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Vol 17 No. 1

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Editor: PK Narayanan

Asst Editor: KA Aravindakshan Nair

RUBBER BOARD BULLETIN

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December - 1981

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Cover: S Rajendran

THE RUBBER BOARD

KOTTAYAM 686 001 INDIA

Chairman
K Mohanachandran

Rubber Production Commissioner
P Mukundan Menon

Director of Research
Dr. MR Sethuraj

Project Officer
CM George

Secretary
V Bhaskara Pillai

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THE QUARTER

The States and Union territories in the north-eastern sector of India hold out great promise for massive development of rubber plantations. The total area that can be considered straight away for planting rubber in this area is estimated to be of the order of 1,00,000 hectares. Out of this, Assam alone will have 50,000 hectares while the share of Tripura is put at 25,000 hectares. The rest 25,000 hectares have been located in other states in the north-eastern zone.

Encouraged by the initial success of trial plantations, the Governments of Tripura and Assam have taken up planting on a commercial scale in the public sector. In Tripura the work is being undertaken by the State owned Tripura Forest Development and Plantation Corporation. This Corporation has targetted to cover 5000 hectares in a phased manner extending up to 19 85-86. The Govt. of Tripura also proposes to organise another Corporation for resettling shifting cultivators through rubber plantation programme.

In Assam commercial planting of rubber is being undertaken by the Assam Plantation Crops Development Corporation which intends to cover an area of 3900 hectares by 1983-84. These plantations are also raised with a view to resettling shifting cultivators.

In Meghalaya, Manipur, Mizoram, Arunachal Pradesh and Nagaland also efforts are afoot to take up rubber planting on a fair scale, both for resettling shifting cultivators and soil conservation.

For extending technical and financial assistance to those who come forward for planting rubber, the Rubber Board has opened up offices in Tripura, Mizoram and Gauhati. The services from these centres are being widened on a need-based manner progressively.

In order to intensify the promotional activities in these areas the Rubber Board had convened a special meeting of its Planting Development and Extension Committee at Tripura on 16th March. Attempts were also made to involve all the agencies engaged in rural development in the activities of the Rubber Board for the promotion of rubber planting in these areas.

Once the message of the Board receives approbation of the farming community in the North eastern states, rubber cultivation will spread far and wide resulting in the utilisation of entire land suited for this crop which will help to increase national production substantially.

RAINGUARDING

By fixing a polythene rainguard to the trunk of the tree above the tapping panel, tapping can be carried out during rainy season also. About 35-40 additional tappings per annum can be obtained by rainguarding the trees under the alternate-daily system. Rainguarding is recommended in areas where the annual yield is 700 kg/ha or more and where normally more than 25 tapping days are lost by rain. As the chances of panel diseases are high in rainguarded areas, systematic application of panel protectants is necessary at frequent intervals.

Gentle scraping to remove dry and flaked bark is carried out on a band of the bark 10-15 cm above and parallel to the tapping cut and extending 5 cm and 10 cm towards the back and front channels. A thin coating of a bitumen based adhesive is smeared on the scraped portion. Frilled polythene of 300 guage thickness and 45 cm width is then fixed where the adhesive has been applied. A strip of 2 cm wide 'kora' cloth is placed and stapled at four or five points, covering the upper edge of the frilled polythene. Then another coating of the adhesive is applied so as to make the rainguard leak-proof.

Some simple and new methods of rainguarding are under testing. The principle is to fix a suitable channel above the tapping panel, so that the stem flow of water is diverted away from the panel, thus keeping the tapping cut and bark below in dry condition.

rubber products manufacturing industry in malaysia

Dr BC SEKHAR

Malaysia continues to dominate the world market in natural rubber. This commodity has manifested itself in the social and economic fabric of the Malaysian society. It has over a hundred years of development history. Activities associated with this unique elastomeric material generates interest and enthusiasm in this country. No doubt with the IRI first taking on synthetic elastomers immediately after World War II and going "polygamous" with plastics recently, PRI Malaysia too has inevitably changed. The plastics industry has already made its "debut" in Malaysia. It will not be long before an SR industry too would emerge in Malaysia. The Malaysian Government has declared the present decade as the decade for resource-based industries with NR at the top of the list of priorities. In the midst of all these exciting developments, Malaysia has formulated a dynamic production policy for effective implementation. Various measures are at different stages of implementation.

The dynamic production policy is designed to meet what has been anticipated by relevant international agencies and consuming countries, the shortfalls in NR supply to meet expected demand in medium and long-term. Of course, the continuing erosion of NR price in the last few months does not seem congruent with the expressed position by consumers at least in the short term. No doubt this is a passing transient phase and price will recover before too long. It behaves on consuming countries at this stage to stimulate their domestic rubber manufacturing industry, so that the initiative taken to implement measures to expand supply in producing countries is not undermined by unrealistic erosion in NR prices. It is sometimes forgotten that the NR industry is the industry of the small man–the smallholder and his enthusiasm with the commodity can vane if he is buffeted again with continuous decline and unrealistic levels of prices. High levels of NR prices and lack of supply usually generates consumer demands for producing countries to step up production. It is time, producting countries asked the consumers what, if any, they are doing to stimulate demand to ensure the confidence of the small producers. The future is certainly pregnant with exciting developments and stimulating activities for the plastics and rubber technologists and scientists.

The '80's have been designated by the Government as the decade of growth for resource based industries and with rubber still the major agricultural resource, the rubber products manufacturing industry must play a dominant role. A challenging target of 300 000 tonnes pa of NR to be consumed in this industry by the end of the decade has been promulgated. This would give Malaysia a rubber manufacturing industry comparable to the present size of that in the UK or France. Even if the per capita consumption of rubber in Malaysia rises from the current value of 4 kg pa to 8.5 kg as found in Europe or Japan the domestic market could only consume 100 000 tonnes pa assuming no imports at all and no usage of SR, neither of which is likely. Therefore the target becomes one of developing a large export market for Malaysian made rubber products.

This paper sets out to examine the achievements of the fledging rubber manufacturing industry so far, its future prospects, the strategies it should adopt and those special factors that will assist or hinder it in reaching its goal. It so happens that as part of its programme to assist the growth of the rubber industry the MRRDB has carried out two detailed surveys of all aspects of rubber product manufacure, the first in 1972 and the second at the end of 1980. I am therefore well placed to present to you today, a reasonably up-to-date and comprehensive picture of the industry, its growth, potential and problems.

Development of rubber product manufacture since 1972

It is quite obvious that the manufacture of rubber products in Malaysia has grown very significantly in recent years. Evidence of the present healthy state is to be seen in the slide depicting a selection of the many types of products now made in Malaysia on exhibition on the MIDA/MRRDB stand at the International Rubber Conference at Harrogate in June. In this and many other ways publicity is being given to Malaysia's capabilities to interest potential Joint Venture partners of which I will have more to say later. The exact growth rate of the industry depends on the particular index of measurement but as can be seen from Table 1 the increase between 1972 and 1980 averages out at approximately four-fold, an annual expansion of over 15%. This is higher than the average growth rate of all types of manufacturing industry in Malaysia which has been 13.6% over the same period.

Table 1

Indices of growth in rubber product manufacture in peninsular Malaysia

Index		1972	1980	Increase (%)
Turnover	(M$ million)	100	550	550
Home sales	(,,)	50	350	700
Export sales	(,,)	50	200	400
Imports	(,,)	19	53	280
Manufacturing units		74	135	182
Employees		8000	23500	290
Rubber consumption (tonnes)		21000	68000	312

Other significant points emerge from this Table. Firstly, although sales to the domestic market have risen very sharply export sales have been less buoyant but still very satisfactory. Secondly, imports have also increased almost threefold despite home production indicating that further import substitution is feasible and, of course desirable. Finally, although the value of products generated per employee has almost doubled from $ 12 500 to $ 23 400 the rubber consumed per employee has risen only marginally from 2.6 to 2.9 tonnes pa. This question of productivity will be referred to again.

It will be useful to comment here on the present structure of the industry.

Size

Measured in terms of paid-up capital there is a roughly equal division between the number of manufacturing units capitalised at less than and more than M$ 500 000 (Table 2).

Table 2

Size of manufacturing units(Capital)

Paid-up Capital (M$ million)	% of Total
less than 0.25	41
0 25 - 0.5	12
0 5 - 1	11
1 - 5	26
5 - 10	6
greater than 10	4

Of the the factories which have been built since 1972 almost all the joint venture operations fall into the over $0.5 M capital group whereas there is still a tendency for locally owned entreprices to be small.

In terms of the number of employees per factory there has been a movement away from the very small units, although these still comprise the largest proportion, with the largest increase being in the 100-500 employee size range (Table 3).

There are now some 23, 500 employed in the industry compared with 8000 in 1972. The largest proportion (31%) are involved in the production of products made directly from latex, the most largest area of employment being the footwear industry while tyres which consume the most rubber require only 15% of the total workforce. There has been a general upgrading of the industry in terms of the capital employed per worker, this rising from M$ 17 000 in 1972 to M$ 40 000 in 1980.

Table 3

Distribution of size of manufacturing units-number of employees

Employees	Percentage	of Units
1 - 50	74.3	53 8
50 - 100	9.5	11.5
100 - 200	2.7	14.6
200 - 500	6.8	10.9
500 - 1000	4.1	4.6
over 1000	2.6	4.6

Product sectors

The relative growth of some different product sectors is illustrated in Table 4.

Latex products

This sector was identified in the 1972 survey as showing the highest potential for expansion as it makes excellent sense to convert latex in Malaysia in products with high added value for export rather than to ship latex concentrate around the world. Joint venture manufacturers speak of a much higher profitability in their Malaysian operations than in their home based factories with no problems from their change from concentrate to fresh latex. Not only will existing units in Malaysia continue to expand rapidly, with the exception of

Table 4

Product Sector	Tonnage of NR Consumed 1972	1980	Average Growth Rate (% pa)
Latex products	3000	13 500	21
Tyres	8800	23 000	13
Retreads	3600	12 150	16
Footwear			
General rubber goods	6400	19 350	15

foam manufacture (see Table 5) but it can be confidently expected that more of the latex industries in developed countries will move into Malaysia. It would be no idle dream to look forward to the time when almost all the latex produced in Malaysia is consumed in our own industries. As this is over 200,000 tonnes pa this is an exciting target to aim for.

Table 5

Changes in latex products

Product	1972	NR Consumption (tonnes) 1980
Gloves	—	5500
Latex thread	—	3500
Foam	3600	3800
Rubberised coir	10	270
Condoms	15	225
Catheters	—	180
Balloons	10	—

Tyres and retreads

It will be essential for the achievement of the rubber consumption target that tyres make their proper and dramatic contribution as world-wide, 70% of all NR is used in this product. The past growth rate of 13% is good when compared to the depressed state of the world tyre industry but has been largely generated by the high demand of the home market. Future growth will depend on the generation of a thriving export business. Excellent tyres bearing the 'Made in Malaysia' mark must become a familiar buy for the world car and truck owner. To be competitive in world markets a certain economy of scale is required and the present and future tyre factories in Malaysia will need to reach this critical size.

The retreading industry is performing well and both quantity and quality of output is rising. The export of high quality precured treads is an attractive future possibility.

Footwear and general rubber goods

The labour intensive footwear industry and the less sophiscated rubber products such as bands are meeting with increasing competition from other areas in S. E. Asia where Rubber and or labour costs are said to be lower than in Malaysia. However, efficiently managed factories where labour utilisation is maximised are still do well and a movement towards higher technology products such as engineering components, V-belts and hose is already apparent.

Factors related to the growth of the rubber manufacturing industry

Given that the recent growth rate of 15% is maintained then the achievement of the 300 000 tonnes NR consumption target by 1990 can be viewed optimistically. Direct projection gives 139 000 tonnes by 1985 and 280 00 tonnes by 1990 so that with a very little extra effort the race will be won. The question is whether the momentum can be maintained and increased. Let us examine some of the factors that will determine this.

Will to succeed

The most important element in reaching such a goal is the inherent determination of the Government to succeed. Only then will obstacles be swept aside and remedies found for problems. There can be no doubt that the Government has such a determination. Consider these extracts from a speech by the Deputy Prime Minister at the Inauguration of the International Conference on Rubber Products Manufacturing in Malaysia last November. "Just as today we are the world's largest exporter of NR it is our aspiration that by the end of the decade of the 1980's this country will also become one of the world leaders in the export of manufactured NR products....... I do not say the path we have to take ...... is going to be easy. But we have the will and the determination to overcome whatever obstacles that may arise in our path....... I can assure you that the Government will take every step possible to give support to such manufacturing operations."

Incentives

The Government's determination has been expressed in practical terms by a package of attractive incentive to investors in the rubber manufacturing industry, both Malaysian and Foreign. These are too complex to discuss in detail but include tax relief dependent on the investment, the location of the manufacturing unit, the percentage of products exported and whether the product produced is listed as a priority product. Tariff protection is available for industries that need it and exemption from import duty is given on raw materials, plant and machinery that are essential for the manufacturing process

Logistics

Suitable, low priced sites for rubber product manufacture have been made available on a large number of well developed industrial estates throughout Malaysia. Each has good infrastructural facilities such as roads, communication services, power and water. Important constituents of rubber products such as carbon black, zinc oxide, clays and many types of reinforcing fabrics are in assured supply from domestic sources. Other rubber chemica's and essential synthetic rubbers can be freely imported at prices competitive with those in other parts of the world. Their production in Malaysia will be undertaken when their scale of usage makes such integration commercially viable.

Natural rubber of the highest quality is freely available to local manufacturers in the dry form or as latex free of export duties, research and replanting cesses. The comparative advantage over world prices will vary with the prevailing NR price but can be expected to be 25–30%. In addition the local manufacturer will not suffer from the disadvantage of long supply lines and the need to hoid expensive stocks of rubber.

Labour

Although labour costs have risen in Malaysia they are still only one tenth of those prevailing in Europe – a very significant advantage to the local manufacturer. However it must be recognised that the once abundant supply of labour is becoming more tightly stretched and that shortages are likely in the future. It will be essential that the productivity per worker is raised by the introduction of newer and more automated processes and that new ventures should be capital rather than labour intensive.

MIDA

There can be no doubt that the creation by the Government of the Malaysian Industrial Development Authority in 1967 (then FIDA) has had and will continue to have a large influence on the expansion of the rubber manufacturing industry. Its wider role is to promote and coordinate industrial development in the country but for the rubber industry perhaps its greatest contrtbution has been to attract and facilitate foreign and domestic investment. Already there are 28 joint venture operations that account for 60% of the rubber consumed. 69% of capital employed and 58% of employees in the industry. The notable success of such ventures stems not only from the foreign partner's transfer of technology to Malaysia but on their existing marketing arrangements which are so vital for the expansion of exports. Marketing is one area where local manufacturers require further help. With the succesful example of the present joint ventures and the decling profitability of the rubber industry in the West one can anticipate that many other ventures will be established in this decade. MIDA also provides a unique service for the investor acting as an 'under one roof' agency providing advice and assistance relating to the functions of many diverse government departments and thereby reducing the 'red tape' involved in obtaining project approval and incentives.

MRRDB

I do not have the time to comment on the influence on the growth of the rubber product manufacturing industry of such important bodies as the Association of Development Financial Institutions of Malaysia (ADFIM) or the Malaysian Rubber Products Manufacturers Association (MRPMA), nor indeed of the importance of the ASEAN market cooperation in rubber products manufacturing through RIASEAN.

I cannot end however without discussing a subject close to my heart – the provision of research and development in rubber technology for the benefit of the manufacturer. The Government has been to it that an enormous fund of expertise has been built up over the years in the MRRDB and its dependent bodies, the RRIM and 'the MRPRA and that this expertise will be freely available to the manufacturing industry. This will giveMalaysian manufacturers a unique advantage over their counterparts in competitive rubber producing countries.

The main vehicle for channelling technological help and innovations to the industry is the RRIM Technology Centre established in 1976 and equipped with over M$ 10 million worth of machinery and instruments. It provides assistance in

- Process evaluations
- Product design and testing
- Tyre fabrication and testing
- Retreading
- Testing in relation to properties and quality control
- Training of junior and senior staff
- Provision of information from a comprehensive data base stored on computors.

Both Research Institutes, the RRIM and MRPRA, are charged with identifying projects for commercialisation and with feeding technological innovations and developments to Malaysian industry as a priority. Examples of recent developments which could be of substantial help to both rubber producers and manufacturers include epoxidised NR, thermoplastic NR and powdered NR.

The Malaysian Rubber Bureaux (MRB) located in the important consuming areas provide market and technical intelligence and have been helpful to MIDA in locating and introducing rubber manufacturers who wish to set up joint venture operations in Malaysia.

Summing up it is apparent that the manufacturing industry is expanding at a satisfactory rate. Given Malaysia's advantages and the multiplicity of steps that have been taken to ensure that the momentum is maintained and increased the target of 300 000 tonnes NR consumed by the industry is realistic and obtainable by 1990.

harvesting of rubber

Hevea latex found in the latex vessels contain 30-40% of rubber in the form of articles. *Hevea* latex is a hydrosol in which the dispersed particles are protected by a complex film. It contains more than one disperse phase. Besides rubber particles, the latex contains certain other particles also named Lutoid and Frey Wyssling particles. Lutoids are believed to be associated with the process of latex vessel plugging which stops the flow of latex a few hours after tapping.

When the tree is tapped and vessel is cut, the pressure at the location.of the cut is released and the viscous latex exudes. This exudation of latex would result in the displacement of latex along the length of the latex vessel owing to strong forces of chesion existing in the liquid phase. This would result in a fall in pressure in the vessels leading to entry of water from surrounding tissues which makes the latex more dilute. This dilution would make the latex less viscous resulting in enhancd flow rate. But subsequently disturbances in the osmotic concentration in latex vessel would cause damage to lutoid particles culminating in the plugging process, which ultimately would block the cut ends of the latex vessels and thus the latex flow would cease.

Tapping

Latex is obtained from the bark of the rubber tree by tapping. It is a process of "controlled wounding" during which thin shavings of bark are removed. The aim of tapping is to cut open the latex vessels in the case of trees tapped for the first time, or to remove the coagulum which blocks the cut ends of the latex vessels in the case of trees under regular tapping.

An inner layer of soft bast, an intermediate layer of hard bast and an outer protective layer of cork cells can be distinguished in the bark of the rubber tree. The latex vessels are concentrated in the soft bast, arranged in a series of concentric rings of inter connecting vessels. The number and distribution of latex vessels and the proportion of hard bark show much variation from tree to tree in a seeding population. Such wide variations generally do not occur in a population of budded trees of a clone.

Standard of tappability and height of opening

The criterion for opening is 55 cm girth at a height of 50 cm from ground level in the case of seedling trees. If opening as higher level is preferred then the seedling trees can be opened at a height of 90 cm when the girth at that level is 50 cm.

It will be generally economic to begin tapping when 70% of the trees in the selected area attain the standard girth. Under certain conditions, it takes an average of seven years to reach this stage.

In India, the best month to open new areas for tapping is March. The trees that are left behind during the season due to want of sufficient girth may be considered for opening in September.

