generally good and therefore irrigation is a practical proposition excepting in certain years when drought experienced. The PH range of soils is well within 7. Temperature does not drop below 10°c d the maximum recorded is rarely above 40°c.

ıri. P. Rajendran, Dy. Rubber Production Commissioner stated that the Project Officer, ITDA, ıderu has already planted 100 budgrafted rubber in 0.20 ha in 1987 on a trial basis. Although e elevation there is well over 700 metres above M. S. L. and the annual rainfall only a little ss than 1,200 mm, the plants have all established and grown well without trace of any disease far. The Rubber production Commissioner was of the view that any large scale planting at ch higher elevations should be only on trial basis now and that definite conclusions on suit-ility should be drawn only after observing the growth for the first 3-4years. Unlike in most her crops, good vegetative growth in rubber could be taken as sure indicator of good yield nce the produce is the latex from the bark of the tree.

ost of Planting

ɔ a question from Shri. Manohara Prasad regarding the economics of crop, the Rubber roduction Commissioner explained that assuming labour wages at Rs. 11/-per day with dditional 20% margin for perquisites, the total agricultural development cost for planting and aintaining rubber upto maturity would be Rs. 25,000/-per hectare. Costs for boundary ncing, road construction and other engineering infra-structure would be extra. The capital ost on planting and maintenance is to be invested over a period of 7 years, the first year's share eing the highest at about 35%. The plantation would be productive for about 25 years starting om the 8th year. Tapping is done on alternate days throughout the year excepting for a month r two during February—March. The yield at a conservative level would be an average of ,200 kg per hetare. At the present day price of Rs. 19/-per kg, the net gain would be s. 12,000/-per hectare per year. The residual value of the trees at the end of production period ould bring in an attractive bonus.

)n a question on marketability, Shri. Menon explained that rubber being an important industrial aw material currently in short supply, there would not be any difficulty whatsoever in selling he produce even at farm gates. The prices would be maintained steady and remunerative by he Government of India and the Rubber Board.

ntercrops

ᒥo another question on possibilites for raising inter-crops in rubber plantations which the tribals vould want to exploit in view of the long gestation period of rubber, Shri. Menon said that annual inter-crops which will not be of the soil exhausting type could be grown during the first three years. However, it was desirable to avoid this. It was more advantageous to grow rubber with a leguminous creeping ground cover right from the beginnig and make use of separate land for growing foodcrops. At any rate, no tribal family should be made to depend entirely on rubber. They should have their own food crop cultivation and rubber should be only to add to their financial well being.

The Rubber Production Commissioner then went on to explain the technical and financial assistance offered by the Board for promotion of rubber cultivation.

The financial assistance

Capital grant	: Rs. 5,000 per ha.
Addl. assistance for use of polybagged plants.	Rs. 3,000 ,,
Assistance for use of fertilisers	: Half cost of fertilisers used during immature stage.
Assistance for boundary protection. (Decided on an year to year basis).	: A fencing grant equivalant to cost of barbed wire.
Irrigation assistance (Decided on an year to year basis).	: A part of the capital cost given as grant.
Interest subsidy on loans availed from banks	: 3 per cent.

(Continued on last page)

SCOPE FOR DEVELOPMENT OF RUBBER AND RUBBER BASED INDUSTRIES IN TAMIL NADU*

Shri C. N. BALAKRISHNAN
Joint Director of Industries and Commerce (Chemicals)

Introduction

Nature has bestowed man with abundant supply of resources with the help of which he has created the modern world and introduced many valuable things based on these resources for the benefit of mankind. One such important natural resource is rubber. To-day a number of rubber products are being produced and are utilised in various fields.

Position of Natural Rubber in the Country

To-day, India is one of the leading rubber producing countries in the world. The production of rubber has registered a spectacular increase in the last three decades. During 1986, tha production of natural was 2,18,985 M. T., cultivated over an area of about 3,62,500 hectares. The production, consumption and imports of rubber in India for the past few years are given below:-

Position of Rubber Industry in the Country

Indian Rubber and Rubber goods industry ranks 16th amongst rubber products producing a wide range of over 35,000 products categorised as tyres and nontyres. Presently there are about more than 3,800 ıubber goods manufacturing units in the country includieg 132 units in the organised sector, spread all over the country, especially in Gujarat, Kerala, Maharashtra, West Bengal, Punjab and Tamilnadu employing more than 2 Lakhs persons with an estimated capital investment of Rs. 1500 crores. During 1986, the industry produced goods worth Rs. 3000 crores and for 1987, it is estimated at Rs. 3200 crores. No. of units, installed capacity and production of rubber goods in India for the year 1986-87 are given below:–

During 1986-87, our country exported rubber goods worth Rs. 97 crores and it is projected at Rs. 162 crores for 1987-88 and Rs. 215 crores by the end of the seventh Five Year Plan. In our country, there are about 23 rubber machinery manufcaturing units in organised sector with an annual installed capacity of

Figure in Metric Tonnes

Year	Production			Consumption			Imports	
	Natural Rubber	Synthetic rubber	Re-claim Rubber	Natural Rubber	Synthetic rubber	Re-claim Rubber	Natural Rubber	Synthetic rubber
1981	150655	28664	24956	181915	43650	25388	36850	21438
1982	165920	28664	28290	197035	49705	29282	45725	20427
1983	168025	31064	30486	205395	53025	29815	25394	16242
1984	183925	37606	35410	212540	59643	33480	38014	21188
1985	198375	36704	39165	232540	70426	38550	37392	30664
1986	218985	34836	37415	251695	69425	37575	57315	29187
1987 Jan-Nov.	198157	39493	36925	249820	68915	37005	43934	22389

l. lo.	Line of Manufacture	Accounting units	No. of units	Installed capacity	Production
1	Auto tyres	Lakh Nos	23	160.58	130.00
2	Auto Tubes	,,	25	171.45	103.00
3	Bicycle Tyres	,,	20	403.03	350.00
4	Bicycle Tubes	,,	20	392.72	250.00
5	V & Fan Belts	,,	16	183.71	165.00
6	Rubber Conveyor Belting	M. Tonnes	8	8910	7500
7	Reclaim Rubber	,,	11	36576	25000
8	Rubber Chemicals	,,	4	18365	12000
9	Carbon black	,,	7	154700	90000
0	Rubber Hoses	Million Mtrs	22	13.45	55.00
1	Rubber Canvas Footwear	Million Pairs	11	37.18	40.00
2	Contraceptives	Million Pieces	3	713.00	600.00

ver Rs. 500 million. The resent pattern of rubber usage n our country is given below:-

utomobile Tyres & Tubes	....	52%
Cycle tyres & Tubes	....	12%
Tread rubber	....	5%
Footwear	....	11%
Belts & hoses	....	6%
Latex foam	....	4%
Others	....	10%

Position of the Industry in Tamilnadu-

In the Southern Region, Tamilnadu is the second major producer of natural rubber. Rubber is cultivated over an area of 15000 hectares in our state and Kanyakumari district alone accounts for 12000 hectares. The annual production of rubber in Tamilnadu is estimated to be around 15000 M. T. per annum and about 94% of the production is from Kanyakumari district. The total consumption of rubber is of the order of 20000 M. T. in our state.

In Tamilnadu, rubber goods are manufactured both in organised and small scale sector. There are about 13 units in the organised sector and about 60 to 70 small scale units are being registered every year. The organised sector units manufacture products like tyres, tubes, belts, reclaimed rubber, whereas the small scale sector manufacturers products like, rubber, balls, washer, tread rubber, rubber sheets etc. The number of licensed manufacturers during 1983-84, 1984-85 and 1985-86 in Tamilnadu was 253,287 and 326 respectively.

Scope for Development of Rubber Based Industries in Tamilnadu

Since Tamilnadu is one of 'the major producers of rubber in Southern States, there is good scope for rubber based industries in this state especially in Kanyakumari District. Projections for some of the finished goods by the turn of the century in the country are given elsewhere.

In Tamilnadu, a few units like, Madras Rubber Factory, Dunlop, Sri Chakara Tyres etc. are manufacturing tyres and tubes in the organised sector. During 1984 and 1985 the production of tyres in the state was around 72,15,000 Nos. and 73,78,000 Nos. respectively. The additional capacities sanctioned for tyres and tubes in the state are given on page 7.

Scope For Development In Small Scale Sector:

There is also scope for the development of rubber based products in small scale sector as the raw material is available within the state. The process involved in manufacturing of these products is also very simple. Some of the rubber based products identified to have scope of development in small scale sector are given below:-

1 Smoked sheets
2 Crepe Rubber
3 Crumbs
4 Concentrated natural rubber latex
5 Rubber bands, elastic thread, balloons, teats etc.
6 Rubber gloves
7 Rubberised coil, slabs
8 Moulded engineering items seals, gaskets etc.
9 Battery boxes
10 Rubber belts.

Projections for finished goods

	Unit.	1989-90	1999-2000
Cycle tyres	Mill Nos	103.04	184.53
Cycle tubes	"	103.04	184.53
V & F Belts	"	42.56	76.21
Footwears	Mill Pairs	127.667	228.63
Conv. & Trans Belting	Tons	12057	21593
Hoses	Mill Meters	8,87	15.88
Latex foam	Tons	24418	43729
Camel back	"	34044	60960
Dipped goods	"	8494	15211
Battery Boxes	"	7360	13181
Cables & Wires	"	2295	4110
Others	"	36323	65050

Additional capacity for tyres and tubes

Name of the Units	Location	Line of manufacture	Annual capacity	I. L or L. O.I & date
1 Sri Chakra Tyres Ltd., Madurai.	Melur Madurai	Tyres for 2 wheelers/3 wheeler,tubes for 2 wheelers/ 3 wheelers	6 Lakh Nos. 6 lakhs Nos	Industrial Licence received in July'83
2 -do-	-do-	Tyres for Cars, Jeeps etc. Tubes for Cars, Jeeps etc.	3 Lakh Nos.	Letter of Intent dated 17-1-84
3 Tamilnadu Rubber Ltd., Madras.	Ramnad	Automobile tyres & tubes	10 Lakhs Nos. each.	Letter of intent dated 13-3-84

Besides tyre few units manufacturing rubber based products in the organised sector in Tamilnadu are given below:-

Name of the Unit	Line of Manufacture	Installed capacity
1 L. G. Balakrishnan & Bros. Pvt. Etd., Coimbatore.	Reclaim Rubber	1800 Tons
2 Fenner Cockill Ltd., Madurai.	Conveyor belts, V & Fan belts, Washer, disphragm moulded goods etc.	not available

3	Madras Industrial Lining Ltd., Ambattur.	Rubber lining of tanks & equipments	20,000 Sq. Mtrs.
4	Nanco Rubber & Plastics Ltd., Coimbatore.	Rubber components	Not available.