The tapping cut of the budded trees should have a slope of about 30° to the horizontal, since the bark is comparatively thin. For seedling trees, the cuts need have a slope of only about 25° to the horizontal, since the bark is fairly thick. A very steep cut leads to wastage of bark when tapping reaches the base of the tree and too flat a cut leads to overflow of latex.

The latex vessels in the bark run at an angle of 3.5 to the right and therefore a cut from high left to low right will open greater number of latex vessels.

Tapping depth, bark consumption and bark renewal

The best yields are obtained by tapping to a depth of one millimeter close to the cambium since more latex vessels are concentrated near the cambium. In India tapping is generally shallow and this results in considerable loss of crop. To obtain optmium yield at the time of tapping care should be taken that the cambium is not wounded. However minor tapping wounds which will heal up in due course need not be considered as serious.

To restart the latex flow from a tapping cut on a subsequent tapping, all that is needed is to cut a thin shaving of the bark along with which the plugs of coagulated latex are also removed. Latex flow ceases when the latex of the tapping panel gets coagulated, clogging the cut ends of the latex vessels in turn with minute plugs of coagulated latex.

The optimum rate of bark consumption will depend much on the skill of the tapper. The rate of bark consumption in India is generally less than that in other countries. For obtaining optimum yield, it is preferable to consume about 20 to 23 cm of bark annually on S/2 d/2 system. However, cutting away a shaving thicker than what is necessary does not increase the latex yield but only wastes the bark.

Bark regeneration is brought about by the activity of the cambium. The rate and extent of renewal are dependent on the inehrent genetic characters of the planting materials, fertility of the soil, climatic conditions, tapping system and intensity, planting density and disease incidence.

Time of tapping and tapping task

It is necessary to commence tapping early in the morning, as late in tapping will reduce the exudation of latex. The "Michie Golledge" Knife used in our country is well adapated for a high standard of tapping with minimum bark consumption. The draw knife or "jebong" type commonly used in Malaysia is well adapated for high level tapping and bigger task and is now becoming popular in this country. A third type called "Gouge" is also used in Malaysia. The knives should be sharp. The knieves, cups, buckets etc. should be cleaned well to prevent bacterial contamination and spoilage of latex.

The tapping task (number of trees tapped on a day by one tapper in India) is only 250 to 300 trees compared to 350 to 450 in other countries.

Tapping systems in use

Response to different tapping systems vary from clone to clone. In general budded trees are to be tapped on half spiral alternate daily (S/2 d/2) system and seedlings on half spiral third daily (S/2 d/3) system. There are however certain clones like GI 1, PB 6/9 and PB 28/59 which are prone to brown bast under alternate daily system. Such clones should be tapped on third daily system. Daily tapping of trees will lead to more incidence of brown bast.

For high yielding varities D/3 systems can be adopted during tapping on the vergin bark. Although the yield per hectare may be during the initial period the return per tapper will be higher. The difference between D/2 and D/3 systems will be narrowed in course of time and there will be an ultimate saving in the cost.

The yield from trees will vary with the clone, age of the tree, fertility of the soil, climatic conditions, tapping systems followed and skill of the tapper. Maximum production generally commences by about the fourteenth year of planting.

Intensive tapping is generally done on old rubber trees prior to their removal. The methods of intensive tapping depend on the condition of the trees, previous tapping system, availability of the bark and the period available for exploitation before felling. The methods employed are increased tapping frequency, extension of the tapping cut, opening of double cuts, and use of yield stimulants. While opening two cuts at the same time, the cuts should be sufficiently apart at least 45 cm to avoid the interference of drainage area between the cuts.

When tapping of renewed bark on basal panels becomes uneconomic, new cuts are opened at higher levels, 130 to 180 cm from ground level or even higher. The tapper uses a light wooden or aluminium ladder to reach the cut. Since ladder tapping is more strenuous and time-consuming, usually reduced tapping tasks are given (135 trees).

In South India, the rubber trees shed the leaves during December to February and refoliate soon along with the production of flowers. During refoliation and flowering, the yield will be comparatively poor and normally the trees are given about four week's rest. In view of the fact that a good number of tapping days are lost in our country during rainy season, tapping during wintering and refoliation period may be tried if the yields are economical.

Chemical methods for yielding trees

Chemicals which can induce ethylene formation in the plant tissue as well as the chemicals which generates ethylene can promote latex yield when applied to the bark near the tapping cut. 2, 4-D (2, 4 dichlrophenoxy acetic acid) and 2, 4,5-T (2, 4 5 tricholorophenoxy acetic acid) are chemicals belonging to the former category and formulations containing these chemicals as active ingredient have proved to be very potent yield stimulants.

New groups of yield stimulants

'Ethephon' manufactured by Amchem products Inc. U. S. A. Containing 2-chloro ethylphosphonic acid as active ingredient is recommended as an yield stimulant for use in the plantations. The marketed product Ethrel is a commercial preparation of Ethephon. Ethephon has proved to be a more effective yield stimulant than 2, 4-D and 2, 4, 5-T.

There is another group of ethylene generating chemicals in which the gas is absorbed on special powdered materials which are then compounded with suitable viscous carriers. After application on the tree the ethylene gas is slowly released which acts as yield stimulant. One such compound developed and patended by RRIM is Ethad (R).

Use of Ethrel is recommended for trees tapped on panel D (First renewed bark of the second panel). Trees tapped in panel C may also be stimulated once in a year.

The method of application known as bark application is recommended for general use. Ethrel should be applied with a brush below the tapping cut to a width of 5 cm after light scraping of the outer bark. In small holdings where the owner himself taps the trees, groove method of application can be adopted. In this method the dried tree lace is removed and Ethrel is applied on the cut surface of the bark. More frequent applications would be necessary if this method is adopted.

The ready to use formulation of Ethrel contains 10% active ingredient. The concentration can be diluted from 10% active ingredient to 5% active ingredient as no significant difference in effect could be obtained between these concentrations in our experiments to justify the difference in the cost.

Only two or three annual applications are recommended. The application may be carried out in April, September and November

There is a declining trend in the response to continuous application of Ethrel and it has been found that it may not be stimulate trees which have been under stimulation for a period of four or five years. Accordingly, continuous application of Ethrel is not recommended for periods of more than three years at a stretch.

Points to remember

Do not stimulate trees which are having late dripping.

Do not stimulate trees tapped daily.

Do not apply Ethrel on rainy days.

Do not apply Ethrel on the portion of bark previously treated; tap off the treated bark before the next application.

At present Ethrel is formulated by M/s. Agromore Ltd., Banglore 26, who are the agents in India, of the manufacturers of this chemical. M/s. Shaw Wallace and Company are the distributors in Kerala.

Rainguard

During rainy season tapping can be carried out, fixing polythene rainguards to the trunk above the tapping panel. About 35-40 additional tappings could be obtained every year by rainguarding the trees. But chances of bark rot disease are high when the trees are rainguarded and tapping is continued during the rainy season. Hence systematic application of panel protectants at frequent intervals is necessary. Rainguarding is recommended only in areas where the average yield is 700 kg/ha/annum or more and 25 or more tapping days are annually lost by rain.

Some simple and new methods of rainguarding have been recently under testing at the RRII. By fixing a suitable channel on the trunk just above the tapping cut, the flow of water through the main trunk is channelled out. This method is found to be effective in keeping the tapping cut and the bark below in dry condition during the rainy season. (Reproduced from 'Rubber and its cultivation.)'

□

low cost nutrient to boost plant yields

The scientists of Hindustan Lever Research Centre at Andheri, Bombay, have made a remarkable technological break through: a plant growth nutrient (PGN), the first of its kind, capable of boosting agricultural production by as much as 20 to 30 per cent.

PGN, orMixtalol, as it will be marketed, has been vigorously tested out on three major cereals wheat, paddy, and maize in Maharashtra, Uttar Pradesh and Andhra Pradesh. Even under varying climatic conditions in six seasons since 1978, covering both rabi and kharif crops, Mixtalol has proved its mettle.

An important feature of the nutrient is that it costs considerably less than chemical fertilizers (though, of course, it is not a substitute of them).

U. S. findings

Experiments done in the United States with alfalfa, a type of grass had identified triacontenol, a chemical in alfalfa, as a prime spur to plant growth. Field trials completed at Michigan State University proved that sprays containing tiny amounts of triacontanol could raise the production of a range of crops by as much as 24 per cent.

Triacontanol has now been isolated from a wide variety of plant materials including alfalfa and tea but it has remained a laboratory curiosity. It costs about $ 360 (3,000) per gram in the American biochemical market.

Hindustan Lever's scientists identified an indigenous raw material as a significant source of triacontanol. One tonne of this is adequate for spraying three million hectares of crops.

The scientists are understandably secretive about the process of manufacturing Mixtalol and its exact chemical composition. But it is known to be extracted from indigenous renewable plant sources as well as agricultural waste.

In Etah, after treatment with Mixtalol, rabi wheat prodution last year zoomed from 277 quintals per hectare to 352 quintals a rise of 27 per cent.

In Andra Pradesh, too, the average paddy yield per hectare has shot up by 8.8 quintals, again an average increase of 27 per cent in both Ap and UP, in some fields the yield rose by as much as 50 per cent.

Minute quantities:

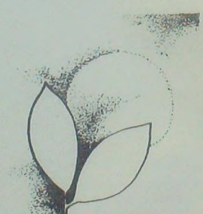
How exactly does Mixtalol act upon the plant? The nutrient is used in exceedingly minute quantities, ranging from 0.1 to 1 part per million (ppm) in water. This is equivalent to a few drops in a bucket. The resulting solution is sprayed over the plants up to the 'drip point', that is till the crop is seen to be dripping with the nutrient.

Mixtalol is sticky in consistency and forms a nutrient layer over the leaves, stems and shoots of the crop, which absorbs it through all these parts and uses the material to its advantage.

One of the strikingly visible results of Mixtalol on crops is the increase in size of roots and shoots. For instance, in the 124 14 variety of paddy, seedlings treated with the nutrient produced roots 4.87 cm long and shoots 6.63 cm long, while untreated seedlings grew only 3.63 cm roots and 3.68 cm shoots.

Simultaneously, Mixtalol increases the crops ability to take in water through the roots and carbon dioxide through the leaves. In effect, the nutrient improves the plant's ability to feed itself and the result is a far heal their crop than otherwise.

Another effect of Mixtalol can be observed through optical microscopy. All plant leaves contain stomatal pores on their 'skin' surface, which remain fully open in bright light, but close under poor light or darkness. Stomatal pores aid in the process of photosynthesis, by which plants convert carbon dioxide and water to carbohydrates using sunlight energy and chlorophil.



plants grow in the air

SITRIYA, ISRAEL – Plants are growing in the air here thanks to "aeroponics", a new Israeli agricultural system that eliminates the need for conventional soil or water methods. Instead of being cultivated in rows of plowed fields, the plants grow in sealed troughs where their exposed roots receive nutrient-enriched mist from a computer-controlled spray system. Lift the plastic lid of one of the empty tubs and the plants come off right along with it–their bushy roots dangling freely.

"Until people see it with their own eyes it's hard for them to believe it", says Amiram Keshet, Director of Adi Ltd., the Israeli company that developed the technique.

Cuttings, seedlings and even seeds can be introduced into the system. Right now, the company's scientists are placing 10 to 30 days old seedlings of citrus, olive, avocado and ornamental plants into the troughs. Tomato, pine tree and flower seeds are anchored in styrofoam, where they germinate, with the roots automatically developing downwards towards the nourishing fog which feeds them.

AEROPONICS USE less water, less fertilizer and less energy and experimental yields are 34-200% higher than those of soil farming, according to Keshet.

Israeli scientists hope aeroponics will one day solve the problem of a shortage of usable agricultural land. In an average trough, a minimum of 1,000 plants grow in approximately nine square feet, four times the density of traditional soil farming. Stacked tiers of aeroponic troughs can grow vegetables on even the rockiest terrain, and there's no need for plowing or fertilizing with gas-guzzling tractors.

Based on calculations of experimental yields a quarter-acre of aeroponically grown tomato plants will produce over 100 tons of tomatoes, while the best hothouses in Israeli produce only 20–30 tons.

Looking after plant health

A SIMPLE COMPUTER console and sensors monitor humidity and temperature in each trough, carefully regulating those conditions which in other farming methods cannot be as closely checked. And the aeroponics system permits farming all year long.

"Because the roots are exposed you can see immediately when a plant is diseased and take it out", says Keshet. So there's no chance for the sickness to spread to other plants."

Evolution of an idea.

SEVEN YEARS ago Keshet's partner, Dr. Isaac Nir, got the idea to grow plants in the air from hydroponics – the system that grows in enriched water. The most expensive process in hydroponics is infusing the water with oxygen the plants need.

"He thought he could reverse the factors and add the water to the air instead", recounts Keshet. "It worked and now we have patents pending on the system in the United States." Nir recently made a lecture tour of American universities to explain the revolutionary new technique.

Initial costs are still a problem. A 90 square foot unit with computer console and special fogging system sells for $ 5,000. But 15 Israeli farmers are already using the system and Adi has sold three sets of modular tubs to American companies in Connecticut, North Carolina and Florida.

The Israelis are using the method to grow house plants for exports to Europe. The unpotted plants are wrapped in wet newspaper and stacked in cardboard boxes for shipping without the weight of soil.

Keshet proposes that aeroponics be used in the United States to grow saplings quickly for reforestration programmes. Taking tree cuttings and sprouting them in air knocks a year off the time it normally takes in American trees nurseries, he claims.

And, to top off the promising prospects of aeroponics: the taste of aeroponic vegetables can be controlled by regulating the mineral content of the liquid nutrient.

"Israeli tomatoes were being rejected in European markets because they weren't flavourful enough", says Keshet. "Now, by changing the level of nutrient we can make them saltier."

the uses of rubber seed

When we talk of rubber, no mention is made of the rubberseed. Yet this seed holds great potential of generating an ancilliary industry in rubber plantations, says O. P. Vimal. Its oil finds ready use in the soap industry while the kernel serves as a source of animal feeds. It could even serve as a foodstuff, as the article on the following pages suggests.

The rubber plantation industry occupies an important place in the economy as it provides the principal raw material for the manufacture of a variety of products which are indispensable in modern life. India now ranks fifth among the natural rubber producing countries in the world, the first four being Malaysia, Indonesia, Thailand and Sri Lanka. The value of the crop harvested annually amounts to over Rs. 110 crores.

According to Rubber Board statistics, the area under rubber in India is 230363 ha. Kerala alone has 209723 ha which comes to 91 per cent. Tamil Nadu has 11570 ha i. e. five per cent and Karnataka 7763 ha i. e. 3.4 per cent and other States total only 1505 ha i. e. 0.6 per cent. In the north eastern zone of the country which is the new home for rubber, Tripura is now at the top. Other adjoining States such as Assam, Nagaland, Manipur, Arunachal Pradesh Mizoram have also taken up rubber plantations.

Progress

Most of the rubber is grown in small holdings. In all, 136532 units cover an area of 1633084 ha and 595 estates have 67479 ha under rubber. The small holdings at present account for 63 per cent of the total production. Thus, by virtue of their number, coverage of area and their contribution to production, the small holdings have come to occupy an important position in the industry. Rubber plantations have recorded spectacular progress, the area increased by more than 250 per cent and production by 800 per cent. With a view to improving the economy of small holdings, efficient utilisation of residues of rubber plantations is an important aspect. Rubber seed is a potential resource material offering promising scope.

Potentially 1,00,000 tonnes of rubber seeds are available from rubber plantations but only 23,000 tonnes are actually collected/processed. The seeds are largely available in Kottayam, Quilon, Ernakulam, Malapuram, Kozhikode and Cannanore districts of Kerala and Kanyakumari district of Tamil Nadu. It has been estimated that on the basis of 50 seeds per tree, a hectare can provide about 17,500 seeds at a stand of 350 trees. This is equal to 80 kg on the basis of 220 seeds per Kg. This may, however, vary according to seasonal changes and incidence of pod disease.

The rubber seed

The rubber seeds resemble castor seeds in appearance; these are large and heavier than ordinary seeds. They consist of approximately 40 per cent shell and 60 per cent kernel. The oil content of the kernel calculated on a moisture-free basis is about 50 per cent This amount corresponds to 25 per cent of the seeds. The oil obtained from the kernel is clear, of light yellow colour and has an odour resembling that of linseed oil. The husk contains a solid fat which has a high sponification number and low iodine value. Since the amount of fat in the husk is very small, it makes but little difference to the properties of the oil obtained from the kernels alone and that of the kernels and husk ground together.

An analysis of para rubber seed oil shows that it cnosists of principally the glycerides of the unsaturated acids like oleic acid, linoleic acid and linolenic acid, along with a small quantity of saturated acids. Although the physiochemical properties of para-rubberseed oils resemble that of other edible seed oils in some respects, it differs in its composition e.g. rubber seed oil contains a large percentage of linolenic acid whereas other common edible oils contain practically nolinolenic acid.

These differencee enable the detection of rubber seed oil when it is mixed with other oils. The oil is inferior to linseed oil and is chiefly used for soap making. The rubber seed oil extracted from the kernel is also found to contain cyanic acid and some important enzymes The kernels of rubber seeds contain a powerful, active, lipolitic enzyme and a cynogenetic glycoside which decomposes later on; either as a result of enzyme action or as a result of too much acidity, thus yielding hydrocynic acid in the meal obtained from the kernel The oil is almost free from glycosides and hydrogen cyanides. The cake has a protein content and carbohydrates.

Commercial trading

During 1965, the extraction of oil from rubber seed was not widespread. The increase in the prices of non-edible oils and the restrictions imposed on the import of goods during the 70s gave a fillip to this industry and a number of organisations showed interest in the commercial trading of rubber seed oil. This stimulus prompted the Rubber Board to conduct an exploratory survey on the quantity of rubber seed produced in India, the method of processing rubber seed kernel, the trend in the consumption of rubber seed oil and cake and other connected details of the industry. This survey, conducted both in Tamil Nadu and Kerala, highlighted the influence of local factors affecting the utilisation of agro-industrial byproducts.

Oil extraction

In processing rubber seed for oil extraction, the millers of Tamil Nadu have the following advantages In comparison to those of Kerala: (i) They have been processing groundnut but this crop arrives late at the mills after December whereas the rubber seed is available between July and September. As such, it is convenient for groundnut oil millers to process rubber seeds during the slack months; (ii) the climate of Tamil Nadu is conducive for drying rubber seeds prior to crushing. During July to September it rains heavily in the west coast of India whereas there is hardly any rain in the inland districts of Tamil Nadu This enables the millers to dry the rubber seeds in the sun; (iii) further, vacant spaces are available to dry rubber seeds in the compounds of rice mills of Tamil Nadu during that period. Some of them rent out that facility to oil millers; (iv) labour for shelling and handling of seeds is cheaper and more plentiful in Tamil Nadu than in Kerala. The cost of processing 1,000 kg dry kernels in Tamil Nadu and Kerala differs widely. There is practically no additional expenditure for drying in Tamil Nadu because of prolonged dry weather. As a result, the cost of drying is negligible.