M. M. Rubber Co. Ltd., Madras also received industrial licence for the manufacture of latex foam rubber products with an installed capacity of 1000 tonnes.

Synthetic Rubbers:

Instead of depending upon natural rubber, production of synthetic rubber can also be encouraged. But this would be in the large scale sector only. At present, there are only two units manufacturing synthetic rubber in our country. The F.C.C. unit of M.R.L. contains butyene and butane mixture from which butadiene and isobutylene can be manufactured. Butadiene can be utilised for production of polybutadiene rubber, styrene butadiene rubber etc. A unit manufacturing any one of the above rubbers can be set in large scale sector near Manali erea or near Chingleput district.

Raw Materials:

Rubber goods industry also depends upon the ingredients like carbon black fillers used in rubber compounds, rubber chemicals etc. Eventhough there are units for manufacturing carbon black, there are only very few units manufacturing rubber chemicals like zinc oxide, stearic acid etc. in Tamilnadu. About 500 M.T. of rubber chemicals are also imported annually to meet the required demand. Attempts may be made to manufacture some of these imported materials which are not manufactured at present in our country. A few more units in the state may help to reduce the cost of production. Chemicals like sulfenamied, Thiuram, dithio carbamate, guanidine etc. are used as accelerators and zinc salts of fatty acid, wax etc. are used as processing aids in rubber goods manufacture.

Foreign Trade:

There is also good demand for Indian products like anto tyres, rubber and canvas footwar, rubber beltings, rubber hoses etc. in the foreign countries. The main countries which import these goods are USSR, U.K., Bangladesh and to some extent by Afganistan, Saudi Arabia, etc. Exports of rubber goods during 1986-87 are given below:–

	Figures (in'000Rs.) Provisional
1. Total Automobile tyres and tubes	5,95,000
2. Rubber Footwear	55,000
3. Beltings	2,00,000
4. Hoses	27,000
5. Hygienic, Medical & Surgical article of rubber including rubber gloves.	20,010
6. Rubber cots and aprons for Textile Industry.	7,000
7. Sheetings	5,000
8. Cycle tyres & tubes	6,300
9. Other Rubber products	55,090

Problems of the Industry:

The rubber industry is at present facing certain constraints. The present price of natural rubber in the country, is the highest in the world. This is mainly due to the fact that the industry has been deprived of supplies of 17,250 tonnes of natural rnbber. The high price in raw material and deficit in raw material supply very badly affect the rubber goods manufacturers.

Research and Development:

The specific areas where Research and Development required are (1) raw meterials- efforts should be made to improve the plantations of rubber with proper assessments to meet the demand of rubber in future. Again the right type of chemicals and other ingredients needed for the industry should be made either indigeneously or through collaboration with foreign firms. (2) Process Technology- Latest developed processes like powdered and liquid rubber processing, modified vulcanisation process etc. should be adopted (3) Product development-Technical data should be collected for the new products developed in other countries and which could be manufactured in our industry if they suit the need (4) Machinery-New and latest machinery should be included so as to quicken the production and also to produce more sophisticated products.

Conclusion:

If proper raw material are made available with the support of enough Research and Development facilities in tyre and non-tyre sector and use of latest machinery and new process technology, there is ample scope for developing rubber based industry in Tamilnadu. The entrepreneurs should come forward to set up rubber based industries particularly in the small scale sector.

*Paper presented at the seminar on 'New business opportunities for Rubber Industries' held at Madras on 29th June 1988.

SYNTHETIC RUBBERS

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Synthetic Rubbers as is well known, have emerged as a strong complimentary to natural rubbers. Synthetic rubbers, also have brought in special properties, which made Hi-tech products feasible for difficult applications. Two most important reasons for growth of synthetic rubbers are (a) Easy availability of uniform, conbolled, sometime tailormade, rubbers and (b) Increasingly severe conditions of operations for rubber products. Natural rubber, ofcourse, still stands as outstanding in many of the properties and therefore finds large share of rubber market.

Although good quality natural rubber is available in India, it is felt necessary to increase the consumption of SR, so as to overcome the, deficit in natural rubber supply. The consumption of SR can be enhanced by indigeneous production of these rubber and in the meantime lowering the import duties on synthetic rubbers. It should be noted with interest that fewcompanies are in process of establishing new capacities for some of these rubbers.

In this paper, various conventional & special purpose SR have been discussed with a hope that some of these datas will be helpful to small scale rubber units.

(A) Styrene-Butadiane Rubber (SBR)

This is one of the well established and most widely used synthetic rubber in the world to-day. Styrene Butadiene rubbers which are copolymers of styrene and butadiene can be manufactured by emulsion as well as solution methods. SBR made in emulsion usually contains about 23% styrene, randomly dispersed with butadiene in the polymer chains having two third trans content. SBR made in solution contains about the same amount of styrene but both block and random copolymers have been made. They have lower trans, slightly lower vinyl and higher cis contents than emulsion SBR. Emulsion polymerisation can be carried out at 50°C (Hot rubber) as well as 5°C (Cold rubber). Cold rubber is found to have gel free rubber with a higher than usual molecular weight allowing the addition of upto 50 phr of petroleum base oils to permit easy factory handling.

The compounding of SBR is on the same basis as natural rubber or any other unsaturated rubbers. Being unsaturated, it is possible to vulcanise with sulphur system. SBR can be reinforced by carbon blacks and semi-reinforcing mineral fillers. It requires softners or extenders for better processing. In SBR, sulphur content for vulcanisation is calculated on the unsaturated (butadiene) portion of the elastomer. For this reason SBR requires relatively less sulphur and higher accelerator dosage. For non-oil extended SBR, the usual range of sulphur is about 1.5-2.0 phr, while for oil-extended SBR, this should be based on the rubber hydrocarbon only. Although some residual fatty acids are present as soaps in all SBR rubbers, stealic acid is customarily added with zinc oxide for cure activation.

In recent years, tailor made SBRs are available which do not require plasification during processing. These exhibits good dimension control during extrusion and calendering. One of the major defects in SBR rubbers is the lack of green tack. This leads to problem of using SBR in built up products. However this could be overcome by addition of enough tackifier to the compound or apply thin layer of natural rubber cement to the surface of the coated fabric to obtain satisfactory green adhesion.

(B) Acrylonitirle butadiene rubbers:

These rubbers are copolymers of acrylonitrile and butadiene and are commonly known as Nitrile rubbers.

The Production process of Nitrile rubber is similar to those used for other emulsion polymers, such as SBR. Although they can be produced as 'hot' and cold' rubbers, the later ones are more popular in recent times due to its linear polymer chains containing little or no gel and are easier to process than 'hot' rubbers. Nitrile rubbers are available in many grades varying in acrylonitrile content, mooney viscosity etc. Effect of acrylonitrile on physical and chemical properties is well known. However for ready rekoning, it is as follows:

i) Increase in ACN content improves resistance to fuels and oils.

ii) Increases Abrasion resistance and hardness.

iii) Improves Tensile strength and modulus.

iv) Improves Processing behaviour

v) Increases Permeability resistance to gas difusssion.

vi) Decreases Low temperature flexibility.

vii) Decreases Resilience and elasticity

Nitrile rubber, being unsaturated polymer, is compounded along the lines similar to those practised with NR & SBR. This rubber can be compounded with ingredients like black and non-black fillers, plasticizers and process aids, curing system based on sulphur.

Since NBR is an amorphous polymer, it needs reinforcement known to meet the requirements giving best balanced reinforcement, stress-strain and state of cure. When used alone, lower reinforcing carbon blacks are preferred as the highly reinforcing carbon blacks tend to stiffen the uncured stock as well as vulcanisate and pose problems during processing. Consequently, high reinforcing carbon blacks are used mainly at low loadings or in conjunction with the less reinforcing fillers. Mineral fillers, such as silicas of various types, alumina and magnesia are capable of importing properties as good as carbon black barring compression set and resiliance.

Ester and polymeric plasticizers are generally used for petrolium oils and are unsuitable due to its incompatibility with the rubber. They are added to give suitable viscosity for processing, to aid the incorporation of fillers, to provide flexibility at lower temperature etc.

Nitrile rubber has relatively less solubility of sulpur than NR&SBR and therefore requires addition of sulphur in initial stages of mixing to avoid dispersion problem. Low sulpur-high accelerator system is preferred to optimise curing characteristics and physical properties. The compression set property of Nitrile rubber is a function of curing system. Combinations of TMTD with sulphur or sulphur-donor accelerators such as DTDM provide low compression set.

Advancements in the field of nitrile rubber technology includes the emergence of carboxylated Nitrile rubber (XNBR) and very recently hydrogenated nitrile rubber. XNBR cantains in addition to acrylanitrile and butadiene, one or more acrylic type acids as part of the comonomer system. The polymerisation of these produces a chain similar to NBR except for the carboxyl groups distributed with a frequency of about I to every 100 to 200 carbon atoms. XNBR can be vulcanised by neutralising carboxylic groups with the oxide or salt of polyvalent metal. The Zn^{++}, Ca^{++}, Mg^{++} and Pb^{++} ions are capable of effecting such a vulcanization reaction. It can also be cured by using sulphur system using Zno as activator. In this case two types of crosslinks are obtaiend

$$\left\{ -\overset{O}{\overset{\|}{C}}-O-Zn-O-\overset{\|}{\underset{O}{C}}- \text{ and } -S_x- \right\}$$

XNBR vulcanisates are claimed to have much better abrasion resistance alongwith hardness, modulus and tensile strength. The later advancement is based on hydrogenation of butadiene monomer thereby getting rid of unsaturation.