Cost factor

Only labour charges amounting to Rs. 2 per tonne would normally be required. However, the average cost of drying is Rs 20 in Kerala. Two units in Kerala are using kilns. As a result, their cost of drying is as high as Rs. 85-100 per tonne. Rubber seed shells are used as fuel and solid in Tamil Nadu, thus reducing the overall cost of processing. In Tamil Nadu there are 75 units which process 11,670 tonnes of dry kernel whereas in Kerala; only 400 metric tonnes were produced in 22 units during 1976-77. During this year, about 4200 tonnes of rubber oil was available, out of which 1830 tonnes was consumed by 89 soap industry units in Tamil Nadu located mainly at Madurai, Coimbatore and Thiruppur. In Kerala only 50 tonnes were used and the washing soap manufactured out of rubber seed oil was of inferior quality. The saline water found in the coastal parts of Kerala also deters its use. Moreover, the soap manufacturers of Kerala get considerable quantity of mutton tallow at competitive prices. These factors have reduced the consumption of rubber seed oil in Kerala.

Rubber seed oil is used mostly for soap manufacture but recently work has been initiated on a number of new uses. Factice is recognised as a valuable processing aid by rubber technologists. This material possesses certain intrinsic properties which make it indispensable in mixes during milling, calendering, extrusion and injection moulding. A wide range of vegetable oils are used for factice preparation. Linseed, rape seed, cotton seed, soyabean and fish oils are some of the widely used glyceride oils. Investigations undertaken at the Rubber Research Institute of India, Kottayam, have revealed the possibiltiy of utilisation of rubber seed oil for factice manufacture.

Rubber seed cake

The epoxidised oil and esters of unsaturated fatty acids are widely used in polyvinyl chloride and its co-polymers in conjunction with other substances to impart a spectrum of properties e.g. heat and light stability, superior ageing and low temperature flexibility. Epoxidised products also find use in the formulation of anticorrosive coatings. Work has been done on the epoxidation of groundnut, cottonseed, safflower seed, tobacco seed, sesame, niger, rice bran and ajwain seed. The investigations carried out at RRII; Kottayam have indicated the possibility of epoxidation of crude rubber seed oil to obtain products with satisfactory oxirane content.

Formerly, rubber seed cake was used only as manure but recently investigations carried out by the Kerala Agricultural University, Trivandrum have shown that rubber seed cake can be used as an ingredient of livestock feed. Therefore, the Poultry Feed Manufacturing Company, a company owned by the Government of Kerala, is using this cake upto 10 per cent of the total weight of the feed. During 1976-77, about 8,000 tonnes of rubber seed cake was produced in the country. On the basis of the estimated production of rubber seed oil and cake, the industry has added nearly Rs. 27 million to national income during the year.

Great potential

Collection of seeds from estates is a difficult process. In order to prevent lipase activity, the collected seeds need to be heated immediately. Cooking of rubber seeds with steam makes the kernels soft and resilient like rubber. Because of this condition of kernels, their crushing in the expeller chamber becomes a problem. The oil obtained is high in free fatty acid and hence not amenable to alkali refining. Kernels have a tendency to brown with age and the extractable oil content diminishes with increasing brownness of the kernels.

The shells and kernels are almost of equal bulk density. This hampers an effective separation of shells from kernels. The decortication of the seed takes place completely but the separation of the shells from kernels requires recycling For one tonne of rubber seed, it takes eight hours for complete decortication and separation of shells from kernels. Therefore, for economic production of oil from the seeds, methods of collection, preservation, extraction and refining need to be improved upon. Work has been initiated at OTRI, Anantpur, on processing rubber seeds but, keeping in view the importance of the problem, it needs to be intensified. If proper methods are developed for removing hydrocyanic acid from the cake, it may prove to be a good cattle-feed.

The rubber seed oil industry holds great potential as an ancillary industry in rubber plantations. Fuller development of this nonedible oilseed industry can not only provide employment to small holders but also generate the highest forms of benefits from the socio-economic point of view.

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GUAYULE IN INDIA

The Guayule plant *(Parthenium argentatum)* is a bushy shrub, native of North Central Mexico and Texas. It provided about 10 per cent of the world's NR in 1910, but faded out as a source of NR during the 1930 depression. During the second World War, commercial cultivation was hastily organised by the United States on a plantation scale, when Hevea Rubber supplies were cut off from South East Asia. When the War ended this project was also terminated. This plant is again receiving attention as a source of NR in Mexico and USA. The ever increasing demand for rubber, limitation of Hevea cultivation to the tropics, dwindling stock of petroleum, etc. have contributed to this rebouncing of interest in Guayule.

Guayule shurb is hardy, requiring little water. Rubber is contained in single, thin walled cells in most parts of the plant except the leaves. Two thirds of the rubber is contained in the stem and branches and the roots contain the rest. The entire plant can be harvested at about the third year. Rubber is usually extracted by mechano-chemical means. The rubber content in the plant is subject to genetic variability and there is scope for improvement.

In India the semi-arid and arid regions in Gujarat, Rajasthan, Madhya Pradesh, U. P., etc. appear to be suitable for Guayule cultivation. Guayule was introduced to India in 1976. The Research Department of the Board has been collecting information on the work on Guayule in India and is trying to get involved in collaborative research.

The National Botanical Research Institute at Lucknow has raised about 2200 plants of Guayule which are at various stages of growth. They are now trying to find out its local adaptability and agrotechnology. The Central Arid Zone Research Institute at Jodhpur have about 7500 plants. Limited number of seedlings have been planted during this year in their different substations for observations. The Central Salt and Marine Chemicals Research Institute at Bhavnagar have grown about 60 plants in pots, which are about 2 years old and are trying to screen the strains based on morphological observations. They have recently introduced fresh seeds also which are being germinated and transplanted. The Biocenter, Ahmedabad, is also interested on Guayule.

The Rubber Research Institute of India has procured sample seeds of Guayule, which had been handed over to Madurai Kamaraj University for collaborative trials The RRII is intending to raise a few plants at the trial rubber plantations at Dapchari, (Maharastra) which is being established for observations.

nutritional disorders of rubber

Rubber plants are found to exhibit typical symptoms of nutritional disorders caused by deficient and or excessive supply of individual plant nutrients. Deficiency symptoms due to lack of Magnesium, Potassium and in some isolated cases Zinc and Manganese have been observed in our rubber nurseries and field plantings.

Of these, Magnesium deficiency is the most commonly observed nutritional disorder. The characteristic symptom of Magnesium deficiency is the development of chlorosis (yellowing) in the interveinal areas on exposed mature leaves giving a herring bone pattern. This deficiency incidences are seldom seen in Kanyakumari district and in the northern part of the rubber tract consisting of Palghat, Malapuram, Kozhikode and Cannanore districts where the soils are found to be fair in available Magnesium status. Usually this deficiency is noticed in the plantations located in central Kerala areas and or in cases where the rubber has been manured with excessive quantities of Muriate of potash and/or rock phosphate.

Potassium deficiency is commonly found on rubber grown in highly impoverished soils.

The characteristic symptom of Potassium deficiency is the development of marginal and tip chlorosis which is followed by marginal necrosis. Only older leaves exhibit the deficienc symptoms. Size reduction of the leaves and the absence of herring bone pattern of yellowing, allow Potassium deficiency symptoms to be distinguished from those of Magnisium deficiency.

Zinc deficiency causes interveinal chlorosis of leaves. The outstanding features of this deficiency are that the laminae become much reduced in breadth in proportion to their length and the young leaflets become incurved towards one another and present a hooked or clow appearance. Zinc deficiency incidences have been noted so far only in the case of young rubber plants either in the nursery or in the field. In most cases these deficiencies were noticed to be only transient. The cause of the deficiency appears to be heavy applications of Rock phosphate in most cases resulting in poor availability of Zinc.

The typical Manganese deficiency symptom is an overall paling and yellowing of the leaf with bands of green tissue outlining the midrib and main veins. Though this deficiency is widespread in India, it has been found to be only very mild in intensity.

Apart from these deficiency diseases, problems connected with nutrition, such as pre-coagulation of latex on the tapping panel and excessive drainage of latex causing dryness of trees, have also been reported from rubber plantations. Of these, the pre-coagulation of the latex on the tapping panel, has been found to be due to excessive supply of Magnesium to rubber. Also, there are indications to believe that unbalanced nutrition can cause excessive drainage of latex resulting in the dryness of trees.

The incidences of nutritional disorders mentioned above, are known to affect the growth and productivity of rubber to a great extent. Therefore, the planters are advised to consult the Rubber Research Institute of India if any of these disorders is noticed in their plantations and to take necessary preventive measures without delay. □

WAKF BOARD TO TAKE UP RUBBER CULTIVATION

The Kerala Wakf Board will cultivate rubber with the financial and technical assistance from the Rubber Board in holdings kept fallow by various Wakf institutions in different parts of Kerala State. It has been estimated that 4000 hectares owned by 6000 Wakf institutions could be converted into rubber plantations. The Kerala State Central Land Mortgage Bank has also offered liberal credit facilities for the venture.

Soil and leaf analysis

The value of soil and leaf analysis for diagnoisng the fertilizer requirements of rubber is well recognised. Before undertaking planting of rubber in nurseries or main field, representative soil from the area should be analysed for fertility status. This practice is particularly important, if the area is outside the rubber growing tract. Fertilizer recommendations based on this initial soil analysis will serve as a useful guide for manuring rubber in nurseries as well as rubber and cover crop in the main field for the initial few years. It is desirable to analyse the soil in the nursery once in three years for fresh recommendations. In the case of rubber in the main field the recommendations based on initial analysis may be followed during the first four years, if the the growth of the plants is satisfactory. During the fifth and subsequent years of immaturity, and after commencement of tapping, discriminatory fertilizer application based on the results of analysis of soil and leaf samples representing the area should be followed.

Method of collection

While collecting soil and leaf samples from rubber plantations for the purpose of analysis, it is necessary to take some precautions. The most important point to be kept in mind is that the samples collected should be truely representative of the area sampled. Moreover, after manuring, two to three months should elapse before samples are collected. If there is uniformity in the nature of soil, lie of the land, manurial history, age of the rubber tree and growth of rubber and cover crop, one composite sample of soil and leaf would suffice for an area upto 20 hectares. But if there are marked differences in the above factors take separate samples for the different areas. It is also desirable to have separate leaf samples for each clone.

If soil and leaf samples are simultaneously collected, the suitable period would be between August and October. But if soil sample alone is collected, the period between December and March would also be suitable. Take composite soil samples at two depths 0-30 cm and 30-60 cm.

For this purpose select at random 5 to 15 spots (depending on the total area to be sampled) and dig 60 cm deep pits at these spots. As it is necessary to ascertain the effect of past manuring on the fertility of the soil, locate pits at the site of past manuring application. (For mature rubber, fertilizers are applied either broadcast or in rectangular patches in the middle of every four trees). Do not sample road margins, labour line sites, cattle shed or compost pile neighbourhoods, area recently fertilized, old bunds, marshy spots, very near trees or stumps or othernon-representative locations. After removing the surface litter and mulch, cut a thin vertical section of soil from the top to a depth of 30 cm using a sharp-edged tool such as chisel. Pool all the samples of 0-30 cm depth from the different pits and mix well. If the size of the composite sample is large, reduce by quartering. For this purpose spread the well-mixed soil into a thin-layered square on polythene sheet or brown paper. Divide the square into four equal squares and discard the soil in the diagonally opposite squares. Repeat this process until about 500 gm sample of soil is obtained. Prepare composite sample from 30-60 cm depth also in similar manner. Dry the samples under shade and pack them in clean cloth bag and never in manure contaminated gunny or alkathene bags. Label each sample giving details of block sampled, depth of sampling and date of collection, and put the label in the bag. (Write the label with pencil and never in ink.)

Leaf samples are collected during August to October period. During this period leaves would be 6-8 months old. Depening on the area to be sampled, select 10 to 30 trees at random, (Upto 5 hectares select 10 trees, for 20 hectares select 30 trees, and for area between 5 and 20 hectares select proportionate number of trees). In the case of branched immature trees and trees under tapping, collect four basal leaves from the terminal whorl of low branches in shade from each of the selected trees. Four basal leaves from 'spur leaves' (small off-shoots with only one whorl from the trunk or main branches) are also suitable for sampling mature rubber. Branches with new flushes and leaves infected by Oidium and other leaf diseases are unsuitable for sampling. Leaves formed during the onset of south-west monsoon are also not mature enough for sampling. Do not select Brown bast or Root disease affected trees for sampling purpose. In the case of unbranched young plants with storeys, select plants without new flushes, and collect four basal leaves from the topmost whorl. If 30 trees are selected, collect only the middle leaf-let from each leaf, if 15 trees are selected, collect the two leaf-lets on either side and if 10 trees, collect all the three leaf-lets, so that about 120 leaf-lets would be available in one composite sample. Place the leaves between sheets of newspaper, and label each composite sample. Send the samples of soil and leaf to the Director, Rubber Research Institute of India, Kottayam-9, Kerala, as quickly as possible, if it is not possible to deliver the samples within 24 hours after collection. The samples may be dried by pressing with an elective iron heated to the temperature used for pressing the cotton clothes. Along with the sample, send the case history of the area represented by each sample in the proforma given below:

Case History Sheet of the Sampled Area/Estate

1. Name of the estate with postal address.
2. Name of the block sampled along with area in hectares.
3. Sample No.
4. Depth of sampling: 0-30 cm 30-60 cm.
5. Date of sampling.
6. Planting material used with spacing.
7. Age of the tree in the sampled area.
8. Average girth of the trees in the sampled area. (In the case of seedling, the girth at the height of 50 cm from the base, and for buddings the girth at 125 cm from the bud union, may be given.)
9. Elevation above mean sea level.
10. Rainfall average for last five years.
11. Slope-level— gentle/medium/steep.
12. Cover crops.
    (1) Pure *(Pueraria, Calopogonium, Centrosema or Desmodium.)*
    (2) Mixture of legumes.
    (3) Others.
13. Previous history of the sampled area. (Here state whether the area is a replanting of new planting, previously cultivated or virgin area.)
14 Manuring history. (Here state the rubber mixtures used specifying the various ingredients, composition and quantity applied per tree or per hectare for the past three years).
15. Time and method of application.
16. Tapping system (S/2 d/2 S/2d/3 etn.) adopted with average yield for the past three years with initial tapping height.
17. Please state whether the sampled field is with rubber mixed with coconut, arecanut, arecanut or intercultivated with tapioca, banana etc.
18. Stand per hectare.
19. Protective measures adopted against diseases.
20. Please state whether stimulants like 'ethrel' are used if so, give details.
11. Any other relevant information.

Place.......................

Date.......................

Signature.................

ARDC PERFORMANCE

Aggregate disbursements (of refiance) by Agricultural Refinance and Development Corporation (ARDC) during the year ended June 1981, reached an all-time high of Rs. 499 crores against Rs. 412 crores in the previous year. Resources required for the purpose were raised by borrowing Rs. 245 crores from the Government of India, Rs. 95 crores from the Reserve Bank and Rs. 35 crores from the open market besides ploughing back repayments. Commitments in respect of new schemes approved during 1980-81 also touched the highest ever mark of Rs. 800 crores.

Cumulative disbursements under the third ARDC credit project assisted by the international Development Association (IDA), which had become effective from January 2, 1980, reached a level of Rs. 377 crores and exceeded the IDA estimate of Rs. 355 crores by Rs. 42 crores as at the end of June 1981. The ARDC successfully negotiated with the International Fund for Agricultural Development (IFAD) the Sunderban development project in West Bengal. Under the bilateral assistance, USAID credit of $ 35.6 million, U. K. credit of £ 11 million two KfW (West Germany) credits of DM 62 million and DM 38 million, and the Netherlands credit of 50 million Dfl were also negotiated during the year. The ARDC also availed of bilateral donor's credit of Rs. 133 crores during the year which again was the highest level ever achieved.

Of the total disbursements of Rs. 499 crores during the year, Rs. 284 crores related to projects assisted by the World Bank/IDA/KfW group. The disbursements by ARDC enabled the government of India to draw foreign exchange of $ 168 million. In addition disbursements qualifying for assistance under the bilateral donor arrangements amounted to $ 162 million.

intercropping

Raising of annual food or cash crops along with rubber during the initial years is practised in many smallholdings in India, as it fetches some return during the immaturity period. Intrercropping also reduces cost of weeding. Many smallholders raise intercrops during initial years and then attempt to establish cover crops. This results in poor establishment of the leguminous ground covers since light becomes a limiting factor as canopy closes. The benefits that can be obtained by growing a legume cover are almost lost by indiscriminate intercropping. Moreover, raising of intercrops after the roots of rubber have started spreading may result in damage to roots, as intercrops require adequate tillage. Tillage will also encourage soil erosion. Howeveı, on economic consideratoins, intercropping could be practised in smallholdings provided the crops selected neither deterioate the soil norstand in the way of establishing a leguminous cover. Intercropping is seldom practised in large estates owing to the high labour requirement, management problems and awareness of the beneficial effects of growing leguminous cover crops from the beginning itself. A survey on intercropping in India conducted during 1976 revealed that in the order of preference tapioca, paddy, ginger and 'nendran' variety of banana are the most popular intercrops grown by smallholders. The net return per hectare obtained from different crops is given below:

Intercrops: Cost of cultivation and net return

Intercrops	Cost of cultivation (Rs/ha)	Profit (Rs/ha)
Tapioca	1454	1421
Paddy	1561	96
Ginger	8023	7107
Banana	2439	1759

The main attraction of ginger is the highest net return. Cultivation of the crop, being labour intensive, can provide employment to the family of the small holder. Even though preparation of beds involves relatively deep tilling, the large quantity of mulch applied to the crop protects the soil, and the farm yard manure added to it improves its physical properties. Moreover, large quantities of inorganic fertilizers are also added. Thus ginger cultivation, with proper agronomic inputs, promotes the growth of rubber. It has been observed that the local marketprico of ginger is liable to wide fluctuations. Many small growers do not take up ginger intercropping owing to the uncertainty of market and the high investment required.

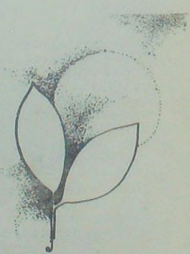
Field experiments conducted in India to study the economics and effects of growing intercrops like paddy, tapioca, banana and green gram showed that 'nendran' banana was the most suitable.

The greatest attraction of tapioca intercropping is that it is easy to cultivate and is in high demand as a food crop. The growth of rubber has been adversely affected by this crop because of competition for sunlight. Moreover, from the agronomic point of view, tapioca is an undesirable intercrop as it exhausts as well as erodes soil. It also attracts rodents which later damage the tap roots of rubber plants.

Paddy and green gram could prove to be profitable only if they are raised employing family labour. Moreover, tillage for paddy results in quick soil deterioration. Nevertheless, this being the staple food is preferred by many growers.

The net returns obtained from 'nendran' banana are quite attractive. This variety has good demand and hence an assured market. The capital investment required is not very high. It has been found that the girthing of rubber is higher during the initial years when intercropped with 'nendran' banana. This is so because, these plants exert a beneficial effect on the microclimate by keeping the vicinity af rubber plants cool and humid and do not compete with rubber for light. The other advantages of this crop are: (i) Cover crops can be established successfully in the first year itself; (ii) Growth of weeds can be kept down thus reducing weeding cost and competition with main crop; (iii) Soil disturbance required for raising the crop is minimum and hence it does not increase soil erosion; (iv) Since large quantities of fertilizers are used for banana cultivation, soil is always left enriched; and (v) Large quantities of crop residues are added by way of sheaths and leaves which can be used as good mulching materials after harvest.

(This is reproduced from a chapter on 'Fieldupkeep' published in the Hand Book of Natural Rubber Production in India. The chapter is jointly written by Dr. S. Narayanan Potti, R Kothandaraman and M. Mathew)

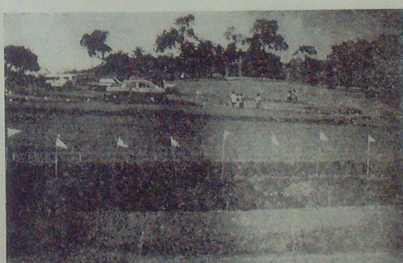


NEWS IN PICTURES

Shri K Mohanachandran IAS inaugurates the plan

INAUGURATION OF THE RUBBER NURSERY AT PANDALAM

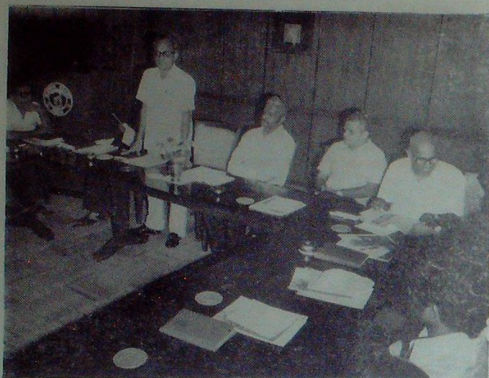
A view of the nursery site



The Chairman Rubber Board Shri K Mohanachandran IAS formally inaugurated the Board's new nursery at Pandalam on 31st August 1981. The meeting arranged in connection with the inauguration was presided over by Shri P K Velayudhan MLA. Shri PD George, Member, Rubber Board, Shri P Mukundan Menon, Rubber Production Commissioner, Shri N Radhakrishnan Nair, President of Varikolil Family Trust and Shri K Pappachan, President, Thekkekara Panchayat spoke. The total area of the new nursery is about 7 hectares.

The Rubber Board has already 7 nurseries in different parts of Kerala.

TRAINING FOR BANK OFFICERS



Shri N P Narayanan IAS, Managing Director, Kerala State Co-operative Central Land Mortgage Bank inaugurates the training programme on 24-9-1981 at the Council Hall of the Rubber Research Institute of India at Kottayam.

The Agricultural Officers from Kerala State Cooperative Central Land Mortgage Bank and various Primary Land Mortgage Banks have undergone an intensive training on the various aspects of natural rubber production and processing at the Rubber Research Institute of India in two batches during September and October 1981.

Shri P Mukundan Menon, Rubber Production Commissioner also addressed the trainees.

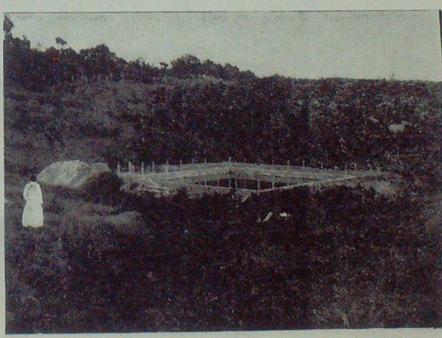
MALANADU DEVELOPMENT SOCIETY

ST VARKEY
PROJECT OFFICER

Malanadu Development Society is an Organisation for spearheading the integrated development of people in the diocese of Kanjirapally. Its objective is to render help to the people through its wide spectrum of activities. The following article gives a brief account of the activities of the Society.

In recent days, the role of voluntary organisations in the development field has assumed wider importance and greater say due to multiple reasons. More than any other body or department these organisations have come to hold a grass-root level contact with the people, and are today in an unassailable position to organise the people and ensure their active participation in the development schemes originating even at the Government level. It will therefore be inadvisable to eschew these organisations, while attempting to implement any people-oriented programmes.

Malanadu Development Society is such an organisation working in the Central Kerala for the integrated development of the people, particularly the weakest sections. Though it is the official organisatian of the diocese of Kanjirapally for social work, no barrier is let to prevent its services reaching to all categories of people irrespective of religion, caste, or any other extraneous considerations. It was registered in July 1977 as a charitable organisation under the Travancore-Cochin Literary Scientific and Charitable Societies Registration Act XII of 1955. His Excellency the Bishop of Kanjirapally is its Trustee, and has the Vicar General V. Rev. Fr. Joseph Thaiparampil as the President. The thrust and depth of its involvement in the development field however is propelled by its Secretary Fr. Mathew Vadakemuryil, whose devotion and hard work have been instrumental in taking this organisation to its present-day shape. The Society is managed by a Board of Directors consisting of nine members, and it has a seven member administrative team to co-ordinate and supervise its varions activities.



An irrigation pond constructed by M D S at Anakavu, Idikki

Objectives

Essentially, it is a service organisation, set-up to work for the development of the people within the diocese of Kanjirapally, viz the civil districts of Idikki, Kottayam, and Quilon. Agriculture development, livestock rearing schemes, poultry, bee keeping, silk worm rearing, nursery schools, community health extension work, mother and child health care projects, khadi & village industries, low cost housing programme, sanitation programmes, drinking and irrigation water supply projects, fuel generation through gobar gas, small scale industries in the co-operative sector, self-employment projects, and C. R. S. aided food for work schemes all become effective tools in the hands of Malanadu Development Society for realising the true development of the people. Notwithstanding this wide spectrum of its activities, Malanadu Development Society invariably clings to social work-or-

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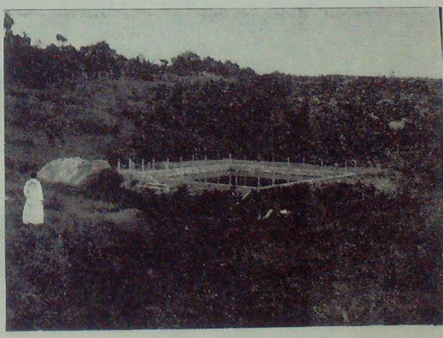

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P. K. Narayanan Public Relations Officer, Rubber Board inaugurating a nursery at the M. D. S. Training Centre Campus, Parathode, by sowing a handful of rubber seeds. The M D S proposes to open few more nurseries during this year. Rev. Fr. Mathew Vadakkemuriyil Secretary M D S and K. K. Ramachandran Pillai are also seen in the picture.

ganising the people, and impelementing development projects of common benefit through local development units constituted by the local people, in which the people themselves play the significant role in decison making planning, and implementing.

Activities

In the field of agriculture, Malanadu Development Society has been giving extra attention to provide relief to the poor farmer. With this intention, it has started working on a major plan to help 1000 poor families to cultivate rubber in their small holdings following the most scientific and proven practices of agriculture. Likewise, it has also commenced a master project to help 2000 families of High Ranges to cultivate coffee and cardamom in their small holdings. The motive behind these projects is to provide necessary orientation to these poor farmers to adopt intensive cultivation even in their small holdings and obtain optimum returns from their land and thus raise their socio-economic standard. 20 centres in the High Ranges, and 8 villages in the Kanjirapally and Pathanamthitta taluks will be covered by these major agriculture development projects. Besides these important strides being made by the Society into the field of developing a very vital sector of our economy, tne Malanadu Development Society has also implemented several other projects.

Livestock Rearing

It has planned and implemented three Dairy projects at Peermade, Kanayankavayal, and Panakachira covering a total number 310 farmers. It has also implemented a goat rearing project in the diocesan area, covering 500 families spread out in 34 villages.

Bee Keeping

MDS has rightly earned the credit for developing bee keeping industry in the central Kerala.

Marketing their own products
Members of the Malanadu Handicrafts Co-operative Society – a co-operative unit started by M. D. S.

Its bee keepers' association has 500 full fledged members and collects an annual production of over 25000 kg apiary honey. It is fast working towards that goal when the entire honey crop of our rubber plantations could be collected without allowing to be wasted as mostly happens now.

Silk Production

Like bee keeping, MDS has also a pionerring role in the silk production activity in Kerala. It has two units producing eri and seri silk, and is making clothes from this silk.

Developing Bee Keeping Industry

M. D. S. provides all equipments for bee keeping industry and also purchases the entire production of bee keepers.

Village Industries

With the help of the Khadi Board, MDS has set up two fibre units, two cane & bamboo units, one village oil industry, one soap unit, and a silk production unit, which together provide employment to 200 persons.

Small Scale Industries

MDS has organised four small cale industries in the co-operative sector, with an employment capacity of 150. One of these units, the Wiemens radio and speaker assembling Unit has been set up with the co-operation of Keltron as its ancilliary unit. Two of these units have been set up for manufacturing rubber bands, threads, and katai sheets.

Community Health Work

MDS has a vast network of 34 centres catering to 6220 beneficiaries under its community health work programme. Distribution of nutritious food, immunization to all children under five health instruction classes to the mothers, small saving programme kitchen gardening, backyard poultry, and medical check-up form the main aspects of this community health plan. We strive to propogate the preventive health care system through this scheme, and emphasise to the people the need for more hygienic living conditions, and nutritious food for promoting a better health.

Low cost Housing

One of its main activities is to provide durable houses to the poorest people. Already it has constructed 300 houses at Panakachira colony with the help of the Government and CRS. It has lso completed 35 other houses with the assistance from Block Development Office. At present the MDS is working at a plan to provide 100 more houses to the poorest families of resettlement colonies.

Water Supply

Realising the grave consequences arising out of lack of drinkingwater the MDS has been rendering special assistance to needy villagers for making drinking water avilable throughout the year. Already 12 projects have been implemented in this sector. MDS support is also available for irrigation projects.

Community Development projects

Lastly, the most outstanding of all activities of MDS is its commendable scheme for the community development plan in the colonies where people of the weakest sections live in large numbers. MDS has formulated a package plan to adopt five such settlememt areas in the initial phase, and implement comprehensive development programmes for the total development of the communities living there. All aspects, including agriculture, housing, employment, health, education, and sanitation will receive just attention under this plan, and the goal is to form completely ideal and model communities in these five villages and to eliminate as far as possible all sorts of social evils from them. MDS is working with the target of forming at least ten such ideal villages and in this task it very much depends on the encouragement and support from the Government and semi-government institutions. □

LOUIS CUTLER WHEELER

rubber seed as food

That the seeds of *Hevea brasiliensis;* the Para rubber tree, and other species of *Hevea* have been and still are used for human food is amply attested by both literature and the testimony of living people. Seeds of *Hevea* are poisonous and somewhat imperfectly balanced nutritionally, but so are the starchy roots of cassava or manioc, *Manihot esculenta,* yet millions of people in the tropics of both hemispheres eat cassava regularly. They have learned how to prepare cassava or manioc so that it can be eaten safely. Detoxification of the seeds of *Hevea* can be done in the home without any special equipment thereby making available this food which is relatively high in protein.

Importance

My encounter with the information about the edibility of seeds of *Hevea* came about partly by chance, but was basically the result of my working on the account of the *Euphorbiaceae* (Spurge family) for the New Flora of Ceylon being prepared under the aegis of the Smithsonian Institution. *Hevea* belongs to the Spurge family and is the source of natural rubber which is the second most important export crop of Sri Lanka. Reliable estimates indicate that over 7,000 metric tons of the rubber seed meal left after the extraction of the oil can be produced annually in Sri Lanka from plantations producing a yield of seed sufficiently high to warrant gathering them on a commercial basis. There are large additional acreages producing lower yields of seed from which substantial tonnages of seed could be gleaned on a noncommercial basis.

As food

Much of my acquaintance with the use of seeds of *Hevea* for human food resulted from my browsing through the library in the National Herbarium of Sri Lanka, housed in the Royal Botanic Gardens, Peradeniya, where I noticed a series of bound volumes entitled only "Botany Phamphlets." Scanning volume 6, I encountered a reprint of an article: 'On India-rubber: Its history, commerce and supply ' On the second page is the statement: "To M Fusee Aublet, the distinguished French Botanist, we are indebted for a description of *Hevea guayensis*. In his Flora Guiana" published in 1755; (*sic*, error for 1775) he says that the fruit is much sought after by the natives for food....." Subsequently I examined Aublet's "Flora of French Guiana" and confirmed that Aublet records that natives used the seeds of *Hevea guianensis* for food.

Experience

When I mentioned this statement of Aublet's to Dr. A. Kostermans who was also at Peradeniya working as a collaborator on the Flora of Ceylon Project, he showed immediate interest because he was personally acquainted with the edibility of the seeds of *Hevea brasiliensis*. During World War II while he was a prisoner of war in Java he and his companions ate seeds of *Hevea* with no more preparation than roasting them in fire. He suggested that I write to Dr. G. van Gils at Bogor for published information. Dr. van Gils kindly referred my query to Nazar Nur at Bogor who not only supplied the reference (Ochse, 1931) but also sent a transcription of the following pertinent passages from pp. 277-278.

Preparation

"Use. This plant is mentioned here only for the use which can be made of the seed-kernels. Since they are poisonous in a raw state they can be eaten only after a laborious treatment. They are prepared in almost the same way as the hydrocyanic acid containing seeds of (*Peetjoong Pangium edule.*) The kernels of *Hevea* are eaten in the shape of *dage* (Sund). The fabrication of *dage* is as complicated as that of *Kelewek* of peetjoong-seeds and is almost the same. Hence it cannot be entrusted to everybody. The seeds are first deprived of the testa and then cooked till they become quite soft. After being washed well they are steeped in floating water for 2 or 3 days. Then the stuff, covered with a banana-leaf, is placed during two days in a cool place within doors. Only then the danger of poisoning can be considered to be past. The *doge* serves for the preparation of *sambelan*, f. i. *sambel goreng*, mixed with petej-beans and coco-nut milk *santen;* Mal. [or *tjeepati*, Sund.). Or like *Kelewek* (Sund). It is mixed through the *sajor*. Further, *pais* is made of it, i. e. it is wrapped together with salted fish in a banana-leaf and roasted. Prepared in this way the *dage* can very well be eaten though the rancid taste of this dish does not enhance its savour. But perhaps this evil can be removed by a better method of preparation. Though *dage-karet* is not yet in general use, yet it is already frequently sold on the native markets (*pasar*) at Buitenzorg and possibly elsewhere also."

Nut like taste

In addition, Nur also kindly supplied the following unpublished information in his letter of 12 August 1974: "Personally, I have also tried to collect some more data on this matter. To those already published by Ochse, I like to add the following information. At this moment the preparation of the so called dage is no longer restricted to Bogor, but its use has already extended to other parts of West Java and even to some parts of Central Java. Honestly, speaking, it is regarded as a kind of food only consumed in times of need. "Usually, the consumers do not detect any effect on their health, probably because, in most instances., only occasional use is made of the dage in the daily menu. From one place, however, the information is acquired that frequent consumption will lead to sterility. According to the informants who are living in the vicinity of a large rubber plantation and in a rather poor area the dage does not affect their physical well-being, but it does not seem that the number of their offspring is limited after a continuous consumption of the dage. No investigation, however, has been made into this matter, but this information is most remarkable since it coincides with the findings in Sri Lanka that the oil cake of *Hevea* seeds has some effect on the fertility of livestock. Regarding the preparation, some suggested the shortening of the period of boiling and steeping in running water. But the figures given by Ochse seem to be on the safe side, because most of the informants have given similar data as Ochse. "Concerning the use it can be added that the processed kernel can also be dried and then fried and the fried dage has a nutlike taste."

Poison removal by boiling

Earlier, I had mentioned my interest in the use of the seeds of *Hevea* to my former classmate in graduate school, Prof. Richard Evans Schultes, Director of the Botanical Museum; Harvard University; who has studied *Hevea* extensively in its native home Amazonia. Dr. Schultes referred me to his published account where he states that the "cyanic poisons are removed by long soaking or by boiling." In a letter of 1974, Schultes states regarding his own experience with the use of seed of *Hevea* for food: "I personally have eaten them and found them, over several weeks, an adequate and good carbohydrate source." He has also referred me to Seibert's article of 1948 which repeats the quotation of Bentham's article of 2854 in which Richard Spruce's observations are recorded:

Savoury

"Siphonia *(Hevea)* — The genus seems abundant throughout the Amazon and its tributaries, but not all the species yield caoutchouc (or Xeringue) as it is here called of good quality. The wood of all is soft, soon decaying. The seeds are excellent bait for fish. Macaws eat them greedily, but to man a quadrupeds they are poisonous in a fresh state. The Indians on the Uapes render them eatable in this way: After being boiled for tw nty four hours, the liquor is strained off, and the mass that remains has something the colour and consistency of rice long boiled. Eaten along with fish it is exceedingly savoury."

Lanjouw notes that "Among the natives the seeds are used for consumption," meaning probably for food.

Detoxification

Giok gives a very logical direction for detoxification and cooking of the seeds: The seeds should be soaked for at least 24 hours in an excess of water in order to allow enzymatic hydrolysis of the cyanogenetic glynoside or an allergic the combined HCN so that it can be leached out and removed. There should be several changes of water during this 24 hour period of soaking. Then the seeds should be boiled at least a half hour in an uncovered utensil. The alternate method of roasting without prior soaking, used by Dr. Kostermans when there was no other method available, was fully justified when the alternative was insufficient food. It should be emphasised that the frying suggested by Nur is to be preceded by the soaking and boiling prescribed by Ochse. In any case, the seed coat should be removed before processing begins except that probably Dr. Kostermans left the seed coats on while the seeds were being roasted in the fire.

To prevent reactions

But we warned that anyone who is going to play gastronomic Russian roulette by experimenting with eating rubber seeds should eat only a little at first and gradually increase the amount with an interval of at least a day between to allow time for any possible unfavourable reactions. There could be poisoning from incomplete removal of HCN or previously unhydrolysed cyanogenetic glycoside or an allergic reaction, or poisoning by unknown factors such as toxalbumin. Actually an interval of three days after the first trial would be best to allow for the incubation period of possible toxalbumin. Although no mention of toxalbumins in *Hevea* has been found in the literature examined toxalbumins are well-known in the *Euphorbiacede* and may occur in *Hevea*. Of course, being proteins texalbumins should be denatured by cooking, but nevertheless caution is urged.

Just because some pioneer in this worthwhile project of experimenting with eating seeds of *Hevea* suffers no illeffects, others should also start with small amounts. It is possible to become tolerant to allergens and to Euphorbiaceous toxabumins by taking small then gradually increasing doses by ingestion. This is well-known to be the case with the notoriously deadly toxalbumin ricicn of *Ricinus*.

Different views

The apparent antifertility fadtor noted by Rajaguru and Nur in his letter of 1974 (quoted above) may be due to lectins though it would seem that prolonged cooking would denature any lectins as they are proteins. The poisonous lectin (toxalbumin) of Ricinus has been reported to prevent fertilisa tion *in vitro* of the eggs of the hamster. The apparent antifetility factor might also be rancid oils. Quackenbush states that rancid fats may interfere with reproduction. The method of preparation of *Hevea* seeds used in Java as described by Ochse would almost certainly result in rancid oils, and the rubber seed meal used by Rajaguru, left after extraction of the oil in expellers, still contains appreciable amounts of the polyunsaturated oil which would become rancid quickly.