This helps in improving the heat ageing charactistics and oil swelling resistance at higher temperature.

Polychloroprene rubber:

Polychloroprene is highly regular in structure, consisting primarily of a liner sequence of trans-2-chloro-2-butenylene units which result from trans 1,4 addition polymerisation of chloroprene.

Polychloroprenes for general purpose applications are divided into two groups-the 'G' types and the 'W' types. The G. types differ from the W types in that the former are interpolymerized with sulphur and contain thiuram disulphide stabilizer. The comparison of these two types is given in Table-I on page 11.

Since CR is a self reinforcing type polymer, it does not require reinforcement to a great extent. However to achieve specific properties, it may be required to reinforce CR. Semi-reinforcing fillers donot detariorate the physical properties consideratly and hence can be used in large quantities.

Petroleum plasticizers are the most commonly used in CR because of their high softening efficiency and low cost. Paraffinic oils have limited utility because of their tendency to bloom. Naphthenic oil are usually compatible to the extent of 20-25 parts. They are incorporated rapidly and are preferred for light coloured, stain resistant products. Aromatic oils are very

TABLE-I

		G Type	W Type
1.	Raw polymer stability	Lower	Higher
2.	Cure Rate	Cures rapidly	Acceptable curing rate.
3.	Processing Characteristics	Break down to great extent. Less nerve, less shrinking and smooth sheeting	Compounds mix faster and develop less heat during mixing and unured extrusions resist distortion better than G type.
4.	Vulcanisate Properties	Better tear strength higher resilience and elangation and better adhesion	Superior compression set, heat resistance and some what lower hardness & modulus.

The compounding of 'G' and 'W' type differ mainly on are aspect-curing system.

compatible but they increase staining and discoloration tendencies.

The balance of Zinc oxide and Magnesium oxide plays a major role in regulating the scorch and cure rate of CR compounds. The use of four parts of magnesia and five parts of zinc oxide gives a good balance between processing safety and cure rate, as well as vulcanisate which display a flat cure profile and good heat resistance. If the Zno cantent is increased the scarch safety of the compound decreases. G type polychloroprenes can be vulcanised by just using these metal oxides, however, if a higher state of cure is desired, organic accelerator like NA-22 may be used (0.25-1.0 phr) with increasing amount of NA-22, cure rate increases, processing safety decreases, and state of cure improves—as measured by modulus, resiliance, compression set and oil swell.

NA-22 acceleration imparts outstanding quality to W type vulcanisates also. However dosage of NA-22 varies with type of compound. It can be varied from 0.75 to 2.0 phr, former for clay and carbon black loaded compouds while later for low temperature cures or very fast high temperature cures. To improve processing safety, MBTS or TMTM can be used as retarder-activators. It is observed that for good scarch safety and a fast cure, it is better to use NA-22/TMTM combination in compounds that are predominantly carbon black loaded, while NA-22/MBTS combination are preferred for compounds loaded mainly with hardclay. Salicylic acid is another accelerator for W types. It imparts high modulus, tensile strength, elongation and tear resistance. Where exceptionally fast cures are needed even at relatively low temperatures, a combination of two parts diphenylthiourea, one part MBTS, and one part DOT G may be used. Sulphur (0.5 to 1.0 phr). can be used with NA-22 to improve tensile properties of W type. However when heat and compression set resistance are also important, a sulphur donating thiuram, such as Tetrone A, is preferable to elemental sulphur. Sulphur also enhances the bond strength between polychloroprene and brass or brass-plated steel.

DNPT which is a nitrogen-releasing type blowing agent may be used for the blowing of either open-cell sponge or closed cell cellular rubber. To lower the decomposition temperature of this, acidic material such as salicylic acid is recommended. However, the by products of decomposition produce on order which is undesirable in some products. This odour may be considerably reduced by using a basic material such as urea to activate DNPT.

Butyl rubbers:

Butyl rubber (IIR) is a copolymer of isobutylene and isoprene. Isoprene which imparts unsaturation to butyl rubber is added in a very small quantity (0.5%-2.5% mol unsaturation). Unsaturation is added to provide the sites for crosslinks during vulcanisation of butyl rubber.

The compounding ingredients for butyl rubber may include promoters, fillers, plasticizers and process aids and curing agents. Nitrol (Monsanto) or polyac (Dupont) at 0.5-1.0 phr can be used as heat promoters for butyl rubber–carbon black compounds to improve the interaction between filler and rubber. Butyl rubber requires fillers for reinforcement as well as to aid processing. Carbon blacks such as HAF, FEF upto 100 phr and white filler such as silica are used as reinforcing fillers. Combination of carbon blacks and mineral fillers are also used take advantage of reinforcement along with cost reduction. Low unsaturation mineral oils (Paraffinic) are suitable plasticizers used for butyl rubber. For low temperature flexibility, more expensive ester plasticizers are recommended.

Since butyl rubbers have much lower levels of unsaturation than other rubbers they require higher curing temperatures (150-170°C), stranger accelerator combinations or longer cure times for adequate vulcanization. Less sulpur is needed in conventional sulphur-donor systems, however, and excellent vulcanizates are obtained with resin and quinoid systems containing no sulphur at all. Sulphur is sparingly soluble in butyl rubber and therefore total amount should not exceed 1.5 ph. Relatively large amounts of powerful accelerators are normally needed to produce a required state of cure in a practical cure time. Thiurams and dithiocarbanates are either used alone or in combinations with each other. When TMTD is used in combination with 4.4 dithiomar–pholine (sulphur donor), excellant heat resistant and compression set values are attained. Curing system based on Tellurium diethyl dithio carbomate give faster curing rate, excellent reversion resistance, very good heat ageing but are scordy e.g TDC-2.5 to 3.0 phr alone or TDC-1-0 + ZDC-1.0 + MBTS-1.5 par (MBTS acting as retardes). Quinon dioxime and dibenzoylquinon dioxime in combination with red lead and MBTS cured butyl rubber has very high heat resistance (even above 150°C) and therefore droducts like curing bags, bladders, cables can be manufactured using this combination (e. g. GMF-2.0 phr+red lead-3.0 phr+MBTS-2.0 phr). To obtain good flex properties at high temperature above 160°C), exceptional heat resistance and very good compression set resistance, curing of butyl with dimethylol phenol formaldehyde resins is recommended. The reaction is activated by halogens (eg. Stannour chloride, polychloroprene or bromo/chlorobutyl) The present of zinc oxide is essential. Typical system includes i) active PF resin-10 phr+stannous chloride 2.0 phr ii) Active PF resin 10 phr+ Neoprene W- 10 phr+zno-5 phr.

Halogenated butyl rubbers:

Chlorinated (1.1–1.3 wt. % of chlorine) and Brominated (1.9-2.1 wt % of bromine) butyl rubbers are commercially available to overcome some of the processing and vulcanisation problems. Halogenation of butyl increases the reactivity of the double bond and also supplies active sites for cross-linking by the action of zinc oxide. Due to this, care should be taken during mixing as early addition of zno may initiate cross linking. Addition of light Mgo in the initial stages of mixing and Zno addition an cold mill are recommeded

The reinforcement effect of carbon blacks and mineral fillers is similar to that of the regular butyl rubber.

EPDM rubbers:

EPDM rubber, a ter polymer of ethylene, propylene and a small amount of unsaturatad monomer has been increasingly used due to some of its inherent properties. Unsaturated ter polymer provides sites for crosslinking with sulphur thus allowing this rubber to be used by any rubber industry. Of the many third monymers tested, those which are currently used in commercial production are ethylidene norbornene (ENB), 1,4 hexadiene (HD) and dicyclopentadiene (DCPD). Compared to ENB, 1-4 HD gives the polymer a slightly slower cure rate. Amongst the advantages of DCPD are low cost and a good polymerisation rate, but its polymer are slow in crosslinking and very branched.

EPDM's exceptional resistance to atmospheric agents in general (particularly to ozane) and to many chemicals, their excellent low and high temperature behaviour, excellent dielectric characteristics and the competitive cost of their compounds make these rubbers suitable for quality applications.

EPDM's can be crosslinked by
i) Organic peroxides,
ii) Sulphur & accelerators,
iii) Resins, quinoid and maleamides, iv) High energy radiation.

Organic peroxides used for crosslinking of other saturated polymers can also be applied to EPDM. Peroxide level upto 6–8 phr (40% actjve) with coagent could be used. Compared to sulphur cure, peroxide crosslinked EPDM's give better high temperature resistance, lower compression set, improved electrical properties and more stable colours.

The quantity of sulpur and accelerator to be used has to be decided on type and quantity of third monomer present in the polymer. Higher the third monomer content faster is the curing cycle. Since EPDM has lower unsauration, it requires relatively high amount of accelerator and less of sulphur conventional accelerator and less of sulphur conventional accelerators used for rubbers like NR, SBR, NBR etc can be employed with EPDM also.

Crosslinking of EPDM'S with resins, quinones and maleamiodes is possible. However these systems have not been investigated and improved any further as the properties of EPDM's with other systems are more satisfactory.

Crosslinking with high energy radiation is entering the rubber scene enabling continuous and fast production. The cost of this can be kept down by the use of activators like trimethylpropane trimethacrylate (TMPT) and ethylglycol dime-thacrylate (EDMA). Being amorphous ploymer, EPDM requires high loading of reinforcing fillers. Upto 200 phr of reinforcing carbon blacks can be incorporated with addition of suitable quantity of oil. For non-black applications, precipitated fine particle size silica alongwith suitable quantity of DEG is recommended. Mineral fillers such as soft clays are added to silica filled compounds for improvement in extrusion characteristics. Pptd $caco_3$is one of the best filler for EPDM where resistance to corrosive acids, chemicals & gases are not required.

Petroleum oils are compatible with EPDM. However, paraffinic and naphthenic oil are preferred to obtain better retention of physical properties on ageing. Oil level of 50-100 phr in EPDM is not uncommon. Easter plasticizers imparts good low temperature properties.

Special low molecular weight saturated resins based on phenol are used to improve the tack property of EPDM's.