The growth-depressant factor might by antitrypsin which would interfere with the utilisation of protein. Antitrypsin should be destroyed by cooking, but the rubber seed meal used in the experiments of Rajaguru and Wettimuny was uncooked although it had been heated somewhat during the expelling process used for the extraction of the oil.

Deficiency

The quality of the protein of seeds of *Hevea* needs to be examined further. There is agreement that there is a deficiency in some of the essential amino acids. Rajaguru and Dr. Neil Macfarlane of the Tropical Products Institute of London in his letter of 27 January 1976, both quoting Lever Bros., agree that there is a deficiency of methionine and lysine, but Rajaguru rates tryptophan as "marginal" while Macfarlane rates it as "deficient." This may be a minor disagreement if it is in fact a disagreement at all. However, Giok *et al.* state "The high level of lysine and tryptophan would make it a good companion protein for maize. The methionine content is low."

Dr. H. P. Gunasena, of the Faculty of Agriculture, University of Sri Lanka, Peradeniya, in whose household I was residing at the time, on hearing of my interest, referred me to reports of recent trials in Sri Lanka of *Hevea* seeds for feed-stuffs for poultry. In addition to the pertinent information which they contained, their references opened a large body of literature to me.

Conclusion

In the hope of learning more about the potentialities and limitations of the seeds of *Hevea* for human nutrition a project is being undertaken at the University of Southern California under the direction of my colleague Dr. Jerzy Maduski, whose training in both medicine and biochemistry combined with his special interest in nutrition makes him admirably qualified to couduct this investigation. We are indebted to the Rubber Research Institute of Sri Lanka and to the National de Pesquisas da Amazonia, Brazil, for supplying seeds.

The particular points to be considered in this study are:

1. Nutritional quality
   a. Proteins (amino acid balance)
   b. Essential fatty acids
2. Growth depressant factor (which may be the same as item I or different).
3. Antifertility factor
4. Toxicology and means of inactivating toxins.

Reproduced from the Bulletin of the Rubber Research Institute of Sri Lanka. □

PROTECTION TO RUBBER SMALL HOLDERS IN MALAYSIA

New York—Falling natural rubber prices have forced the Malaysian government to act to protect the interests of rubber smallholders according to Malaysia's minister of primary industries.

The decline of NR prices "has been a matter of serious concern (to the Malaysian government), affecting as it were the interests and livelihood···of the smallholders," said Datuk Paul Leong Khee Seong, who was in New York recently to sign the Sixth International Tin Agreement at the United Nations headquarters.

Per-kilo NR prices fell almost onequarter between Jan. 1 and July 31 of this year, from approximately $ 1.27 to 97 cents American. Some decline in prices was "probably unavoidable" during the summer months, Datuk Leong said, but "there was no doubt to that unhealthy speculative elements were at work to depress rubber prices to what may be described as 'artificially low levels.'"

Because of the price drop, the large Malaysian rubber estates were forced "to increase their commercial stocks (i. e. stockpile) as a matter of commercial prudence."

But the smallholders, whose livelihoods depend on selling their NR crops as soon as they are harvested had no such resource. Therefore, the Malaysian Rubber Development Corporation stepped in, according to its government mandate during times of sagging NR prices, and bought NR from smallholders at "an adequate market price," Datuk Leong said.

In addition to buying smallholder rubber, the Malaysian government introduced a new export duty structure expressly to assist smallholders. The changes include the introduction of a "cost-plus" concept to allow for increasing production costs and export duties calculated on nine different grades of rubber, instead of on the highest grade possible (RSS 1).

The export duty changes were made, Datuk Leong said, "after taking into account the interest and problem of smallholders, without detracting from the need that every incentive should be provided to encourage further upgrading and improvement in quality of rubber production."

Finally, Malaysia is pushing to get the International Natural Rubber Agreement on a "proper footing" in regard to the rules and regulations governing the establishment of a buffer stock.

(Rubber & Plastic News)

news and notes

EMERGENCY MEETING OF IRRDB

An emergency meeting of the International Rubber Research and Development Board was held at Kuala Lumpur on 10th August 1981. Dr. B. C. Sekhar, Chairman of the IRRDB chaired the meeting. Representing India Shri V.K. Bhaskaran Nair, Director of Research and Dr. A. O. N. Panikker attended. Besides the participants from India, representatives from Brazil, China, Indonesia, Ivory Coast/France, Malaysia, Nigeria, Thailand and U. K. were also present.

Plant Breeders meeting

The meeting considered the report on the IRRDB Senior Plant Breeders meeting, on the collection and conservation of Hevea germplasm from South America, which was held from 5th to 8th August 1981 at Kuala Lumpur. This meeting, held in the RRIM Board Room, was attended by Senior Plant Breeders from Brazil, China, India, Indonesia, Ivory Coast/ France, Nigeria, Thailand and Malaysia. The Secretaries of the IRRDB and MRRDB were also present. Dr. E.K. Ng(Dy. Director, RRIM) was elected Chairman of the meeting. This meeting reviewed in detail the progress made so far in the collection of Hevea germplasm from Brazil and arrived at conclusions with regard to the maintenance of germplasm and the future course of action.

First expedition and results

The first expedition under this joint IRRDB Brazil programme, was launched during the first quarter of 1981. Scientists from Brazil, Ivory Coast, Malaysia, Indonesia, Thailand, Nigeria and China were members of the collection teams. The broad areas of collection of germplasm were State of Acre, Territory of Rondonia and State of Mato Grosso. The teams collected seeds from these areas as well as budwood from selected trees. All the materials collected were sent to Manaus (Centro Nacional de Pesquisas de Seringueira & Dende) Over 64500 seeds and 1500 m of budwood from 194 selected trees were collected from the three areas. Out of these 54% of the seeds were retained at CNPSD in Manaus, where the germinated ones are maintained in nursery. The entire buwood collected have also been retained in a primary nursery in Manaus where 162 clones have been multiplied. 37.5% of the seeds have been received by RRIM and 12.5% by IRCA after inspection, prohylactic treatment and repacking at the Intermediate Quarantiue station in UK for germination and establishment.

The viability of the seeds collected was good. The germplasm centre at RRIM raised about 14,600 seedlings. These will be maintained in seedling nurseries and planted out in the field after 18-24 months. It was agreed that budding of all the genotypes be carried out as a precaution prior to transplantingin the field and that the buddings be maintained in the nursery. Observations on girth, height and disease incidence will be carried out af both the centres in the nursery stage and that on girth, yield, response to stimulation etc. in the field and will select about 25 per cent promising genotypes. The information will be commpiled by the IRRDB and sent to participating member institutes.

With regard to the clonal material raised in the primary nursery, the agreement was that one metre each of all the 162 clones established will be sent to the intermediate quarantine nursery at Goudeloupe for multiplication in 1982. Budwood of these clones will be ready for distribution to participating institues by 1983-1984.

The plant Breeders meeting also discussed about the need for future expeditions. The general concensus was that there is need for future expeditions and that emphasis be given to H. brasiliensis and its variants, at the same time not forgetting other wild species. The necessity of sending out the expeditions without delay was also felt by the Plant Breeders and the possible locations for subsequent expeditions were identified as Brazil, Bolivia, Peru, Colombia and Venezuela. The estimates for the establishment and maintenance of the primary nursery at Manaus, the intermediate quarantine nursery at Goudeloupe and the IRRDB germplasm centres in Malaysia an Ivory Coast worked out to 13,11,539 US.

Future expeditions

The suggestions of the Plant Breeders meeting were in general approved by the Board during emergency meeting. It was also agreed that the next expedition be carried out in February-April 1983 as it may not be possible to launch the same in 1982 due to limitation of time. In this context India's interest to join the team was emphasised. It was mentioned that the composition of the team etc. will be decided in the next meeting of the IRRDB and the Chairman wanted that India participates in this meeting.

General

The progress with regard to the decisions taken earlier were then discussed. It was informed that the first meeting of a research group on the exploitation and physiology of latex production will be held at the Rubber Research Institute of India in early 1982 and that the circulars will be issued soon. It was suggested to hold the proposed meeting of Plant Pathologists, to investigate and assist the phytosanitary precautions against South American Leaf Blight disease be held in London during October end November beginnig 1981 which will be followed by a limited study tour to African Research Institutes. It was also decided that the next meeting of the Plant Breeders be held in Indonesia early next year to discuss about the International clone trials. The next meeting of the IRRDB, it was agreed be held in Mexico or Brazil during May 1982.

BID TO HALT RUBBER SLIDE

In a bid to halt the downward slide of world rubber prices Indonesia's Rubber Producers' Association - Gapkindo - has called on its members to back Malaysia's plan to reduca the volume of natural rubber available for the world export market. Gapkindo, which represents virtually all Indonesia's estate rubber producers as well as those responsible for marketing a major portion of the country's smallholder output, has called on its members to reduce production by 20 percent.

"The average price of rubber on the world market has dropped 41 per cent from its 1980 peak. The current price means that for many it's just not worthwhile tapping at all. Something has to be done to bring the price back to a more realistic level. My association is giving strong support to the Malaysian Government's actions" says Mr. Harry Tanugraha, executive head of Gapkindo.

Reduction of output

Despite the association's call to its members, there has been no official Indonesian Government reaction as yet to Malaysia's request to Indonesia to withdraw output from the world market. Anyway it seems individual producers in Indonesia have already started reducing output under their own initiative in the face of weak demand and poor prices.

Some smallholders, appear to have stopped tapping altogether and switched, as they traditionally do in Indonesia at times of prices, to other jobs. Others are understood to be tapping between 50 per cent and 80 per cent of normal levels. Overall, Indonesia's rubber output may already be down by 20 percent this time compared to last year.

However, any decision to follow Malaysia's stated intention of creating its own rubber buffer stock must await a decision from the Indonesian Government.

Malaysia the world's largest producer of natural rubber, decided last month to create its own buffer stock despite the formation last year of an inter national agreement on rubber which provides for market intervention if rubber drops below a specified price on the world market.

Unrealistic

According to Mr. Tanugraha, the buffer stock price range is uhrealistically low and does not reflect current production costs.

"Though the International Rubber Agreement was formally adopted only last year, the buffer stock price range was based on a figure agreed in 1978. The reference price of 210 Malaysian cents per kilo does not reflect the economic cost of producing rubber in 1981, and a clause within the agreement does not allow us to change this until April 1982.

"This means that the rubber price has still not dropped to the level which allows intervention by the buffer stock manager, and even it had, we have still not collected money from our members to make intervention buying a possibility. This is why Malaysia felt impelled to act." □

rubber far from its crude beginnings

Brazil is the country where rubber tree had been identified long back. Until recent times only very little modernisation took place there. The rubber plantations there provide only a fraction of its own needs. At present, Brazil has to import 54,000 tonnes of rubber a year to satisfy her annual 84,000 tonnes consumption. RE Kaufman analyses the origin and history of natural rubber production and confirms that despite the lay-offs, a bright future is ahead. The article gives an interesting study of the role of synthetic rubber also.

In the primeval forests of the Amazon basin hundreds of years ago, the rubber industry had its first crude beginnings with the discovery of the *Hevea brasiliensis* tree.

The latex found in its stem was used for a variety of purposes by its early cultivators but soon became used mainly for water proofing. Then in 1839 the discovery of the process of vulcanisation by Goodyear brought a substantial increase in the range of rubber applications.

With the increase in demand which followed from the vulcanisation improvement, the cultivation of trees was placed on a more stable footing and plants from Brazil were moved to more suitable cultivational regions.

The rubber trees were transported to London's Kew Gardens and after surviving the change were then moved to the Far East to areas which were soon to become vast plantations.

Brazil-the birth place

Brazil, the father of the rubber tree, has seen ironically little modernisation until recent times and still only provides a fraction of its own needs.

At present, Brazil has to import 54,000 tonnes of rubber a year to satisfy her annual 84,000 tonnes consumption.

Following the vulcanisation breakthrough and the invention of the pneumatic tyre about 50 years later by Dunlop which revolutionised the rubber industry, demand for natural rubber soared and the price of rubber rocketed with the shortfall in supplies against demand.

Experimentation was begun to produce a synthetic substance and in 1906 Friedrich Bayer's the forerunner of today's Bayer group, polymerised the first synthetic rubber.

From this base, the world's first synthetic rubber tyres were produced.

Synthetic rubbers were given a further boost during the first world war in Germany when natural rubber supplies were cut off. Alkali metals were successfully used as catalysts and butadience rubber was produced using sodium.

Research on Synthetic

Although natural rubber prices fell briefly in consequence and there was less encouragement to continue work on alternatives, research continued to improve the versatility of synthetic rubbers and increase the range of applications in tyers and technical products.

There was also much interest in attempting to improve manufacturing capabilities using alternative polymerisation techniques, better initiators, activators, modifiers and other additives. It was in 1920 that an aqueous emulsion of butadiene was polymerised for the first time to form BUNA-S (or ESBR)

This development accounts even now for more than 50 percent of world synthetic rubber consumption and almost 40 percent of all rubber. Some 60 percent of it is used to make tyres.

In the Eighties, with the recession biting deep into the rubber industry—affecting both natural and synthetic profitability — the industry faces new challenges

Price hikes of oil

The incrsase in OPEC countries, bargaining power over energy prices has sparked off rapid rises in oil and gas prices, as well as chemical feedstock which has led to a crisis in the drive to find economies of scale to deal with plummeting profits

Investment levels in new plant are at an all-time low, partly due to over-expansion in the Fifties and Sixties, and the chances of evolving a solution with new bulk quantity polymers are slim.

The future for the industry must therefore lie in development of new manufacturing processes, better uses of feedstock increased manpower efficiency and new end - user applications.

The industry has much to learn from the plastics processing industry during the Fifties, when new and more efficient manufacturing techniques were developed, new markets were penetrated and fresh markets created for its products.

The major aim of the rubber processing industry must, like any other manufacturing sector be to produce the most suitable product for an application at the right time and in the right quantity at the appropriate price.

Cost reduction

With competition for markets increasing, within the industry and between different supply industries, more and more emphasis is being put on computerised-assisted technology. By automatically and precisely controlling the manufacturing process to increase the quality and consistency of the product, unit costs can be reduced and labour more efficiently deployed.

During the last five year, employment in the UK rubber manufacturing industry has been cut by some 20 percent. Although much of this reduction is due to the general downturn in business, a good proportion is a result of streamlining to meet increased competition.

Whether this process will lead to a more healthier—though slimmer —industry, only time will tell.

A long way to go

There is still a long way to go. The industry has only just begun to explore the opportunities offered by the silicon chip.

But it is also vital that these advances are implemented because while new processing aids are being developed which could significantly affect production efficiency, the full potential will only be realised when useed with similarly advanced machinery.

This requirement becomes all the more vital when one considers that replacement costs for standard manufacturing plants are becoming prohibitive and many companies are still producing on outmoded equipment.

The chance should be taken now to consider the possibility of introducing completely new technology—which, while requiring a certain amount off retraining, will quickly provide a much higher return on expenditure because investment and running costs will be considerably below those of processes in current use.

Powder technology

A suitable case for such innovation is powder technology, which offers the processor the opportunity to compound his own materials and reduce reject material.

Availability of many rubbera in powder form represents s significant technological advance in the industry, and machinery development has now solved many of the problems of homogeneity, 'dispersion, energy input and other problems which originally obstructed its introudction and caused many people to fight shy of it.

Long-run extrusion products are particularly suited to this process.

Following the 1973 oil crisis, much was made of the fact that plastics and rubber industries in a highly vulnerable position owing to their dependence on petrochemical feedstocks. The situation in truth threw into the sharp focus the insecurity of all manufacturing industry because of dependence on oil.

The rubber industry has not yet priced itself out of its markets and as long as it pays sufficient attention to its feedstock supplies should continue to avoid the trap. As it is, petrochemicals account for less than 6 percent of all the world's oil.

Automotive sector

The main threat to the continuing supply of oil is more likely to come from its use for petrol, which consumes over a quarter of production. It is therefore imperative to encourage the trend towards energy-efficient vehicles and because the automotive sector is so important to rubber.

Oil feedstocks will not last forever, but should with care last well into the next century. Thankfully, much work has already been done in the area of alternative raw materials.

In the past, the development costs and conversion costs of producing feedstock from other sources has been prohibitive.

However, the quadrupling of oil prices since 1973 has severely affected the production costs of synthetic rubber. As a result, research into other feedstocks has shown that coal, for example, has become a viable proposition.

It is likely that in the next two decades the full-scale production of synthetic rubber from coal will be possible. Other less conventional sources are also being considered.

Although the costs of producing ethanol and ethylene from carbohydrates are still high, this is still an area which has substantial possibilities for the future.

Healthy industry

The industry has for some time now been reducing its workforce.

However, such reductions should not be made indiscriminately because it is vital for a healthy industry to ensure it has the right quality as well as quantity of people.

If the industry is to maintain its markets and develop them in the future, it must have the right calibre of skilled engineers, technologists and managers.

A fundamental aspect is the education and recruitment of personnel. Tomorrow's men and women must be better trained to be able to cope with the ever-changing pattern of business and to react more quickly to new situations.

In Britain in the past, while universities and polytechnics have been producing graduates of the highest quality in rubber technology and materials science, the industry has had a tendency to opt for scientists with more general backgrounds.

Fortunately this situation is now changing, but it must be emphasised that idustry should build still stronger links with the educational establishment.

Industrial relations

Education should not be forgotten once a person enters a job, but should continue throughout his or her career. The rubber industry should use its excellent industrial relations to get management and unions to work together to plan for future requirements.

The industry must also care for its environment and have regard to the healty hand safety of its environment and have regard to the health and safety of its employees as well as its customers.

Employers have a responsibility under the Health and Safety Work Act in the UK to provide a safe environment for employers and to ensure that they are made aware of any problems related to the use of chemicals.

The rubber industry has for many years realised the value of such measures and should continue to retain its reputation of a safe industry by its active co-operation with the regulatory authorities.

Looking foward

One blot on the horizon here is the discrepancy in regulations between trading nations. Although attempts to achieve multinational agreement on legislation have had limited success, it is important that further progress is made in this area both in the interest of manufacturing companies and customers.

I believe progress will be made not just in health and safety, but on all fronts that so there is no reason to doubt the future of the industry. The days of massive growth are long gone, but this is no sign of decline-merely a reflection of the mature state of the industry.

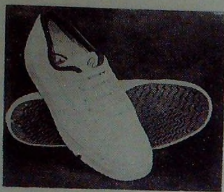
The future holds good prospects so long as we are prepared to take calculated risks. World growth for the next decade is predicted at 2 percent each year.

While Europe faces competition on its home ground from certain Far Eastern countries, it is equally true that in many developing nations there is enormous potential for technology and for finished products.