Mixing of EPDM rubber is not a difficult preposition at all. Fillers have to be added with process oils to facilitate quick mixing with good dispersion. For mixing in banbury, upside down method is suggested. Extrusion and colendering of EDPM compounds are relatively smooth and easy as they are generally well loaded.

Ethylene Vinyl Acetate:

Ethylene Vinyl Accetate is copolymer of Ethylene and Vinyl Accetate obtained by random polymerisation under high temperature and moderate pressure with peroxides as initiators. Large variation in Vinyl Accetate is possible giving rise to effect on properties such as flexibility, optical clarity, suitability for crosslinking expansion, processing behaviour etc.

EVA copolymers have some very good characteristics. This includes weathering and ozane resistance, resistance to alkalis, non-oxidising acids etc, excellent surface finish and ability to give bright colour, high expansion characteristics- the last two properties being used mainly in hawai chappal application. However, its abrasion resistance and compression set resistance are poor. And therefore care care should be taken during compounding for foorwear applications.

As EVA is a completely saturated polymer, it can be only cured with peroxide crosslinking agent. Addition of acidic materials to the compound should be avoided so as to avoid retardation in crosslinking. Open air curing is also not possible with this curing system. EVA can take upto 100 phr of fillers. This may include carbon blacks for cable compounds and mineral fillers for footwear applications.

Mixing of EVA can be done either on mixing mill or in internal mixer. However, the disadvantage of this polymers is that mixing has to be done at higher temperature (80-90°C). Also vulcanisation temperature of about 165°C-170°C is required to cure the foam sheets in hydraulic compression press with necessary arrangements for rapid opening of the press (10cm/Sec.) after every cycle.

Applications of EVA include microcellular foams/Hawai chappals, collars, padding in shoes etc, sound deadening sheets, blending with other elasstomers, cables etc. Out of these, microcelluar application has relevant interest and is discussed here briefly.

For manufacture of microcellular foams, there are four polymers available to choose from. a) Conventional natural rubber/high styrene resin combination, b) NBR/PVC, c) High trans content polybutadiene (e.g RB 820), b) EVA of these, the last two are of great interest as they claim to give similar properties. Poly-butadiene with over 90% trans content yields tough, leatherycrystalline vulcanisate which has bright colours, high abrasion resistance and relatively good compression set properties. Another advantage with this polymer is that it is sulphur curable and hence special need not be taken. However this polymer is relatively more expensive and imported. While on the otherside EVA is cheap and isexpected to be manufactured indigeneously in near future. Although EVA has some demerits like poor compression and slipping characterstics, it is possible to overcome these by proper compounding and sole design.

Chlorinated and chlorosulphonated polyethylene:

Both these polymers are being considered for indigeneous manufacture and hence it was thought appropriate to mention here.

These polymers are produced by the random chlorination of high density polyethylene. Chlorination turns rigid crystalline polyethylene in to amorphous flexible elastomer. Chlorosulphonated polyethylene (CSM) in addition to chlorine has a very small quantity of sutfonyl chloride group. This group helps in allowing curing of polymer with non-peroxide systems. Chloride content of both polymers can vary between 20% to 45%. As the chlorine content increases, the flexibility increases. This is true upto certain concentration of chlorine and then polymer will again start becoming stiff due to polarity of chlorine.

Both these polymers can be compounded with fillers available to rubber industry. These include carbon blacks, mineral fillers and metal oxides (e. g Mg°) as acid acceptor. However when peroxide is used as curing agent, acidic fillers should be avoided. Filler loading upto 150 phr can be easily done. Both polymers require relatively higher quantity of plasticizer to control modulus and hardness. Unsaturated plasticizers (e.g petroleum oils) should be avoided. In peroxide cured compounds plasticizers, like DOP, DOA, DOS, TATM etc are suitable.

For CSM, apart from peroxide system, sulphur/accelerate system, maleimide system/ can be used. In sulphur accelerator system, TMTD/ sulphur or TETD/sulphur or Tetrene A can be used with MBT, MBTs and DOTG as secondary accelerators.

Since both these polymers have basically same polymer structure, they exhibit similar physical & chemical characteristics. These include:

- Excellent weatherability and ozane resistance.
- Excellent heat ageing resistance.
- Inherent resistance to ignition.
- Very good oil & chemical resistance.
- Good low temperature property.

SBR based:

Brake Cylinder Cup		Jar Rings	
SBR 1500	100.0	SBR 1502	100
Zinc Oxide	4.0	Zinc Oxide	4.0
St. Aciod	2.0	St. Acid	1.0
HAF black	55.0	Act $caco_3$	50.0
C.I. Resin	4.0	Har clay	50.0
Aromatic Oil	5.0	Process Oil	5.0
Antioxidant DPAD	1.0	P. Wax	2.0
TMTD	0.7	Red Oxide	1.0
TETD	0.7	TMTM	0.75
ZDC	0.3	Sulphur	2.3
Sulphur	0.5		

Nitrile based:

Pressure Cooker gasket	phr	Petrol hose (Tube)	
Nitrile-Medium ACN	100.0	Nitrile-Med ACN	100.0
FEF black	40.0	FEF black	20.0
Ppt $caco_3$	50.0	China clay	150.0
Paraffinic Oil	5.0	Whiting	50.0
Zinc Oxide	5.0	Zinc Oxide	4.0
St. Acid	1.5	Tt. Acid	1.0
C.I. Resin	5.0	Aromatic Oil	10.0
ZDC	0.5	Ci Resin	5.0
TMT	0.5	DOP	5.0
Sulphur	0,75	MBTS	1.2
		TMT	0.15
		Sulphur	1.6
Cure: 160°C–5 Min.		Cure: 140°C–20 Min.	

Polychloroprene based:

	Petrol hose (cover)
CR (W type)	100.0
Zinc Oxide	5.0
St. Acid	1.0
Light Mgo	4.0
China clay	100.0
FEF	25.0
Whiting	75.0
Naphthenic oil	15.0
Cl Resin	5.0
DPG	0.7
TMTD	0.7
Sulphur	1.0

Cure: 140°C–25-30 Min.

	Oil resistant –Vee Belt (Base)
CR (G Type)	100.0
Light Mgo	4.0
Zinc Oxide	5.0
St. Acid	2.0
GP Fblack	50.0
SRF black	30.0
Naphthenic Oil	10.0
NA-22	0.7
Antioxidant	3.0

Cure: 150°C/15 Min.

Butyle Rubber Based:

	Curing bag
Polysak butyl 301	90.0
CR (W type)	10.0
Zinc Oxide	5.0
St. Acid	1.0
FEF black	50.0
Process Oil	5.0

	Automative heater hose
Polysar butyl 301	92.0
Cr (W type)	8.0
Zinc Oxide	5.0
St. Acid	2.0
FEF black	30.0
Clay	150.0
Tackifier	15.0
Paraffin Wax	2.0
MBTS	20.0
GMF	2.0
Red lead	3.0

	Conveyor belt (cover)
Bromobutyle ×2	100.0
Zinc Oxide	5.0
St. Acid	1.0
HAF carbon black	40.0
FEF carbon black	20.0
Naphthenic Oil	10.0
Cl Resin	3.0
Light Mgo	0.5
MBTS	1.0
TMTD	1.0

EPDM rubber based:

	Vacuum brake hose
EPDM (ENB)	100.0
Zinc Oxide	5.0
St. Acid	1.0

	Weather strips
EPDM (ENB)	100.0
Zinc Oxide	5.0
St. Acid	1.0

GPF black	150.0
SRF black	100.0
$caco_3$	50.0
Naphthenic Oil	150.0
DTDM	2.0
TMT	3.0
ZDC	5.0
Sulphur	0.5

Cure: 150°C-30 min.

FEF black	50.0
SRF black	50.0
$caco_3$	75.0
Whiting	100.0
Process Oil	120.0
6-Ppd	1.5
Sulphur	1.0
TMT	1.0
ZDC	2.0
CBS	1.5

Cure: 150°C-20 min

EVA based:

Hawai Chappal

EVA (18% VA)	70.0
Natural rubber	30.0
Act. $CaCo_3$	70.0
Zinc Oxide	2.5
St. Acid	1.0
TiO_2	3.5
Micro crumb	40.0
ADC blowing agent	6.0
Dicumyl peroxide (40%-active)	3.0

Colour-As required

Cure: 160°C-12 min.

RB-820 based:

Hawai Chappal

RB 820	70.0
Natural rubber	30.0
Zinc Oxide	5.0
St. Acid	2.0
Silica	20.0
Act $CaCo_3$	50.0
Micro crumb	50.0
TiO_2	3.5
ADC blowing agent	7.0
Sulphur	1.5
MBTS	1.3
DPG	0.2
Urea	2.0

Cure: 160°C-8 min.

Chlorinated polyethylene based:

Heat resistant conveyor belt

CPE (36%Cl)	100.0
Magnesium Oxide	10.0
FEF black	40.0
SRF black	40.0
TATM plasticiser	30.0
TDO antioxident	0.5
Peroxide(40% active)	6.0
TAC coagent	2.0

Chlorosulphonated Polyethylene based

General purpose compound

CSM (35% Cl)	100.0
Magnesia	4.0
SRF carbon black	3.0
Whiting	80.0
Chlorinated wax	20.0
Pentaerythritol	3.0
NBC	3 0
Tetrane A	2 0
MBTS	0.5

*Paper presented at the seminar on 'New business opportunities for Rubber Industries' held at Madras on 29th June 1988.

Butyl Rubber Project

A Rs. 250 crore butyl rubber project will be set up at Vishakapatanam by the Modi Rubber Limited in collaboration with the Soviet Union for manufacture of 25,000 tons of butyl rubber per annum.

The clearance of the Project is expected by the end of 1988. Butyl rubber production involves high technology and would lead to 100 percent import substitution. At present, about 14,000 tons of butyl rubber is being imported annually at a cost of Rs. 35 crores in foreign exchange.