With skill, determination and foresight we can look forward to a bright future. (Rubber and Plantics News) □

PESTICIDE HAZARDS IN DEVELOPING COUNTRIES

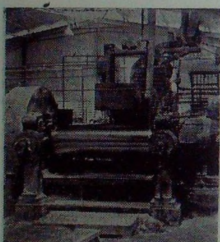
According to U. S. Government registers, one fourth of the pesticides that cause problems and are not used in that country, are marketed in developing countries. A publication of Banana Exporting Countries in Panama City has reported that pesticide manufacturers in United States use developing countries as testing ground for their products, posing a serious health hazard. The British review of International Agricultural Development says, a product especially hazardous to human life, "DBPC" is widely used today in Central American Countries, the Carribbean Islands and some African Countries. Another toxic pesticide, 'phosph el', which caused serious damage to nervous system of workers in Texas is being extensively used in Indonesia. The World Health Organisation (WHO) says, that every minute a person in the Third World is being poisoned with pesticides. Though the exporters are required to inform their foreign customer of the risk discovered in pesticides banned in the United states, there is no legal disposition for enforcing them. However, the United States adopts measures to make sure, that the poison it exports do not re-enter that country.



The Punch Smash, result of collaboration between Punch Gunalan and Marco Shoe.

natural rubber and canvas put punch into play

The story of Marco has been one of achieving as much as possible with the minimum of financial resources. Like many other companies in the Malaysian rubber manufacturing industry, it has been benefited from the availability of cheap, good quality raw materials, particularly natural rubber; from Government incentives including tax holidays and export incentives; from the dedication and hardwork of its employees; and from the facilities provided by the Technology Centre of Rubber Research Institute of Malaysia. BARBARA DAVIES of Malaysian Rubber Producers' Research Association gives an account of its functioning with particular reference to the consumption of natural rubber in Malaysia.



The Iddon mill with its direct conveyor feed, modified by Marco engineers

WHEN PUNCH Gunalan, ex-badminton champion and chairman of Malaysian badminton coaches, decided there was a market for a new sports shoe, the design and manufacturing expertise of Marco Shoe Sdn Bhd was sought. The result was the natural-rubber-soled *Punch Smash*. The *Smash* underwent nine months of continuous testing, both under tournament conditions and with the Thomas Cup training team on a variety of court surfaces, before it was brought onto the market. A further development was the *Punch Classic*, designed with extra comfort in mind for older players. Both styles have been well accepted and are enjoying good sales.

Efforts behind

Macro Shoe is a relatively young company, but its technical managers have a great many years of experience behind them. The managing director, Mr. Coutts, is an ex-managing director of Bata (Malaysia) Bhd: he was the first Asian to be elevated to his post in Bata. Similarly, many of the top management and technical experts are ex-Bata personnel. The managing director is the largest shareholder, having provided 40 per cent of the initial capital outlay of MSI .5 million. The Malaysian Rubber Development Corporation is another partner, owing 30 per cent. The remaining investment was provided by a foreign partner, Kiftdisco, a shoe company 70 per cent owned by G. J. Coles. The partners

Cutting and folding bias strip

Industrial sewing machine modified for eyelet insertion in the uppers

A selection of Marco shoes now in production for the 1980-81 season. Each style is exclusive to a particular customer

signed the joint venture agreement in June 1975.

In under one year a factory was built at Port Klang near Kuala Lumpur, machinery installed and the first shoes produced, although production was not in full swing untill November 1976 as additional electricity supplies were required. The whole operation–specifications, plans, building and machinery–was supervised by Mr. Coutts himself. Similar dedication was displayed by his employees; during the first year of operation no leave was taken by any of the executives except in emergencies the team would often put in 12 hours per day, and working on Sundays was not unusual.

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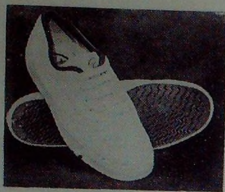
Production runs are based on a 5½- day schedule. The emphasis is on quality, and materials are tested at every stage of production. All raw materials are sampled by the small test laboratory and subjected to a dozen tests, including elongation at break, tensile strength, abrasion resistance, colour fastness *etc.* A technically specified, high quality, light-coloured natural rubber, SMR 5L, is used for all shoe soles. Tests carried out at the RRIM, with whom the company has close links, showed that Marco's soles were way above minimum requirements. Natural rubber consumption is now about 600 tonnes/a, but with expansion and the development of new products (bath and shower mats are currently being developed for the Australian market) this figure should soon be exceeded.

Compounding ingredients are weighed under controlled conditions and conveyed semi automatically to the rubber mills. Marco started production with inexpensive open mills imported from China and Taiwan, but now uses,



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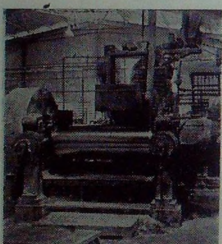

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Compounding ingredients are weighed under controlled conditions and conveyed semi automatically to the rubber mills. Marco started production with inexpensive open mills imported from China and Taiwan, but now uses, for initial mixing, a Shaw internal mixer which can be operated by one person producing up to 5 tonnes/ shift. From here the compound is fed by conveyor directly to an Iddon mill which has been modified by Marco's engineering department. Wherever possible, processes have been automated by building specialized equipment on sit or modifying existing equipment.

Soles are stamped out from the sheet rubber by a semi-automatic cutting machine developed and built by Marco. The resulting surplus, some 30 per cent of the total, is recycled. The uppers are cut by a clicking machine, or a load of 15-20 tonnes from fabric supplied by local maunfocturers. Bias strips are cut rather than bought in, to facilitate control over material quality. Aftar cutting, the strips are folded by passing through heated alumnium rollers.

All component parts of the uppers are assembled on long lines by a combination of gluing, using natural latex adhesives, and stitching, on over 100 industrial sewing machines. Some of these have been modified for particular tasks: the insertion of eyelets at positions marked by a template, for instance. At the end of each line a thorough quality control check is made.

Uppers, insoles and soles are assembled, again using latex adhesives,and each joint is sujected to a pressure of 300kN/m² for 3-4 sec. The assembled shoes are stacked on racks which are convoluted to hold 42 per cent more shoes. The racks stay in a hot air vulcanizing pan at a controlled temperature and pressure for one hour- There follows a final inspection: because such careful attention is paid to testing and quality control throughout the production sequence, the reject rate at the final inspection is only 0.25 per cent. The finished shoes are transported by mechanical loader to the warehouse, where turn-round is very fast: most are stored for less than four weeks, leaving by the container load at a rate of four containers per week.

About 20 per cent of Marco's production goes to the home market, divided equally between government contracts (rubber-soled boots for the military, police *etc*) and the retail market. One style which has enjoyed remarkable success from small beginnings is the *Murid* (murid means student in Malay), designed for school children. Marco started selling his shoe through rural shops run by the Federal Land Development Authority, and its popularity grew: more than half a million pairs have been sold to date.

The marketing philosophy is simple but effective, and starts with product design. Before the beginning of the season, a number of new styles are designed, taking into account fashion trends in colours, shape *etc*. Each style is costed and a sample shoe and production guide produced, which are used subsequently in manufacture and quality control. Attention to detail is important: each component of the shoe is specified by large scale diagrams from several angles similar to engineering drawings. A range of new styles is thus on show to agents representing foreign retail outlets and the customer is free to make modifications to any basic style to meet market requirements. Once a style is'sold'it is removed from Marco's public display. Thus each shoe is exclusive to a particular outlet. For instance, the range of Marco shoes sold by the well-known high street retail chain, British Home Stores, will not be found in other shopes unless it is copied by another manufacturer.

Marco Shoe Sdn Bhd has survived and grown through its emphasis on high quality shoes using the best raw materials available. Its highly-experienced management team is concentrating on passing on knowledge gained from lifetimes in the shoe industry to younger staff so that they might continue in the same tradition. Marco's natural- rubber- soled shoes should feature strongly in the footwear industry of the future. (Rubber Development) □

THE NUT THAT BURNS

The Philippines Government is launching a $ 1.3 million research project to to study an exciting new find a tree which bears fruits that burn. The tree, popularly called petroleum nut tree (Pittosporum Resiniferum Heme, to Scientists) yields nuts having an odour similar to petroleum. Even the fresh nuts burn brilliantly when lighted with a match stick. The nut's oil contains hydrocarbons. This tree normally grows to a height of 30 metres and bears fruits twice a year; yielding about 800 nuts. (The Hindu)

A Pilot Crumb Rubber Factory

A Pilot Crumb Rubber Factory was established under the Rubber Board in 1976. In 1977 the Factory was transferred to the Department of Rubber Processing with a view to orient its activities towards the successful implementation of the Rubber Processing Component of the Kerala Agricultural Development Project (KADP) financed by the IDA of the World Bank. The article is prepared by the Department of Rubber Processing.

Introduction

The idea of establishing a Pilot Crumb Rubber Factory (PCRF) within the Rubber Board to improve and modernise natural rubber processing in India was conceived in 1973. The PCRF was established in 1974–75 period and was inaugurated by Shri. V. P Singh, the then Deputy Minister of Commerce on 24 January 1976.

Objectives

The objectives in setting up the PCRF as origianally conceived were as under:

i) To develop machinery for crumb rubber production indigenously, by adaptation of suitable machinery available in the country.

ii) To use as a demonstration and training centre to interested crumb rubber manufactures.

iii) For perfecting the processing procedures for tailor-cut and chemically modified rubbers.

iv) For improving the machinery once installed, so as to increase the efficiency and throughput of the crumb rubber processing factory.

Development

The factory was established under the Chemistry and Rubber Technology Division of the Rubber Research Institute of India. In line with the objectives, the Board could develop all machinery indigenously; one of the commendable achievements being fabrication of an electrically heated dryer for crumb rubber which is the first of its kind in the world. The factory was transferred in May 1977 to the Department of Rubber Processing of the Board with a view to orient its activities towards the successful implementation of the Rubber Processing Component of the Kerala Agricultural Development Project (KADP) financed by the IDA of the World Bank. With this reorientation, the working of the PCRF was tuned up to achieve the following additional objectives.

Additional Objectives

* To bring about radical changes in the processing of field coagulum (scrap) by assuring a better price for the small rubber growers and by making available a superior quality rubber to the consuming industry.
* To study the problems connected with crop collection and transportation from small holdings for centralised processing.
* To promote marketability of natural rubber in block form in accordance with ISI Standards (Technically Specified Natural Rubber).
* To evolve sound practices in factory organisation and management and in machinary maintenance practice for crumb rubber production.
* To undertake studies in treating factory effluent and its disposal.

With this end in view, three shift working was introduced from July 1977 in the factory which was working single shift only till then. In order to study the improvement in the economic viability of a small size crumb rubber unit and the processability of small holder scrap, the factory experimented during 1977–79 with processing of dry scrap procured by the Kerala State Co-operative Rubber Marketing Federation (KRMF). The factory processed the dry scrap supplied by KRMF against recovery of processing charges.

From May 1979 the factory also started a pilot project for establishing Small Holder Development Centres on the AMUL pattern. During all these period the factory promoted markets for crumb rubber by direct sales to manufacturers and through the KRMF.

Organisation and Management

The factory started with a minimum staff of ChemicalEngineer, Accountant, Office Assistant, Foreman, two Factory Assistants and four Workmen. At present the factory gives direct employment to 33 persons.

In addition the factory also provides indirect employment to over 10 persons. The factory is also adopting the procedures and practices prescribed in the Accounting and Procedural Manual prescribed for adoption in the crumb rubber factories to be set up under the KADP.

Financial Position

The factory has a gross investment of Rs. 12.11 lakhs (31-3-1981) including Rs. 1.77 lakhs for effluent treatment plant. The sale of processed rubber from the factory showed a regular increasing trend as indicated below:

Year	Quantity of sale (Tonne)	Sales value (in lakhs) Rs.
1976-77	23	1.40
1977-78	73*	4.70
1978-79	90*	8.35
1979-80	280	27.48
1980-81	341	44.10

* excludes the quantity processed for KRMF.

The factory also established financial viability of a small unit processing even less than 1 tonne/shift by generating a net profit of Rs. 0.58 lakh in its operations during 1980-81.

Physical Progress

The crumb rubber processing in the factory also showed significant improvement year after year.

Year	Quantity processed (M. Tonnes)
1975-76 (From 1/76)	4
1976-77	56
1977-78	213
1978-79	282
1979-80	274
1980-81	347

Marketing

The progress achieved in the field of marketing, market research and market promotion has been quite significant. Considering the limited quantum of production in the factory, emphasis is laid on judiciously making use of the end products to create market demand for various grades of crumb rubber. To start with, the potential consumers of crumb rubber were spotted out through market surveys and personal dialogue. Armed with this knowledge different market segments where crumb rubber could replace conventional grades have been identified. The rationale behind this approach was to generate demand for crumb rubber to ensure a regular market for the products of KADP factories.

The price structure for the various grades of crumb rubber is arrived at taking into consideration market demand, cost of production, prices of competing conventional grades and so on. It is being subjected to periodic review in the context of changing circumstances. The grade-wise demand for crumb rubber is also monitored regularly and the price structure is suitably modified to stimulate demand.

Achievements

While working for the fulfillment of the above objectives, the factory made significant contributions to the achievements of the Rubber Board as shown below:

* Developing superior processed rubbers like PA 80, SP 20, Viscocity Stabilised rubber, Carbon Black Master Batches, Latex Stage Compunded Rubber, tyre rubber etc. to suit the specific needs of the polymer consumers.
* Establishing the viability and feasibility of Small Holder Development Centres and popularising it among the small growers. These centres collect latex and fresh scrap from small growers facilitating transportation centralised processing and marketing. The growers are paid a provisional price for the latex based on accurate drc estimation. Moreover, they are also eligible for differential payments at the end of the year. The collection of fresh scrap is a novel concept which is popularised among growers as this system prevents degradation of small holders scrap, and the resultant unhygenic conditions at the growers premises. Besides it also saves energy required for processing. The response of the growers to this scheme has been quite encouraging. The number of growers participating in the scheme recorded a phenomenal growth from 30 in May 1979 to 150 in March, 1981 The number of centres has also increased from 3 to 5 during the corresponding period. The factory was able to declare purchase bonus to the participants for the rubber supplied by them in 1980-81.
* Increasing the market acceptability of crumb rubber signifïcnatly. The premium of ISNR 5 (LC) grade latex crumb, over the average lot sheet price could be enhanced from Rs. 0.50 in 1977 to Rs. 2.00 per kg. in 1981 (september). The factory has generated sufficient demand for various grades of crumb rubber, only a portion of it could be met due to limited production.
* Stabilising to some extent the price of latex by processing and marketing of preserved field latex. This has demonstrated the economic of advantages of the system to the growers
* Imparting training to the Factory Managers, Assistant Managers (Finance), Fore man, Procurement Assistants and Collection Agents recruited for the KADP factories in the co-operative sector.

Looking Ahead

The work initiated by the PCRF will be instumental in bringing about the following welcome changes in the pattern of natural rubber production, processing and marketing in India.

* Substantial increase in the production and productivity of rubber small holdings will be achieved by dessiminating the concept of establishing small holder development centres.

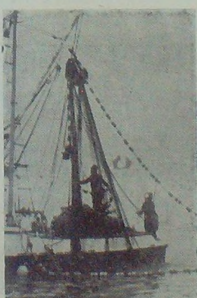
(continued on page 15)

the fall and rise of fishery fortune

NATURAL RUBBER has played a significant role in making purse seining the most important method of commercial fishing in the World. According to the Food and Agriculture Organization of the United Nations, more fish are caught today by purse seining than by any other method. This was not always the case. As recently as 1950, purse seining was simply one of several methods of catching fish with a net. The dramatic change came with the invention, by a Jugoslav fisherman, of a powered pulley block incorporating a natural-rubber-coated grooved wheel. It was this that revolutionized the hauling of nets in the tuna, anchovy, sardine, herring, menhaden (a large herring found off the east coast of North America), pilchard, and salmon fisheries.

In purse seine fishing, a school of fish is located and then surrounded by a net or seine. The bottom of the seine is closed, or pursed, with the purse line, trapping the fish within. As the net is hauled aboard the boat, the fish are concentrated in the resulting bag, known as a bunt. Once this is accomplished, the fish are pumped to a hold on the fishing vessel.

Salmon seiners along the north-west coast of the USA were the first to adopt the power block in the 1950s

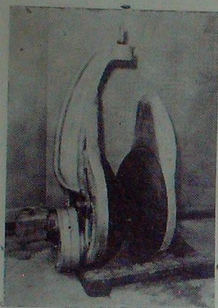


Until the invention of power blocks, one of the most vexing problems of purse seining was the slowness of the net hauling operation. Fishermen hauled their nets in by hand, just as their predecessors had for five thousand years. The mechanical methods available were primitive and incredibly slow. Boats could only make two or three catches a day. Because the net remained in the water for such a long time, many fish died and the net was often damaged by marauding sharks.

By the mid-1950s the economic health of many commercial fisheries was precarious at best. The inefficient and labour-intensive methods of net hauling doomed many fishermen to a subsistence level economy. Any change in these conditions hinged on the development of a mechanical method of net hauling that would allow a reduction in crew size and an increase in hauling speed.

The problems of net hauling were obvious to fishermen who handled the nets manually. One such fisherman, Mario Puretic, who had emigrated to the USA from Jugoslavia, saw at firsthand the amount of time wasted in the hauling operation. Not willing to accept this situation, Puretic invented the power block, a mechanical, V-shaped pulley with a natural-rubber-coated grooved wheel, or sheave. During a net hauling operation, the net is threaded through the opening of the power block. When power is applied, the rubber-coated sheave turns, drawing the net onto the vessel deck with a minimum of slippage and a maximum of speed.

Puretic took his invention to an enterprising naval architect, Peter G. Schmidt, and his company, MARCO SEATTILE, Seattle, Washington. Together they developed, refined, manufactured, and marketed the power block around the world. The MARCO *Puretic Power Block* became the linchpin in the mechanization of purse seining. Like Eli Whitney's cotton gin and Cyrus McCormick's reaper, Mario Puretic's power block was nothing short of revolutionary. One need only look at a few of the many fisheries that have adopted the power block with its natural rubber-coated sheave to understand its profound effect on commercial fishing. By enabling fishermen to haul the large synthetic purse seines faster using high speed diesel power, with less



Different types of power block have been designed to suit the needs of various fisheries in all parts of the world

Left. The 0.5m diameter open-topped power block: this is popular in salmon purse seining, in the Scottish and Danish seining industries, and in gill-netting

Below. In menhaden seining, the 1.7m side-opening power block is often used

Right. Net slippage can be reduced by use of the power grip, the main component of which is a natural rubber-tyred wheel. It is seen here attached to the largest power block model, measuring 1.5m in diameter.

were on the nets and half the manpower, the purse block changed the course of commercial fishing overnight.

The salmon fishery along the North American west coast was the first to adopt the new powered pulley. Catches increased, crews were halved, and net hauling time reduced. A complete operation, which had required four to six hours without the power block, now took less than an hour. Time is an especially important factor in the salmon fishery: because the salmon are constantly moving toward the shore and their spawning streams, there is only a limited amount of time for catching the fish. The power block enabled the fishermen to make more catches in the available time by permitting large modern nets to be hauled with a minimum of manual labour. The crew was reduced from 8–10 to 5–6 men. This was beneficial from the simple economic standpoint that the smaller the crew the larger the individual crew share.

In the Gulf of Mexico menhaden fishery, the introduction of the MARCO *Puretic Power Block* meant that only 12 men were needed to handle the net, doubling labour efficiency in a single stroke. In addition, because the

power block and the superior gripping of the natural rubber sheave permitted the use of larger nylon nets, faster hauls could be made on larger schools of fish.