Problems of small scale rubber units and suggestions for redressal

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INTRODUCTION

A common man is of the opinion that every businessman is amassing wealth and every company in an Industry is making huge profits. Talking of the Rubber Industry, the growth projection is so encouraging that every entrepreneur is attracted towards it. As a result of which, there is a mushroom growth of Small Scale Rubber Units in different parts of the country which has given rise to a lot of problems. The problems are not inherent in nature, but basic, which are to be defined and analysed to evolve suitable solutions.

SIZE OF UNITS AND RESOURCES:

Most of the Small Scale Units are either proprietory or partnership firms which are managed by a single person who takes important decisions. He frames the policies, sets objectives and executes them. The basic problem here is the *Capacity, Knowledge and Skills, the man possess and the Style* he adopts *to lead his team* in the organisation *to achieve its objectives*.

OBJECTIVES-UNCLEAR:

Considering various factors organisations set objectives. But the question is '*Do they orient themselves to achieve these objectives*''-For example; A company's marketing objectives may be for

- SURVIVAL
- CURRENT PROFIT MAXIMISATION
- MARKET SHARE LEADERSHIP (OR)
- PRODUCT QUALITY LEADERSHIP

Each objective may have different impact on the price, quality and the process of manufacture. The marketing strategy has to be totally different for each situation. If this fundamental aspect is not clearly understood, it will lead to the problem of sickness.

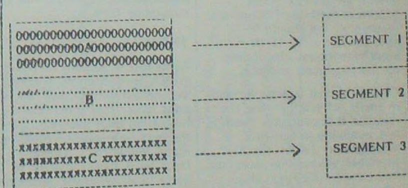
MARKETING CONCEPT/STRATEGY:

The basic distinction between the concepts of selling and marketing has to be clearly understood; otherwise it amounts to the problems of *Turnover of Capital and Finished goods inventory*. Without doing SWOT analysis, adopting any marketing strategy is suicidal- A Company with limited resources cannot afford to go in for ''Differential Marketing'', because this strategy involves,

- Product modification costs
- Product cost,
- Administration cost
- Inventory cost
- Promotion cost

MARKETING COVERAGE STRATEGY

Company's Marketing Mix



Since, this leads to *'HIGHER SALES & COSTS'* nothing can be said, in advance regarding profitability. The Company *with limited resources* will not be able to meet both the ends and ultimately run into loss.

UNHEALTHY COMPETITION

Companies concentrating on a particular industry, say, Automobiles, compete among themselves to bag orders by cutting down their prices. Sometimes, they go to the extent of *working on break-even prices,* to fill the capacity. Of course, this action is justified for a company which is struggling for survival. But, the fact remains that a few companies neither comply with the schedules nor complete the order as a result of which, both the buyer and the supplier suffer. Besides this, another prospective supplier has been deprived of an opportunity. It is not unusual in open tenders of Public Sector Undertakings. The reason being the *lack of planning and attention to pricing* due to working capital problems and *desperate attempt to grab the orders irrespective of viability.*

COST CONCIOUSNESS/ INVENTORY:

Level of Inventory depends on Company's marketing Mix and the Capacity of production. Even if we do not adopt Japanese method of "Conveyor Inventory', we should be able to work with 15 days or 1 month inventory, depending on the resources available.

Control of cost is very difficult in small scale units, for the reasons that adequate fund is not available to buy raw materials in time. Credit purchase always increases the input cost. Besides this, labour turnover & consequent loss of production does increase the cost.

HUMAN & INDUSTRIAL RELATIONS:

There are instances where the managements fail to fulfill their commitments to their workmen, in time and in some companies even legal obligations are not met where the Unions gain importance and at times it leads to confrontation and strained relationships. Most of such problems are invited.

PRESENT TREND:

Quality is of prime importance in today's business. Most of the industries need only quality products irrespective of their prices. The invasion of Japanese technology, has reinforced this trend. Besides this, the export market, is *highly price sensitive and quality oriented.* This being the trend, small scale units find it rather difficult to comply with the requirements of 'Consistent Quality", due to *lack of testing facilities.* Most of the small scale rubber units do not test the rheological properties of compounds, due to the high investment on the Testing Equipment. For instance, a company which has an Injection Moulding machine must have a rheometer. Formulations are standardised only *by trial and error method,* which *causes rejection and consumes time.*

THREATS:

Large Scale Rubber factories, which have built in systems and infrastructure have an edge over other units in marketing their products. In the non-tyre sector, there are many evidences. These large units have capacity to cater to all types of industries and they do not spare any opportunity and compete with even a small scale unit. They are better placed with regard to market information and resources.

"Keeping pace with growing technology" is indispensible for any type of industry.

As far as the Rubber Industry is concerned, the advent of new types of polymers for critical applications and new processing machineries for precision and consistency of quality and higher productivity have been to some extent utilised by some non-tyre units, who have got tie-up with companies like Maruthi. They are better placed than other similar units as the latter either do not have such opportunity or worry about investment and marketing. The need of a qualified and experienced technologist is stressed here, who can better understand the changes taking place and adopt faster.

EXTERNAL FACTORS:

In the Rubber Industry, some companies have products which are seasonal in nature, some *concentrating* on one industry or a particular company and some have a single product line and a few have multi product system. The consumer durable 'footwear' business is seasonal in nature. The production *is badly affected by power cut'* due to the failure, of monsoon, as a consequence of which booming sales in the month of May, June and July cannot be effected.

Besides this is "The Budget' Every company has to modify its policies, and strategies depending on the outcome of the budget. It is obvious from the fact of introduction.

REQUIREMENTS OF INTEGRAL COACH FACTORY.

S.No.	Description of item	Drawing No.	Approximate annual requirements.	Approximate annual consumption value.	Present source of supply (State).
1	Celling Rubber Profile	T. 55.525	900	9,900	Tamil Nadu
2	Rubber Guide	F. 56.014001	2,600	1,300	—do—
3	Rubber Stop	F. 56.017.01	6,500	6,500	—do—
4	Door Stop	T. 63.543.01	22,700	4,54,000	Maharashtra, Haryana, Kerala.
5	Rubberised Coil Cushions	TCN 61 801.01 to 12	35,000	21,44,600	—do—
6	Foam Rubber	WGSC WAC-61 .002 01 to 09	9,400	93,75,000	—do—
7	Rubber profile	T.44.641	4,500	1,00,000	Tamil Nadu
8	Rubber Profile	T. 54.511	16,00,030	1,44,80,000	—do—
9	Rubber Profile	T.54.550	4,270	21,400	—do—
10	Window Stop	T 54.606	1,33,200	20,000	—do—
11	Rubber Seal	ICF—SK—541082	45,000	22,500	—do—
12	Rubber Buffer	T.55.527	7,800	3,900	—do—
13	Rubber Profile	T. 54.137	860	60,200	—do—
14	Door Stop	T.54 517	5,400	5,400	—do—

S.No.	Description of Item	Drawing No.	Approximate annual requirements.	Approximate annual censumption Value.	Present source of supply (state)
15	Ceiling Rubber Profile	T.51.640	5,000	8,17,500	Tamil Nadu, Maharastra.
16	Ceiling Rubber	MGT 52 001	5,300	5,300	Tamil Nadu
17	Lower Rubber Washer	T.01.601.01	10,000	5,90,000	Tamil Nadu. Maharastra and West Bengal
18	Lower Rubber Washer	MGT 01·007.01	6,400	2,56,000	—do—
19	Upper Rubber Washer	T.01.609.01	10,000	5,15,000	—do—
20	Rubber Snubber	MGT 01.020.01	6,400	51,200	Tamil Nadu
21	Rubber Packing	T 01.532.01	10,700	32,100	—do—
22	Rubber Packing	MGT 01.045	7,600	15,200	—do—
23	Upper Rubber Washer	T 05.618.01	5,000	8,17,500	—do—
24	Rubber Snubber	MGT 05.029.01	7,700	53,9000	Tamilnadu, Maharashtra & West Bengal.
25	Ceiling Rubber	F 06 008.01	2,200	15,400	Tamil Nadu
26	Ceiling Ring	T 02.624.01	8,800	17,600	—do—
27	Siient Block for Anchor Link.	T 07.601.01	6,000	7,20,000	Maharashtra:
28	Silent Block for Centre Pivot Pin.	T 06.611.01	1,500	7,05,000	—do—

of modvat scheme, mainly in the interest of Small scale units in one budget and subsequent withdrawal of a portion of the benefit. Such uncontrollable factors hamper the stability and growth of small scale units.

SUGGESTIONS:

It is always challenging to work under constraints. Despite the fact that most of the problems cited above are unavoidable, some companies have overcome and shown steady growth probably because of their ability to forecast the trends and needs and their systematic approach to solving problems.

As a general guide to "problem solving" the following may be considered:

—Short term planning for 3 years.

—Recruitment of right personnel.

—Operating at maximum possible efficiency.

—Stagewise quality control. Minimum inventory.

—Obtaining market information (about the raw materials availability and price)

—Knowledge about buyers characteristics and capacity.

—Efficient distribution & promotion system.

—Adoption of a suitable marketing strategy depending on the resources available.

CONCLUSION:

The Indian Rubber Industry has made significant progress during the last 3 decades. Keeping in mind, the growth rate and the challenges that lie ahead, the small scale units which form the major part of the Rubber Industry, with a sense of competence and expectations of a brighter future, should overcome all hurdles and march forward. 'The need of the hour" is the "Action plan', for the growth of every small scale unit which is the backbone of the entire industry and in turn the economy.

REQUIREMENT OF OIL AND NATURAL GAS COMMISSION

RUBBER MOULDED/RUBBERISED ITEMS:

	Qty.	Value in Lakh (Rs.)
1) For A-1400 PT/850 PT/12P-160/10P-130:		
1. Liner Gasket 5"	150 Nos	0.025
2. Liner Gasket 6"	200 ,,	0.1
3. Liner Gasket 7"	300 ,,	0.6
4. Gasket for value cover	500 ,,	0.05
5. Valve seat bushing far valve assy.	1140 ,,	0.03
6. Valve inset	360 ,,	0.3
7. Diaphragm	20 ,,	0.05
8. Valve Inset Polyurethene	200 ,,	1.00
9. Piston Assy. for Triplex Pumps in various sizes ranging from 5" to 7.5"	2200 ,, (all sizes)	12.00
10. Piston cups (spare) for above pistons	2200 ,, (all sizes)	2.50
11. Valve guide	250 ,,	0.16
12. Valve cover packing	150 ,,	0.02
13. Gasket for liner	150 ,,	0.02
14. Packing for piston rod and piston	450 ,,	0.02
15. Seal for valve cover	300 ,,	0.01
16. 'O' Ring	100 ,,	0.01
17. Compressor balloons for all triplex pumps	200 ,,	4.00
2) For A-1700 Slush pump:		
1. Gasket for valve cover	190 ,,	0.02
2. Valve Guide bushing for valve assembly	300 ,,	0.006

	Qty.	Value Lakh (Rs)
3. Gasket for cylinder head	75 ,,	0.010
4. Valve insert	625 ,,	0.5
3) For A-700 Slush pump:		
1. API–6HP Piston assembly 8;'	350 ,,	2.75
2. Baffle for cross head	60 ,,	0.07
3 Packing rig (Spacer) for Cylinder liner	80 ,,	0,20
4. Valve Cover gasket for valve assembly	650 ,,	1.0
5. API 6 HP Piston Cup 8" size	700	1.0
4) For Garden Denver Pump:		
1. Valve Insert	200 ,,	0.08
2. Packing assembly	75 ,,	0.15
5) Miscellaneous Items:		
1. Bladder for air ventilated clutch size 500×200	75 ,,	1.60
2. -do- 600×250	80 ,,	2.00
3. -do- 1120×300	70 ,,	2.20
4. Bladder for air ventilated clutch size 1250×300	64 ,,	2.50
5. Air fluex clutch 24 CB 500	20 ,,	5.00
6. Air flex clutch 24 VC 500	20 ,,	6.00
7. -do 42 VC 1200	30 ,,	10.00
8. Drill pipe protectors plain/flutted in various sizes	- ,,	20.00
9. Packing for 3" Uniflex wash pipe	150 ,,	0.75

ALTERNATE SOURCE REQUIRED FOR ITEMS ALREADY DEVELOPED.

	Qty.	Value Lakh (Rs)
1) For A-700 Slush Pump:		
1. Valve insert	620 Nos.	0.50
2. Disphragm Grease Seal Retainer	30 ,,	0.05
3. Universal Packing set for stuffing box	750 ,,	1.00
4. Liner Packing Rig	545 ,,	0.10
5. API-6 HP Piston Assy. for Duplex pumps 7"	700 ,,	5.00
6. API-6 HP Piston Assy. for Duplex pumps 6.5"	700 Nos.	4.00
7. API–6 HP Piston Cup size 7"	1400 ,,	0.18
8, API-6 HP Pis on Cup size 6.5"	1200 ,,	1.50

Items 5,6,7 and 8 are common to all Duplex pumps.

	Qty.	Value Lakh (Rs)
2) For 1700 P Slush Pump:		
1. Compensator Balloon	40 ,,	0.5
2. Liner Packing Ring	150 ,,	0.04
3. Packing Set for stuffing box	50 ,,	0.05
3) For 2 PN-1250/1258/100 Slush Pump:		
1. Valve inserts for Valve Assembly	1500 ,,	1.00
2. Cylinder line Packing	1000 ,,	0.40
3. Glass Packing Assembly	500 ,,	1.00
4. Valve Guide Upper & Lower	2000 ,,	0.40
5. Valve, Cap Packing	1200 ,,	0.75
4) Miscellaneous Items:		
1. Air Tube Clutch Assy Size 1070 x 200 mm	50 ,,	4.5
2. ATC Assy. 700 x 200 mm	50 ,,	3.00
3. ATC Size 500 x 125 mm Complete Assembly	350 ,,	8.00
4. ATC Complete Assembly 300 x 100 mm	50 ,,	0.60
5. Wash pipe packing for swivel on Russion rings	2000 ,,	0.50

*Paper presented at the seminar on 'New business opportunities for Rubber Industries' held at Madras on 29th June 1988.

Rubb. Board bull. 23, No. 4

Rubber Cultivation in Madappally Village

V. K. BHASKARAN NAIR
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1 Introduction

The Rubber Development Project of Modi Rubber Limited was established with the avowed objective of helping the small rubber growers to increase the production of rubber from their holdings. The Project is intended to work as a catalyst for the quick and efficient implementation of the various development programmes drawn up and launched by the Rubber Board for the small rubber growers. The production and productivity of the small holdings in the Project areas are envisaged to be increased by resorting to intensive application of modern scientific cultivation practices over a period of three to four years.

The development activities of the Project were first started in Akalakunnam village in Kottayam district in April 1979. The rubber area in the village was 1517 hectares and the number of rubber holdings 1705. Intensive extension and advisory work was carried out by the Project's technical staff among the small growers for four years. The Project's work in the Akalakunnam village was completed in 1983. A skeleton staff only was kept there afterwards for follow-up actions and the staff was completely withdrawn in August 1987.

The Project's activities during the four years resulted in phenomenal improvement in the condition of the rubber small holdings in the village. There has been steady progress in the adoption of scientific cultivation practices such as use of high-yielding advanced planting materials, timely manuring and spraying, scientific methods of exploitation of the crop and its processing. The productivity of the small holdings in the area increased by about 81 per cent in 1983, and 88.5 per cent in 1986.

On completion of the work in Akalakunnam village in 1983, the Project switched over its activities to Vakathanam and Madappally villages in Kottayam District in response to the wishes of the rubber growers in that area. Preliminary to the extension and advisory work, a detailed survey of the rubber holdings in the whole of Vakathanam village and in two wards (Nos I and 10) of Madapally was first undertaken. The survey brought out significant information regarding the rubber area, cultivation practices, exploitation methods, yield pattern, diseases and various other aspects. The data collected, analysis of the data, and a summary of the elaborate observations made in the field were compiled and published as a report in July 1984. The Project's activities in the villages were drawn up and implemented on the basis of the findings of the survey.

In the Vakathanam Project area, there are 1983 small rubber growers an the total area under rubber is 2406 hectares. Extension and advisory activities were started there in 1984. Considerable improvement has been noted in regard to use of high-yielding planting materials, timely application of fertilisers, spraying against leaf diseases, adoption of other plant protection measures and practice of scientific methods of exploitation of the crop within the span of about four years. The lowest yield recorded at the time of the survey was 165 kg. and the highest yield 1770 kg. per hectare per year. By 1985 the lowest yield increased to 300 kg. and the highest yield to 2000 kg.per hectare. So also, 54 per cent of the holdings is now getting the yield of above 750 kg. per hectare per year against 22 per cent in 1983.

Since the objectives of the development project in Vakathanam village have been achieved to a large extent, it was decided to extend its activities to a new area. The village now selected is Madapally which lies adjacent to Vakathanam village and two wards of which had already been included in the Vakathanam Project.

The survey work was started in August 1987 and completed in December 1987. The method of survey was the same as was adopted in 1983 for the survey in Vakathanam village. The cultivators were personally contacted by the Extension staff of the Project and each holding was visited. The details were recorded in a standard proforma. The data collected were collated and transferred to tabulation sheets. The analysis was undertaken on the basis of the information provided by the tabulation sheets. The tabulation and analysis were completed within a period of two months. This report is a summary of the elaborate data collected during the survey.

2. Area and its Distribution

The total area of Madappally village is 2402.08 hectares, of which 2089.66 hectares are dry land, 258.33 hectares paddy fields and 54.09 hectares poramboke land. There are 1664 rubber holdings, all of them being small holdings below 20.23 ha. in extent, and their total area is 956.55 ha. Rubber occupies 39.82 per cent of the total area of the village. The average size of a rubber holding is only 0.57 hectare.

Madappally village consists of II panchayat wards. Of these, wards No. I and 10 were already surveyed in 1983 along with Vakathanam village and formed part of the project area. The number of rubber holdings in the two wards is 245 and the area under rubber is 160.54 hectares.

The panchayat wards in Madappally village now surveyed are wards No. 2, 3, 4, 5, 6, 7, 8, and 11. The total number of rubber holdings in the nine wards is 1419 and the total area of the holdings is 796.01 ha. The present report is based on the survey conducted in these nine wards of the villages.

3 Registration of Estates

As per the provision of the Rubber Act, 1947, every rubber holding in the country must be registered with the Rubber Board. An application in the prescribed form (Form A) in duplicate has to be made by the owner for each of the holding owned by him, to the Deputy Development Officer in charge of the concerned regional office of the Rubber Board who is vested with the authority to issue planting licences and registration of rubber estates. A register number will be allotted to each estate or holding. Only registered holdings are eligible for the benefits of the various development schemes implemented by the Rubber Board.

However, it has been found during the survey that a large percentage of the growers in the village has not registered with the Board their area under rubber.

From the table it can be seen that the percentage of unregistered holdings is 64.69, which is rather very high. The same phenomenon was observed in Vakathanam village also during the survey conducted in 1983.

The reasons for not registering the holdings, as ascertained from the holders, can be explained as follows:

i) A large number of small growers (about 62%) believe that they are not eligible for subsidies or other assistance from the Rubber Board as their area is below the specified minimum extent or the area is interplanted or planted with clonal seedlings, or their ownership of the land is not absolute. As such they do not bother to get their area registered

ii) Some of the growers (about 20%) feel that the procedure for registration is cumbersome and hence avoid it.

iii) A small percent (about 2 %) of the growers has applied for registration but has not followed it up.

iv) About 16 per cent of the registered holders have planted clonal seedlings for which the Board does not grant registration unless they are budded with approved varieties. It is

Table 1

Registration of Rubber areas

Whether registered or not	Number of holdings	Percentage	Area (Ha.)	Percentage
Registered	501	35.31	M 214.26	49.83
			I 215.68	50.17
			T 429.94	54.01
Unregistered	918	64.69	M 134.26	36.68
			I 231.81	63.32
			T 366.07	45.99
Total	1419	—	796.01	—

(M = Mature, I = Immature, T = Total)

noted that an extent or 44.33 ha. of immature rubber area is planted with such unapproved material.

Serious efforts have to be made to convince the growers about the necessity for getting their areas registered and the benefits accruing therefrom.