The effect on the California tuna fleet was even more spectacular. Labour costs In the early 50s had risen sharply and the live-bait-pole fishing method then in use was extremely inefficient. Economic collapse was imminent. This was averted, however, when the California tuna fleet observed the dramatic difference the power block had made in the salmon purse seine fishery. They quickly made a wholesale conversion to purse seining and the power block, an action which brought about complete economic recovery. The increased mechanization, the use of huge new tuna superseiners of up to 68m long and a tuna carrying capacity of 1200 tonnes, and the new large synthetic purse seines of up to 1650m long by 275m deep, all came together to make the tuna fishery a showcase for profit and efficeiency. And all from a fishery that three years earlier had been on its last economic legs.

MARCO manufactures 15 standard models of the *Puretic Power Block*, ranging in size from 0.3 to 1.4m in diameter and able to handle every type of large commercial fishing net. The natural-rubber-coated sheave is powered by a hydraulic motor and surrounded by a metal casting which is usually attached to the end of a vessel's main boom. Depending on the model, the hydraulic system will require from 10 to 14MPa at oil flows of 15 to 500 l/min.

The coating for the sheaves was critical to the success of the power block, and natural rubber was chosen for its high coefficient friction. This provides a superior gripping surface on the sheave, which minimizes slippage of the net during the hauling operation. At the same time, the high abrasion resistance and cushioning effect of the natural rubber increases the longevity of the expensive synthetic nets.

Each size of power block requires a different coating a natural rubber. The largest power block, the mammoth 1.4m diameter model, has a 40mm layer of natural rubber at the throat, and a 20mm layer along the sides and top. 1.2m- and 1.1m-power blocks, on the other hand, require only a 20mm layer along the side, 10mm layer along the top, and a 40mm layer at the throat. Other models have corresponding thickness, which can be smooth-faced or cleated for even greater gripping tension.

Another aid to gripping tension is the *power grip* attachment. This patented device increases the effectiveness and efficiency of the power block by reducing net slippage and enhancing the peripheral pull of the sheave with positive net gripping action. The natural rubber-tyred wheel of the power grip compresses the net into the 'V' of ihe rubber-coated sheave to provide additional traction and to assist in 'squaring-up' the net, a feature especially useful when the power block is in a low hauling position.

Three devices

There are three basic styles of *Puretic Power Block* to suit the requirement of various fisheries around the world. More than 75 per cent of purse seine fisheries use the standard power block with its fixed side shells and either smooth or cleated natural rubber sheave. It is common on South American anchovy seiners, Scandinavian herring seiners, tuna seiners around the world, and in many sardine and salmon fisheries. The open-topped style permits nets which are partially set to be lifted into the block at any time. This is popular in salmon purse-seining, beach seining, Scottish and Danish seining and gill-netting. A hinged, side-opening style of power block can be opened and operated while suspended from the boom. This method is used in menhaden seining, where the open block is sometimes used to pull only the corkline so as to close the top of the net over the fish.

These various styles are possible in large part because the natural rubber coating of the sheave provides the necessary traction to draw in the net: the configuration of the block can then be varied to meet the other needs of the particular fishery.

No coating material, not even natural rubber, can withstand indefinitely the tremendous tension of drawing in the net plus the harsh marine environment of commercial fishing. Therefore renewing the natural rubber coating on the *Puretic Power Block* becomes necessary at certain intervals, depending on the size of net and the frequency of hauling operations. The smaller power blocks used in south-east Alaska salmon seining for instance, require rerubbering only periodically while the larger blocks used in tuna seining with large modern nets require rerubbering more often.

Rerubbering

Scougal Rubber Co of Seattle has perfected a rerubbering process that provides a natural rubber-to-metal bond at least equal to that of the orginal. When a power block needs a new coating of natural rubber, the fisherman returns his sheave to MARCO-where the old rubber is stripped off. MARCO then sends the stripped sheave to Scougal, where any oil, water, fish fluids, etc are leached from the sheave: this leaching is crucial to the bonding process. Scougal takes the clean sheave and applies a polychloroprene/natural rubber adhesive that firmly bonds the natural rubber layers to the sheave. After the sheave is heat cured, it is returned to the fisherman ready for fishing.

The Scougal process, with its use of natural rubber, makes rerubbering an economically feasible operation for the fisherman. It provides the same qualities as new power block at a fraction of the cost, and fishermen continue to come back for Scougal rerubbering because the natural rubber protects the net from excessive wear. With the soaring cost of synthetic nets, this has become a sound investment for the working fishermen. There have been attempts to manufacture an uncoated power block, but these attempts have not been popular with the fishermen. Some fishermen who have tried the uncoated power block have found it necessary to rebuild their nets each year because of excessive wear.

Experimentation and fishing ground trails have shown that no substance can beat the durability hardness, and adhesion to metal of natural rubber. The MARCO *Puretic Power Block* with its natural rubber coated sheave is still the best selling and most effective power block on the market. Since its introduction 1955, it has been adopted by more than 17000 commercial fishing vessels, from small open dories to large tuna Superseiners. Natural rubber has played-and will continue to play-a vital role in purse seine fishing around the world. (Rubber Developments) □

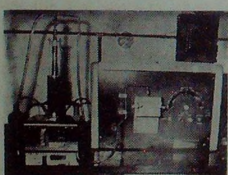
(Continued from page 12)

* The replacement of conventional individual sheet processing by modern methods of centralised processing will receive more acceptance in the producing and consuming sectors.
* The upgrading of scrap rubber by scientific mothods of processing, quality control and marketing will increase the economic return to the small growers and ensure operational efficiency and better profit margin to the rubber goods manufacturers.
* The active involvement and participation of the co-operative sector in organised marketing of small holders, rubber will bring about welcome trends in price stabilisation and regulated supply of natural rubber in the country to benefit the producers and consumers alike. □

Facilities for rubber products development and testing at the RRII

Chemistry and Rubber Technology Division of the Rubber Research Institute of India has a full fledged rubber Chemistry and Technology Division, having facilities for testing raw rubber, latex concentrate, various compounding ingredients and rubber products as per the specifications prescribed by national and international standards. The Chemistry Division of the RRII has brought out a leaflet on the facilities for rubber products development and testing at the RRII, Kottayam-9. The contents of the leaflet are reproduced below:

The Rubber Research Institute of India, under the Rubber Board, Ministry of Commerce, Government of India, has a full fledged Rubber Chemistry and Technology Laboratory. This Division is having facilities for testing raw rubber, latex concentrate, various compounding ingredients and rubber products as per the specifications prescribed in national and international standards. The different types of assistance available to rubber processing units and rubber goods manufacturers from the Rubber Research Institute of India are described the following paragraphs.



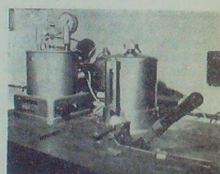
DBP Absorptometer

Testing of Raw Materials

The Institute offers facility to rubber goods manufacturers in testing of raw rubber, latex, rubber chemicals or fillers in accordance with the standards laid down by the Indian Standards Institution. Testing of raw materials will give information on purity of them. It thus helps to detect adulteration of raw materials and to identify good sources of supply. This Institute is one among the twelve regional laboratories approved by the International Rubber Association for testing of raw natural rubber.

Raw material testing equipment available at the Institute are listed under.

a) DBP Absorptometer— For identification of carbon black
b) Mechanical Stability Tester For concentrated latex
c) Lovibond Colour Comparator
d) pH Meter (Accuracy 0.01 pH)—For the determination of KOH No. of Conc. latex
e) Aniline Point Apparatus— For Process Oil Test
f) Melting Point Apparatus
g) Abbe Refractometer
h) Flash Point, Cloud Point, Smoke Point and Pour Point Apparatus —For quality assessment of rubber process oils
i) Wallace Plastimetef and Ageing Oven—For the determination of Po and P R I cf Raw Rubber



Wallace Plastimeter

Processability Tests

Processability of raw rubber compounds is an important factor for the economic production of rubber goods. For example, raw rubber of high Mooney Viscosity requires more power for mastication and a scorchy rubber compound may increase the percentage of rejections in the product. This Institute has the following equipments to assess different processability properties.

(a) **Scott Mooney Viscometer**

The following tests can be performed, as per the standards specified, using this equipment.

i) Mooney Viscosity
ii) Compound Viscosity
iii) Mooney Scorch Time

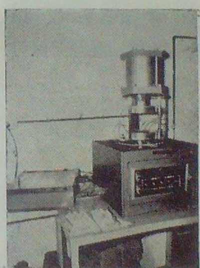
(b) **Rheometer (Monsanto) R-100**

This equipment is used for assessing the following characteristics of rubber compounds

i) Cure rates
ii) Optimum cure time

(c) **Scott GSV Model Viscurometer**

(d) **WallaceDirect Reading Specific Gravity Balance**



Rheometer (Monsanto) R—100

Physical Testing of VulcanisedRubber & Finished products

Regular testing of finished products is highly essential to maintain quality of the products and to assess whether the products conform to the required specifications. Physical testing is also necessary for product development and undertaking research work. The following equipments for testing vulcanised rubbers are installed at the RRII

(a) **Scott Tensile Tester**
The following tests can be conducted using this equipment.

i) Tensile strength
ii) Modulus at a particular elongation
iii) Elongation at break
iv) Tear strength
v) Rubber to metal bonding strength

(b) **Du Pont Abrader**

For determining the abrasion resistance of vulcanizates.

(c) **Dunlop Tripsometer**

(d) **Scott Rebound Resilience Tester**

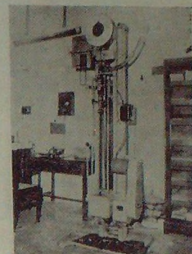
Wallace Direct Reading Specific Gravity Balance

Rebound resilience of vulcanizates can be tested at various temperatures

(e) **Durometer—Shore A,D & OO**
For testing the hardness of rubber vulcanizates

(f) **Constant Deflection Compression Set Apparatus**

For testing the compression set of vulcanized rubbers



Scott Tensile Tester

(g) **Tubular Ageing Oven**

For carrying out accelerated ageing tests of vulcanized rubbers

(h) **Ozone Chamber**

Fer assessing the ozone resistance of vulcanisates

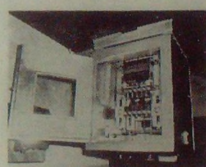
(i) **Frost Micro Tome-**

For Dispersion Study

(j) **De-matta Flexer with heating chamber** — To measure crack growth resistance

(k) **Goodrich Flexometer—**

To measure the heat build up in rubber compounds



De-mattia Flexer with heating chamber

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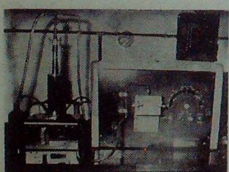

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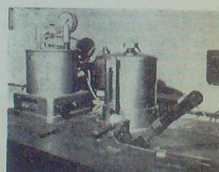

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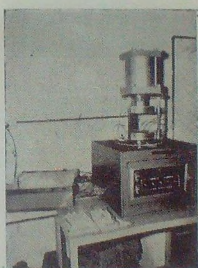

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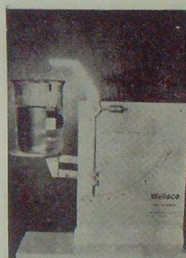

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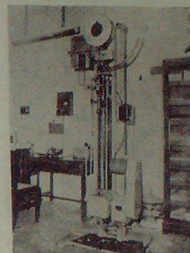

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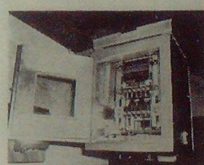


De-mattia Flexer with heating chamber

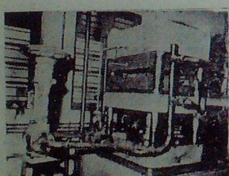
Processing Equipments

It is always better to take laboratory scale trail production and standardise the process for product manufacture before large scale production is attempted. The following equipments installed at RRII are useful in trail production.

1. 6"×12" Mixing mill
2. 12"×30" Mixing mill
3. 4½"variable speed extruder
4. 50 tonnes hydraulic press with 18" × 18" steam heated platens
5. Jeep tyre retreading press
6. 100-S Boilcr for steam generation
7. 6' × 2½' Autoclave vulcanizer
8. Moulds for various dry rubber products
9. Laboratory ball mill
10. Hobart mixer— for foam rubber production
11. Moulds for dipped goods.

Product Development Standardisation Work

Chemical analysis of products enables to identify the nature of polymer, filler, plasticiser etc. used in the product. Information obtained by this method can be used as a valuable tool for product development. New entrepreneurs or those who are already



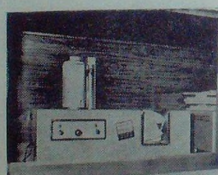
Tonnes Hydraulic Press

in the field of rubber industry can get assistance of this nature from the Institute for developing new products or substitutes for imported ones. Institute also helps the manufacturers to produce and market products as per the specifications prescribed by ISI, Defence Department. Railway etc. Some of the important equipments available at RRII for chemical analysis of rubber products include I. R. Spectrophotometer, solvent extractor etc.

Mixing Mill 12"×30"

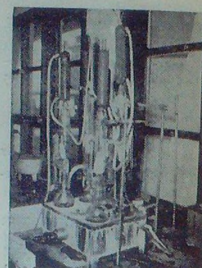
Training and Advisory Assistance

The Rubber Research Institute of India assist raw rubber processing units and small scale rubber products manufacturers in training their technical personnel. Tech-



I R Spectro Photometer

nicians from raw rubber processing units are given training in analysis of raw natural rubber latex concentrate as per the relevant Indian Standard Specifications Two weeks training courses are conducted here for the benefit of small scale rubber goods manufacturers. Theoretical aspectf of rubber technology, supported by practical demonstrations, are provided in these training classes New entrepreneurs are given guidance in drafting project profiles



Solvent Extractor

Apart from these, the manufacturers are given technical advice in solving their day to day processing/manufacturing problems.

Achievements of the Division

The important achievements of the division are listed under

1. Sponge rubber components used as sealants in rocket and missiles were developed for the Defence Research and Development Laboratory, Hyderabad. These were being imported from Russia expending huge foreign exchange.
2. Cover compounds and diaphragms used in transducers were developed for war ships in collaboration with Naval Physical & Oceanographic Laboratories, Cochin. These products were imported from Un ted Kingdom,

DECOMPOSITION OF RAW NATURAL RUBBER BY SOIL BACTERIA

By

R. Kothandaraman, Microbiologist, Rubber Research Institute of India

Natural rubber like other polymers is resistant to the attack of micro-organisms. However earlier findings show that raw natural rubber can be easily decomposed by a variety of soil micro-organisms. Hence a study was initiated to find out the presence of soil bacteria that can decompose natural rubber in rubber soils in India. Raw natural rubber was subjected to the extraction with acetone and dissolved in petroleum ether. A thin layer of this solution was spread over carbohydrate free mineral nutrient agar medium and allowed the petroleum ether to evaporate. Then 0.2 ml of 10 fold soil dilution in sterile water was placed in small drops over the rubber film and the plates were incubated for 7 days. After the incubation period the plates were found to have white and pink powdery growth in places where the water drops were put. On peeling the rubber film got ruptured in such spots. Similar degradation of rubber film was also noticed in glass slides coated with rubber solution and burried in field soil The rubber degrading bacteria of different shades were isolated and the isolates were identified as *Bacillus megaterium* by CMI, Kew London.

B. megaterium is a common soil bacteria and this bacteria may be responsible for the degradation of rubber particles reaching the soil by way of leaf and spillage during tapping and collection of latex. □

(continned from page 18)

3. Rubber diaphragm and sealing bush used in television lens assembly was fabricated for M/s. Bharat Electronics Ltd., Bangalore: These were imported from West Germany at high cost.

4. Formulation and processes for backing of carpets with latex foam were developed as per request from National Institute of Designs Ahmedabad and private industries.

5- Tissue equivalent rubber phantom materials were developed for Cancer Institute, Madras.

6. Standardised formulation and process for the production of injection bottle caps meeting ISI specification using natural rubber.

7. Processes were developed for the production of carbon black master batch, constant viscosity rudber, oil extendsd natural rubber, latex stage compound and styrene graft rubber

8- Know- how for processing natural rubber into energy saving from of raw material was developed.

9. In collaboration with the Indian Standards Institution implemented a scheme for the marketing of raw rubber (block rubber) and concentrated latex with ISI mark. □

RAIN FORESTS ARE GENETIC STORE-HOUSES

Tropical rain forests represent a vast store-house of genetic resources built up over millions of years. While in the temperate regions a hectare of woodland normally contains 10 species of trees, tropical rain forests have an average of 100 species per hectare, rising to an astonishing 200 species in the Malay peninsula. Plant resources in our forests are magnificiently varied and distinctly valuable Forests are one of the important habitats where the genetic resources of medicinal plants and spices are to be found. The wild population of these plants thus constitute the major genetic sources. They represent valuable reservoirs for resistence and adptability genes. Unfortunately the tropical forests in many parts of the World are fast disappearing or under going extreme modification at an increasingly rapid rate to meet the demands on forest resources in developing countries due to population explosion. Depletion of forests, the destruction of ecosystems by forest felling, prainage of marshes and general replacement of natural vegetation by arable farming have accele rated the geneticerosion. (Plant Genetic Resources News Letter 44-FAO)

mucuna bracteata

an ideal cover crop for rubber plantation

Mucuna Bracteata is an ideal leguminous cover crop for rubber plantations having characters like draught resistance, shade tolerance and high nitrogen fixing capacity. One of its advantages is its non-palatability to cattle. This plant was collected and brought to Rubber Research Institute of India by Shri. PK Sivasankara Panicker, Field Officer, Rubber Board.

Cultivation of a leguminous cover crop along with planting of rubber is an important agronomic practice recommended in all rubber growing countries. This is being adopted extensively in rubber plantations. An ideal cover crop for rubber plantations may be one having characters like draught resistance, shade tolerance, high nitrogen fixing capacity and non-palatability to cattle. However none of the cover crops presently recommended are having all the aforesaid characters.

A wild legume *Mucuna bracteata* collected from Tripura and brought to RRII was found to be drought ressitant and shade tolerant. It is also not eaten by cattle. In pot culture experiments the nitrogen fixing capacity of this legume was found to be high.

This plant grows fast and covers the field very quickly. Since the growth of this plant is very thick and luxuriant it suppresses all weeds in the area. Older leaves of these plants are shed during the months of December and they are observed to form a thick layer of much on soil surface. After that new leaves and inflorescences develop. Flowering is not noticed under local conditions. Fruit set was not seen even after hand pollination and treatment with plant growth regulators. Fertilizer application and pest protection operations also did not result in fruit set. However normal fruit set is reported in Tripura area.

During the monsoon new roots are observed to develop from the nodes of the vines lying on the ground surface. Heavy nodule formation was noticed under pot culture conditions. Nodules are found to be much bigger than that of the other cover crops. Nodules formed earlier were observed to be round and pink in colour and those formed later were corolloid, branched and dark in colour.