4. Year of planting

The year of planting varies from 1960 to 1987. 51.97 per cent of the holdings were planted during the period 1981 to 1987 and 48.03 per cent before 1981. From this it can be seen that about 52 per cent of the planting is young and productivity will largely depend on the quality of the materials used in and the standard of maintenance of these holdings.

The following tables indicate the extent of immature and mature areas and the year-wise planting.

5. Planting materials used

More than 81 per cent of the total area is planted with budded materials. Only obout 19 per cent of the area is under clonal seedlings. This indicates great improvement over the situation in Vakathanam village where at the time of the survey in 1983 more than half the area was planted with seedling materials. However, the objective should be to make 100 per cent planting with high-yielding materials. Majority of the growers who planted clonal seedlings in their holdings cited financial stringency as the reason for not going in for budded materials. Some of them believed that budgrafts would not grow well in their fields which were densely interplanted with other crops.

6. Topography

The general terrain of the land is moderately slopy or level. Steep slopes are comparatively rare.

Table 2

Immature and Mature areas

Maturity	Area in hectares	Percentage
Immature	447.49	56.22
Mature	348.52	43.78
Total	796.01	

Table 3

Immature area

Immature area: yearwise planting	Area in hectares	Percentage
1985—1987	194.35	43.43
1981—1984	219.47	49.05
Pre—1981	33.67	7.52
Total	447.49	

Table 4

Planting materials used

Planting material	Area under cultivation in hectares	Percentage
Budgrafts	644.96	81.02
Clonal seedlings	151.05	18.98
Total	796.01	

Table 5

Topography

Type	Extent in hectares	Percentage of total area
Level land	305.89	38.43
Moderate slopy	427.43	53.70
Steep slope	62.69	7.87
Total	796.01	

7. Intercropping

Generally intercropping and interplanting are considered to be harmful to the proper growth and yield of rubber plants. However, planting of certain crops like banana, ginger, pineapple etc. are allowed in rubber holdings. But interplanting with tapioca and other soil exhaustive crops is not advisable. In the Madapally village, only about 29 per cent of the planted area is seen to be intercropped.

Table 6
Area under intercropping (Immature)

Intercrop	Area in hectares	Percentage
Intercropped	130.77	29.22
Not intercropped	316.72	70.78
Total	447.49	

8. Interplanting

The survey indicates that only about 65 per cent of the rubber area is exclusively planted with rubber and/or with the admissible minimum number of other trees.

9 Ground Cover

Cover crops are established and maintained in rubber plantations for covering the soil and improving or maintaining the soil structure and fertility. In most of the rubber holdings in the surveyed area, good ground cover is not seen to have been established. It is necessary to advise and convince the growers about the necessity of establishing and maintaining good ground covers in their rubber holdings.

10 Planting Techniques

Seed-at-stake planting, stump planting and planting of stumped buddings are not much favoured now as per latest recommendations. Raising the planting materials in polybags and transplanting them in the field is considered to be the most modern method of planting rubber. The survey shows that 81 per cent of the area in the village is planted with budded stumps and 19 per cent with seedling stumps which comprises both mature and immature areas. The situation calls for concerted action to arrange field budding in immature areas wherever practicable. Planting with polybag plants should be encouraged in future. The planting density should be limited to the recommended number of 420 to 455 per hectare.

11 Manuring

About 95 per cent of the holdings are being manured (Table 9). But, to obtain optimum results, it is important to see that application of fertiliser is made judiciously. Farm manure cannot be considered as a balanced fertiliser. Even in the case of application of fertiliser mixture, the optimum dosage and proportion could be determined only on the basis of soil and leaf analysis. Facilities for the same are available with the Rubber Board and other agencies. Rubber growers should make use of these facilities and ascertain the manuring formula most suited to their holdings. The discriminatory method of fertiliser usage has come to stay as the most efficient and economic one for rubber. It offers the following advantages over the blanket recommendations commonly practised-(i) ensures optimum growth and yield of rubber, (ii) most often reduces the cost of manuring, (iii) avoids problems resulting from unbalanced nutrition such as wind damage, pre-coagulation of latex and inducement of brown bast.

12 Plant Protection

i) *Spraying*: The survey revealed that about 52 per cent of the area remains unsprayed (Table 10) against the incidence of abnormal leaf-fall disease. The damages caused by the disease are reflected in several ways. In young rubber, leaf fall and shoot rot cause extensive die-back resulting in

Table 7
Area under interplanting

Interplanted	Area in hectares	Percentage
Interplanted	281.71	35.39
Exclusively planted with rubber or with allowable number of other trees	514.30	64.61
Total	796.01	

Table 8
Planting techniques

Technique	Area in hectares	Percentage
Field budding	55.46	6.97
Polybag planting	42.67	5.36
Budded stumps	546.83	68.70
Seedling stumps	151.05	18.97
Total	796.01	

Table 9

Manuring Practices

Manuring	Number of holdings	Percentage	Area in hectares	Percentage
Single applications	482	33.97	235.56	29.60
Two application	666	46.93	445.69	55.99
Farm Manure	188	13.25	77.97	9.79
Nil	83	5.85	36.79	4.62
Total	1419	–	796.01	–

Table 10

Prophylactic Spraying

Spraying	Number of holdings	Percentage	Area in hectares	Percentage
Sprayed	521	36 72	382.99	48.11
Unsprayed	898	63.28	413.02	51.89
Total	1419	–	796.01	–

retardation of growth. In mature rubber, loss of yield to the tune of around 30 to 50 per cent is reported in high–yielding cultivars, due to the occurrence of the disease. The facilities available with the Rubber Board and other agencies for spraying should be fully utilised and all rubber areas brought under proper protection from leaf disease.

ii) *Pink disease treatment:*

Pink disease is more damaging for plants in the age group of 3 to 12 years. The main seat of infection is usually at the fork region. The treatment recommended in the early stage is application of Bordeaux paste at the affected region. If appropriate protective measures are not taken up timely, severe damages may be caused to the plants. In surveyed area pink disease has been observed in 57 per cent of the holdings, most of the plants affected being immature.

iii) *Panel protection*: In the holdings visited, brown bast has been observed in almost all areas under tapping. Various other diseases affecting the bark of trees are also prevalent in rubber. Appro–priate panel protection measures have to be adopted regularly to prevent these diseases. In our observation only in about 21 percent of the area panel protection measures have been undertaken (Table II). More emphasis has to be given to this aspect. Negligence in the proper upkeep of the tapping panel may lead to low yield and affect proper bark renewal.

iv) *White washing*: Sun-scorch is of common occurrence in young rubber plants during summer. As a preventive measure, white-washing of the stem from the collar upwards on the brown bark has to be carried out using lime, during hot weather. If untreated, affected plants may dry up or may be blown over by wind.

Rubber plants in over 65 percent of the immature area have been found to be protected by white washing. The rest of the plants have also to be given protection.

v) *Mulching and shading*: Mulching with dry leaves, grass cuttings and cover crop loopings around the plants is recommended as a cultural operation for young rubber, because it will be helpful in preventing soil degradation. Mulching should be undertaken after fertiliser application and before the onset of regular summer. Usually the month of November is the ideal time for mulching to protect the plant from the adverse effect of drought. Provision of bamboo baskets or plaited coconut leaves affording shade and mulching the plant bases for young rubber plants in the field will be helpful in reducing sun-scorch.

It has been observed that mulching and shading are not generally practised by all the rubber growers.

Table 11

Panel protection for trees under tapping

Panel protection	Area in hectares	Percentage
Protected	71 86	20 62
Not protected	276.66	79.38
Total	348.52	–

13 Exploitation

The general recommendation is that budded trees are to be tapped on half spiral alternate daily (S/2 d/2) system and seedling on half spiral third daily (S/2 d/3) system. To ward off incidence of brown bast, it is recommended to adopt d/3 tapping system in cases where high incidence of brown bast is encountered. But it has been noticed during the survey that in the Madappally village, irrespective of the type of the trees, in over 53 per cent of the area, daily tapping is practised (Table 13). This points to the need for impressing upon the growers to adopt a scientific approach in selecting the tapping system most suited to the trees in their holdings. The advantages of following the correct tapping practices are to be clarified to them and they should be convinced of the benefits.

14 Rainguarding

The survey revealed that in the Madappally village, only about 4 growers have adopted rainguarding in their holdings. This shows that the rubber growers are not generally aware of the advantages of rainguarding. It is stated that the number of tapping days can be increased by about 30 to 40 in an year by rainguarding the trees.

15 Yield

The average productivity of of the rubber plantation industry in India as a whole as per the statistics for 1986-87 is 926 kg. per hectare and that of the estate sector 1088 kg. per hectare. The average productivity of the small holding sector is reported to be 886 kg. per hectare. On an analysis of the yield data collected during the survey it is seen that the average yield of the rubber holdings in the 9 wards of the Madappally village is only 735 kg. per hectare. It can be seen from the table given below (Table 14) that in over 75 per cent of the holdings in the area, the average yield is below the national average recorded for small holdings in the country. Our experience in the other project areas has clearly convinced us that the situation can be improved. A hundred percent increase in yield in the low yielding holdings would be possible within a period of three to four years by undertaking proper scientific development activities on an intensive basis among the small holders. The Rubber Development Project's main objective would be to achieve this goal.

16 Labour for Tapping

About 40 per cent of the holdings are utilising hired labour for tapping. Work in 10 per cent of the holdings•

Table 14

Yield levels

Yield (kg/ha)	Number of holdings	Percentage
250-400	30	4.94
401-550	95	15.65
551-700	159	26.19
701-850	172	28.34
851-1000	89	14.66
Above 1000	62	10.22
Total	607	—

(Out of 756 tapping units, the yield of 149 units has not been considered, these units being either under slaughter tapping or newly opened).

Table 12

Plant protection against sun-scorch

(Immature area consisting of 2nd, 3rd and 4th year plantings)

White washing	Area in hectares	Percentage
White washed	141.62	65.02
Not white washed	76.19	34.98
Total	217.81	—

Table 13

Tapping system

Tapping system	Area in hectares	Percentage
S/2 d/1	186.10	53.40
S/2 d/2	109.98	31.56
2S/2 d/1	52.44	14.04
Total	348.52	

is managed by the labour of family members. In about 50 per cent of the holdings, services of both family labour and hired tappers are utilised for tapping. (Table 15).

Table 15
Type of Labour for Tapping

Type of Labour	Number of holdings	Percentage
Family Labour	146	10.29
Hired Tappers	566	39.89
Both	707	49.82
Total	1419	

17 Sources of Income

The main source of income of all the families surveyed is agriculture. A few families have reported other sources of income also, such as business, other employment etc.

Table 16
Source of Income

Source of Income	Number of holdings	Percentage
Agricultural and local employment	435	30.66
Agriculture and business	176	12.40
Agriculture alone	730	51.44
Employed abroad	78	5.50
Total	1419	—

18. Processing And Marketing

The survey has revealed that 182 small holders have their own facilities for sheeting. Others are making use of hired facilities. Only a very small number (about 4) of holders have smoke house facilities. Others resort to sun-drying and kitchen-smoking.

There is no separate co-operative rubber marketing society registered in the village. The nearest Rubber Marketing Co-operative Society is located at Karukachal. There are two Rubber Producer's Societies functioning in the village, one at Kurumpanadom and the other at Palamattom. There is one Service Co-operative Society functioning in the area. 767 holders (54 percent) are members of the co-operative society. Rubber sheets are mostly sold as lot rubber to private dealers. 33 holders sell their production as latex.

19. Financial Assistance Needed

About 336 holders (24 percent) have indicated that they are in deed of financial assistance and about 1083 holders (76 percent) have sought both financial and technical assistance for the development of their rubber area.

20. Summary

A survey was conducted in nine wards of the Madappally village during the period August—December 1987 prior to extending the Project's activities to the area. The total area under rubber in the nine wards is 796.01 ha. and the total number of rubber holdings 1419. A large percentage of the rubber growers has not registered their holdings with the Rubber Board. Over 50 percent of the area under rubber is immature. More than 81 percent of the area is planted with budded materials. The area under clonal seedlings is about 19 percent. The percentage of intercropped area is about 29 and that of interplanted area about 35. Concerted action is required to arrange field budding in immature areas where seedling stumps have been planted. Planting with polybag plants should be encouraged in future. Planting density should be limited to the recommended level. The correct method of plant protection, manuring practices and tapping techniques need to be popularised. The necessity of establishing and maintaining good ground covers in holdings should be emphasised. Facilities for soil and leaf analysis should be encouraged to be utilised freely and the advantages of discriminatory methods of fertiliser usage impressed upon the growers. The average yield of over 75 percent of the holdings is below the national average. The objective of development work should be to raise the yield of the holdings considerably above the national average with in a period of 3 to 4 years by concerted application of all modern scientific cultural practices.

21 Acknowledgement

The field work of the survey was carried out by Messrs K. Janardhanan Potty, C. D. Abraham, K. Ramachandran Nair and T.J.Ravindra Panicker, who are the extension staff of the Rubber Development Project of Modi Rubber Limited. The tabulation and analysis of the data collected were also done by them. Valuable assistance has been rendered by Shri T. N. V. Namboodiri in the preparation of this report.

* Report presented at the Rubber Growers' Seminar organised by Rubber Board, Modi Rubber Limited and Madappally Service Co-operative Bank Ltd., at the St. Peter's High School, Kurumpanadom.

news and notes

ANRPC Meet-Minister calls to Eschew Price Fluctuations

The Union Minister of State for Commerce, Sri PR Dasmunshi has urged the comity of natural rubber producing nations to evolve marketing strategies to eliminate violent fluctations in NR prices. He was addressing the valedictory session of 13th Assembly of the Association of Natural Rubber Producing Countries (ANRPC) at Bangalore on 17 August 1988. The strategy should include a proper trade-off between a reasonable price to the grower and the consumer. The developed countries are always looking at substitutes for natural products of developing countries. Any untoward increase in rubber prices would lead to large scale substitution by synthetics. The ANRPC countries accounted for about 85% of the world NR production, but they used only a small portion for internal consumption. The major portion exported came back to them in value added forms of finished goods. He wanted the producing countries to establish a strong base for rubber based industries to bring an end to the exploitation tactics.

The Assembly was inaugurated by His Excellency the Governor of Karnataka Sri P Venkatasubbiah on 16 August. Sri PC Cyriac, Chairman of the Rubber Board was elected as Chairman of the Assembly for the year 1988/89 by delegates from Malaysia, Indonesia, Singapore, Thailand and Sri Lanka, the member countries of the ANRPC besides India.

Report on the progress of multilateral clone exchange trials started in 1974 was presented at the meeting. This programme has immensely helped to widen the genetic base of high yielding hevea clones in these countries through mutual exchange of the material developed in each country. India could not take advantage of this programme since it was not a member of the ANRPC in 1974. The Indian delegation suggested to initiate a second round of

Chairman, Rubber Board presides over the 13th Assembly of ANRPC.

the trials to exchange the clones developed since 1974. The suggestion was remitted to experts in the field for examination. The ANRPC Secretariat will furnish on a regular basis data collected on yield performance of commercially viable clones to the member countries.

In the Seminar and Work shop on progress and development of rubber smallholders which followed the opening session, it was decided to set up demonstration projects to train small holders in using selected techniques in planting, crop harvesting and processing. The member countries were asked to present to the Secretariat demonstration projects. The Secretariat would explore the possibility of obtaining external funding to put accepted projects into operation.

There were also protracted discussions on the recent spurt in price in the international market. The price of NR had been surging forward from January 1988. The average price of RSS-3 grade which was MS 2.73 per kg (Rs.14.00) in January went up to MS 3.69 a kg (Rs.19.50) in June. Prices of all the grades reached their peak in June 1988. The price of latex grade rubber went up to MS 11 per kg (drc) (Rs.58). Since then the prices of various grades recorded a downward trend. By August the price declined to MS 3.3 per kg (Rs. 17.80) even though the price of latex has not declined much because of strong internal and external demand.

Factors that contributed to the price upsurge included increased demand over supply triggered off by better world economic performance during the first two quarters of 1988, fall in output due to unfavourable weather conditions, increased demand for latex to produce examination and surgical gloves and speculative transactions by Japan. In 1987 there was a shortfall of 55,000 tonnes in NR production vis-a vis consumption. According to the International Rubber Study Group, NR demand is predicted to exceed supply by 140,000 tonnes in 1988 and 125,000 tonnes in 1989. The Assembly felt that the current favourable market conditions may continue to the end of 1989 and warned the member countries that the continuing high prices may lead to NR substitution in end uses and the search for alternate sources.

THE PROGRESS OF REHABILITATION PLANTATIONS

The public sector Rehabilitation Plantations Ltd., Punalur, jointly owned by the Government of Kerala and the Government of India, have made a net profit of Rs. 1.82 crores (before tax) for the year 1987-88. Profit earned during the previous year was Rs 0.84 crore.

The company's paid up share capital is Rs. 3.34 crores. While loan liabilities amount to Rs. 2.23 crores, reserves and surpluses held are to the tune of Rs. 4.31 crores.

The company's rubber plantations are spread over 2,070 hectares at Ayiranallur and Kulathupuzha near Punalur. The planting of the area was carried out during the years from 1972 to 1978. The clones used are mainly RRIM 600, GTI, PB 5/51 and PR 107. A small area is also planted with RRII 105.

The rubber production of the plantations during 1987-88 was 2,356 tonnes. The average yield works out to 1,137 kg per hectare. The corresponding figures for the previous year were 1,967 tonnes and 1,017 kg. The production is on the rise and is expected to reach 3,500 tonnes in a few years. The rubber is now marketed mainly as centrifuged latex. Block rubber processing facilities are also being set up.

The plantations were primarily intended for rehabilitating repatriate families from Sri Lanka. The original target for resettling 675 families has already been achieved and 25 additional families would be inducted soon. □

The banks' representatives present stated that since NABARD refinancing is available, they would be prepared to extend credit financing at the approved rates for the proposed rubber cultivation programme.

After further discussions, it was decided to undertake rubber planting as follows under the various agencies during 1989-90:

ITDA, Ramachodavaram	: 100 ha.
Girijan Co-op. Coffee Development Corporation Ltd., Vizag.	: 100 ,,
ITDA, Paderu (3 trial plots of 10 ha each)	: 30 ,,
ITDA, Parvatipuram (do)	: 30 ,,
ITDA, Srikakulam	: 20 ,,
Total	: 280 ha.

Implementation

Board's officials at Maredumille would immediately visit all the proposed areas, collect detailed information on prevailing agro-climatic factors, select suitable plots for establishing nurseries of polybagged plants keeping in view proximity to planting sites, easy accessibility and availability of water for irrigation and educate the tribal families and officals concerned on various aspects of the programme. They would be equipped with necessary visual aids such as slide projectors, slides etc. They would also study and report on extent of areas which hold potential for plantation development. It was made known that several thousands of hectares of land would be available for the purpose in East Godavari District.

The Dy. Rubber Production Commissioner would make available free of cost the required polybags at the rate of 625 Nos. per hectare of planting proposed. Budgrafted rubber stumps would be supplied from Board's regional nursery at Devarappally near Maredumille and supplemented from the Central Office at Kottayam.

After discussiug the manner of plantation development, it was decided that it would be undertaken by the agencies concerned in compact blocks with intended tribal beneficiaries initially engaged as wage earners. When the plantations get ready for tapping, family-wise divisions and distri-butions would be undertaken. For management purposes, there would be one official of the status of an Agricultural Inspector for every 1C0 ha. He would be assisted by one official of a lower cadre. Necessary project reports would be drawn up with the active assistance of the Board.

The Rubber Production Commissioner suggested that the trees in the existing rubber plantations at Maredumille might be taken over from the Forest Department by the Girijan Co-operative Coffee Development Corporation Ltd., on a suitable lease and managed for harvesting of crop. This would help in imparting training to tribal beneficiaries for the future. The Officer on Special Duty agreed to this and requested that the Board might also write to the Principal Chief Conservator of Forests and the Director of Tribal Welfare in this behalf. □