Since fruit set is not noticed under local climatic conditions, propagation of this plant may not be easy. Even though propagation through cuttings is possible this method also yielded only limited success. Proper methods of propagation through cuttings may have to be evolved for large scale evaluation of this plant as a cover crop in rubber plantations. □

Calcutta Rubber Units in Crisis

One who chances to walk down the congested, and dirty lanes and bylanes of thickly populated Topsia and Tangra, east of Calcutta, is not likely to miss the sight of the string of factories producing rubber goods. They are small units, existing in a world of their own.

There are some 300 such units in all about 200 in Topsia, and the rest in Tangra. They provide direct employment to about 6,000 workes, and indirect employment to about 2000 more who depend on these industries for livelihood by doing contract jobs for them at piece rates.

Four Groups

The units can be classified into four groups according to the amount of capital investment made in each case. The capital employed in the first 20 units varies from Rs. 1 to 5 lakhs. In the second group of 100 units, it is from Rs. 50,000 to Rs. 1 lakh. In the third group, also of hundred units, the investment varies from Rs 10,000 to Rs. 50,000. For the fourth, the investment is below Rs. 10 000 in each case.

Most of these units have come up after independence, particularly in the late fifties. They are largely proprietary concerns with the exception of a few units which have private limited status.

Mr M. Qamar, who owns a factory of medium size in Topsia, says all these small entreprenuers are men without any previous business background but who have trained themselves to be experts in this trade.

Products

Products manufactured in these units include chappals, microcellular sheets, rubber autoparts for the automobile industry, retreat rubber for the retreading of tyers, footwear like gum boots, waterproof shoes, rubber matting for cars, V-belts, fan-belts etc.

A big unit can turn out goods worth Rs. 2 lakhs a month, while the turnover for a small unit varies from Rs 20,000 to Rs. 25,000 a month. Unlike in other small-scale industries, labour productivity in these units is up to expectation.

Though these industries have sufficient growth potential, they are now in a very bad shape because of various problems. The situation has become so critical of late that many of the units face heavy production cuts or closure.

Power Cuts

Unscheduled power cuts for long periods has crippled the industry, resulting in heavy loss of costly materials and damage to machinery and equipment. A spokesman of the industry says that when electricity is restored, it becomes difficult to use the same material for the process again. In fact, a factory is not able to work for more than half of its full time.

As a result, the profitability is declining. The units, in these two areas irrespective of their sizes have to be contended with a small margin of profit, varying from 5 to 10 per cent. This, by any standard, is much below the economic level of operation, in the present context of high production costs and inflation.

Interference

Mr. Qamar, who is the secretary of the small Rubber Manufacturers Association, says that in addition to the daily power cuts, the meter inspectors of the C. E. S. C. have also created other problems. These inspectors check the meter boxes of the factories and cut the lines at will without assigning any reasons, he alleges.

The lines are restored only when they are paid 'handsome premiums,' Mr. Qamar adds. complaints to the authorities do not yield much result.

Unsatisfactory communications in these areas also pose a very serious problem to entrepreneurs, particularly during the monsoon when the entire area becomes a 'veritable hell.'

High Prices

The high price of rubber and chemicals, coming on top of the power crisis, have reduced further the economic viability of these units The price of one kg. of rubber now costs between Rs 18 and 20, against Rs. 7 four years ago. Even at this prohibitive price, one may not set the quantity one needs, because of artificial scarcity created by wholesalers and middlemen. The manufacturers do not have direct supplies from the main producers in Kerala, which is the principal centre of rubber production in the country.

The middlemen, who are supposed to supply the commodity at fair prices, take full advantage of the transport difficulties and the short supply and demand higher prices. Tiny units with small working capitals meet their rubber requirements out of scrap rubber, available at low prices from the big organised units located in this state.

Chemicals

Similary, the prices of chemiclas have also moved up abnormally in the past seven to eight years. One kg. of thio-tax (MBT) is selling at Rs. 53 against Rs. 18.40 in 1974. The prices of thio-side, ureka while F (thiaxole guanidine blend) and thiurad (TMT) have more than doubled.

The prices of the chemicals have also escalated.

However, unlike rubber, there is no supply bottleneck in respect of chemicals, which are available quite easily in local markets.

Entrepreneurs are happy that there is no labour trouble in this industry, but the cost labour is very high. A daily rated worker-even in a tiny factory, which operates on scrap rubber, is given a minimum wage of Rs. 10 a day. A piece rated worker can earn a minimum of Rs. 12 to Rs. 13 a day. The workers get wages even when there is no production due to power cuts. In addition, they are also given bonus, variable dearness allowence and other statutory benefits.

Competition

Previouly, the industry had a wide market for its products throughout the country when the cost of production was low and when there were no competitors. The situation, however, changed during the last four to five years because of the emergence of new rubber-manufacturing units at Jullundhar, Delhi, Gaziabad, Faridabad, and Kanpur. Their products are not only cheaper but superior as well.

Consequently, Calcutta-made products have gradually lost their ground and are now confined to markets in the eastern region only, mainly in Bihar, Orissa, and Assam. A spokesman of the industry says manufacturers in other places are not beset with so many problems as we are in this state.

They get rubber at lower prices and have better power supply facilities for production. This apart, they have modern machines and equipment to make products of superior quality.

Poor revenue

The poor return on capital has left most of the Calcutta units with little reserves for any worthwhile modernisation. The small units which are not equipped with proper machines have to get their jobs done by hiring machines from others on payment of exorbitant loan charges. These local disadvantages give units in other States an advantage.

Faced with numerous problems, some of the entrepreneurs promoted an organisation in 1974, named the United Custom Serivice Corporation. One of the promoters says it was intended to procure essential raw materials at reasonable prices, dispose of finish products at fair prices and provide funds for hiring of machines and overhauling of units.

In fact, it was the maiden attempt to boost rubber industries in the area. The organisation was inaugurafed with the blessing of the ministers of the then government in the State. Unfortunately, however, it did not last long.

He is very much critical of the State administration which has made no attempt to make an in-depth study of these small units now in a servere crisis.

(Business Standard)

FIRESTONE DEVELOPS A 'FUN TUBE'

Firestone has developed an inner tube for water sports and is marketing it at 49 dealer and company stores under the name "Fun Tube".

Taking the cue from Disney World's River Country, where tubing is a popular recreational activity, Firestone's Russellville, Ark., has built a Butyl rubber inner tube that differs from a regular passenger tire tube in that it is smooth and free of protrusions.

Instead of a valve stem protruding from the tube wall, Fun Tube inflates with needle valve in the same manner as a football or basketball, according to Firestone.

Fun Tube currently is being test-marketed in Tampa, St.Petersburg and Clearwater, Fla., Birmingham, Ala., and San Diego. (Rubber ane Plastics News)

composition collection and preservation of field latex

(I)

K. KOCHAPPAN NAIR

The following are two lecture notes of Shri K. Kochappan Nair, Specifications Officer, Rubber Research Institute of India prepared for the Refresher Course conducted for the small scale latex goods manufacturers. The lecture notes were later compiled and published. One deals with composition of field latex and the other with ISI Specification and testing of latex.

Latex as it comes out of the tree is a white or slightly yellowish opaque liquid with a specific gravity in the range of 0.96 to 0.98 and having a variable viscosity. Fresh latex is slightly alkaline or neutral. It becomes acidic rapidly due to bacterial action and gets coagulated on keeping. The surface tension of fresh latex is 38 to 40 dynes per cm. at a rubber content of 38 to 40%.

Hevea latex is a weak lyophilic colloidal system of spherical or pear shaped rubber globules suspended in an aqueous serum. The size of the rubber particles ranges from 0.025 to 3.0. Due to the refraction of rubber particles the colour of latex appears to be white. The rubber globule is surrounded by a protective layer of proteins and phospholipids. Latex contains a variety of non-rubber constituents also. These non-rubber components are important not only as natural stabilisers for latex but as a possible source of variability in raw rubber and its processing behaviour. The proportion of these constituents may vary but in general the composition of latex is as follows:

Rubber	—	30-40%
Protein	—	1-1.5%
Resin	—	1-2.5%
Sugar	—	1%
Ash	—	Less than 1%
Water	—	55-60%

These substances are distributed among three phases, i. e., the rubber phase (35% of latex by weight) the aqueous phase (55% by weight of latex) and the lutoid phase which accounts for most of the remaining 10%. There is also Frey-wyssling particles.

Proteins

Of the total protein content, one half is dissolved in the aqueous phase, one quarter absorbed on the surface of rubber perticles and the remaining quarter associated with the lutoids. The absorbed proteins and phospholipias impart colloidal stability to Latex. The important proteins present are globulin and Hevein

Lipids

The lipids of fresh latex consists of fats and waxes, sterols, sterol esters and phospholipids. These are concentrated in or on the rubber phase with smaller quantities in bottom fraction and in the Frey-wyssling particles.

Enzymic hydrolysis of the latex phospholipids occurs rapidly after tapping. Breakdown of lipids in ammoniated latex gives a mixture of fatty acids. The increasing mechanical stability of ammoniated latex on storage is accounted for by the release of fatty acids in the form of ammonium soaps. The rapid enzymic breakdown of the phospholipids is retarded by ammonia. The higher the concentration of undegraded phospholipid the higher will be the rate of cure.

Sugars and sugar like substances

Quebrachitol is the most important of this group. It occurs to the extent of one percent in latex. Other sugars are present in latex in very small proportions. The carbohydrates are metabolised by the bacteria in commercial latex and converted to volatile fatty acids. These acids are not present in fresh latex and their concentration in commercial latex is a measure of the degree of bacterial decomposition which the latex has undergone.

Inorganic salts

The most important cations present in latex are Na, K, Mg, Ca with traces of Al, Fe & Ca. Phosphate and carbonate anions are also present in latex. The relative proportion of these ions can have a marked influence on the colloidal stability of the latex and its concentrate. In particular a high ratio of Mg. to phosphate ions is found in latices of low stability

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Lutoids

Lutoids are easily deformable bodies which consists of a viscous aqueous solution or gel of non-rubber materials probably surrounded by a membrane, which breaks down on addition of NH_3 and their contents pass into the latex serum. It has been suggested that the lutoids may play an important role in determining the stability, viscosity, creaming and spontaneous coagulation of latex.

Frey-wyssling particles

These particles have intense yellow colouration due to the presence of carotenoid pigments and may be extracted from latex by centrifugation. On centrifugation these particles are seen immediately below the rubber layer or above the bottom layer or in both regions.

Natural antioxidants

The presence of materials which provides antioxidants action to rubber in latex has been identified. It appears that while some of the natural antioxidants are water soluble, the more active materials occur in the ethnr extract. The most active substances are the lecithins and certain amino acids particularly glycocoll and alanine To cophenols present in NR also confer antioxidant action.

Enzymes and bacteria

The presence of enzymes in latex has been recognised. Spontaneous coagulation results from their activity. Proteolytic enzymes, coagulase, oxidases and peroxidases are some of the enzymes present in latex. Enzymic hydrolysis of latex phospholipids occurs rapidly after tapping.

A large number of bacteria have been identified in latex. They act on latex proteins to form amino acids and hydrogen sulphide.

Latex collection and Preservation

Latex has to be collected from the field as soon as possible after the stoppage of flow which may be three to four hours after the first tree is tapped. If signs of precoagulation are observed in the latex it is necessary to use an anticoagulant for preventing pre-coagulation. Ammonia is the anticoagulant used in the preservation of concentrated latex. Ammonia is a bactericide, volatile and alkaline.

Clean utensils-a must

The collection cups can be coconut shells or glazed earthenware. The spouts and buckets are made of galvanised iron. Unclean utensils are sources of bacteria resulting in enhanced precoagulation which may badly affect the quality of processed material. Latex is poured from cup into collecting bucket, and last traces are wiped out from the cup. The use of lumps of rubber for cleaning out the cups should not be allowed. It is not desirable to rinse the cups with water. The tappers should not leave the buckets exposed to sun, as heat increases tendency for fermentation of latex. In order to avoid premature coagulation the latex should be delivered to processing factory as rapidly as possible after collection. Aluminium or galvanised iron tanks are used for transporting latex. Provision of a large man-hole facilitating thorough cleaning of the tank each day has to be given. The outlet tap is kept at the bottom of the tank. Brass fittings must be avoided to prevent contamination of latex with copper. Iron tanks, if unprotected, will contain some rusty water which will contaminate the latex. The best way to protect them would be to coat the surface with an inert material which will prevent latex from coming into contact with the metal. Bitumen based or chlorinated rubber based inert paints are suitable coatings for the tank.

Avoid bacterial Contamination

The latex collection cups, the spouts, the buckets used for collecting latex and all other utensils used in the processing factory should be scrupulously clean to prevent bacterial contamination. Latex being a good medium for bacterial growth should be properly preserved so that precoagulation due to putrefaction and fermentation can be prevented. It is advisable to clean all latex tanks and equipments with a 1% formalin solution of with 0.3% lysol at weekly intervals to ensure cleanlinest of the containers and utensils.

For efficient preservation

In order to provide preservation for an indefinite period, a concentration of ammonia equivalent to 1.0% w/w of the field latex is required. Some clonal latices such as from GI 1 an PB 86 has a high magnesium content. Magnesium stimulates bacterial proliferation and it also accelerates chemical coagulation. Hence magnesium has to be removed from latex for efficient preservation. A part of magnesium is removed by the action of ammonia with phosphates present in latex forming magnesium ammonium phosphate which is precipitated as sludge

Improving stability

The addition of calculated amount of 10% solution of diammonium hydrogen phosphate (DAHP) would precipitate the remaining magnesium. About 1 litre of 10% solution of diammonium hydrogen phosphate has to be added to 100 litres of ammoniated field latex for complete removal of magnesium. The sludge formed must be removed by using a sludge trap in the bulking tank. Since ammonia preserved latex is stabilised by ammonium salts of fatty acids formed by the hydrolysis of phospholipids, addition of a 10% of ammonium oleate or the ammonium salt of the coconut oil fatty acid at the rate of 50 g per 100 litres would improve the stability of field latex. □

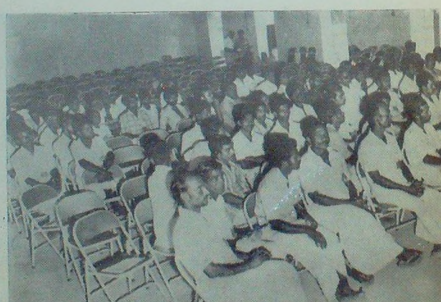
NEWS IN PICTURES

THE RUBBER GROWERS' SEMINARS AT VARIOUS PLACES

A Rubber Growers' seminar under the joint auspices of Koothattukulam Service Co-operative Bank, Rubber Board and FACT was held at the K T Jacob Memorial Hall, Koothattukulam on 11th December 1981. The President of the Bank Prof. N I Abraham delivering the presidential address. Seated on the dias are (L to R) Sarvashree P K Narayanan, M G Jagadish Das, V Parasuraman, M Philip George and K K Ramachandran Pillai

A view of the participants in the seminar at Koothattukulam.

Shri K Mohanachandran IAS inaugurating a one day seminar at Vadakkancherry on 30th October 1981. Sarvashree P Mukundan Menon, Rubber Production Commissioner, V K Mohammedkutty Sahib, President of the Kerala State Co-operative Rubber Marketing Federation and K C Unni Nayar, President of the Rubber Marketing Society, Palghat are also seen in the picture



The Rubber Growers assembled at the Vadakkancherry seminar.

Shri Olappamanna addressing the seminar held at Mannarghat on 31st December 1981. Shri V Rajagopal, State cum Area Manager of IFFCO is also seen in the picture.

The participants in the seminar at Mannarghat are listening the deliberations.

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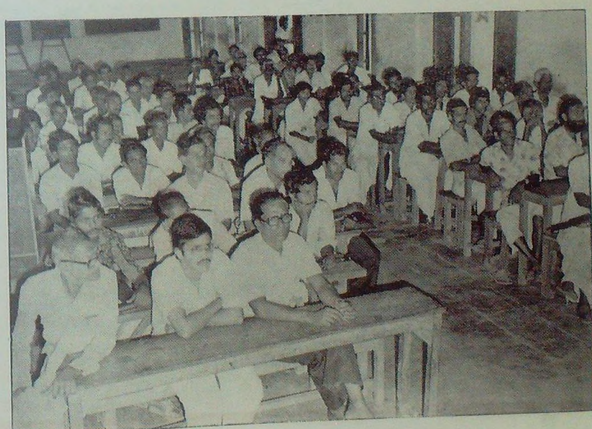
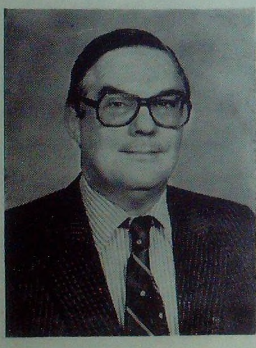


The participants in the seminar at Mannarghat are listening the deliberations.

Many rubber growers in an around Koratty have utilized the services of the Mobile Soil and Tissue testing laboratory of the Rubber Research Institute of India recently when Koratty Public Library, Samskara Stage of arts and Grama Sasthra Samithy jointly organised a camp there from 23rd to 27th November 1981. Here Shri M G Jagadish Das Jt. Rubber Production Commissioner is seen inaugurating the camp organised at the Koratty Public Library premises. He receives the sample from Shri M C Varkey a small rubber grower of the locality.



Mr. LJ Tompsett
New Managing Director
of Dunlop India Ltd

II ISI SPECIFICATION AND TESTING OF LATEX

Significance of tests

Ammonia preserved natural rubber latex concentrate is tested for the following parameters:

1. Dry rubber content
2. Total solids content
3. Non-rubber solids
4. Coagulum content
5. Sludge content
6. Alkalinity (Ammonia content)
7. KOH Number
8. VFA Number
9. Mechanical stability
10. Copper content
11. Manganese content

Dry rubber content is important from a financial and technical view point. Total solids content will give an indication of the non-rubber constituents. Alkalinity gives an idea on the perfecttion of preservation. The different grades are known based on this parameter mainly to suit the product manufacturers' convenience. VFA Number and KOH Number will give a clue on the quality of latex, its pre-processing condition and purity in the processing. Any lack of care in preservation and storage before processing into concentrated latex will give a high VFA indicating putrefaction. VFA Number denotes total organic acids including volatile fatty acid. Coagulum content and sludge content are specified to ensure that the latex is free from coagulated particles or sedimentable impurities. MST is specified because it denotes the degree of colloidal stability of latex. Specificity of MST ranges according to the type of product manufactured. MST and VFA means a low MST. By addition of higher fatty acids at low concentration the MST can be boosted to a high level. Copper and manganese are accelerators of oxidation of rubber and any excess if present will reduce the life of the rubber product.

Indian Standards Specifications

Requirements for different grades of concentrated natural rubber latex have been given in IS:5430. The test methods have been given in IS:3708. The details are given below:

Colour: The colour for all types of latex, when visually examined, shall not be pronounced blue or grey.

Odour: For all types of latex there shall not be any pronounced odour of putrefaction after neutralisation with boric acid.

	Characteristic	Requirements Type HA	Type MA	Type LA	Methods of test according to Clause No. of IS: 3708 Part 1-1966
i)	Dry rubber content percent by weight. Min.	60.0	60.0	60.0	NRL : 1
ii)	Total solids content percent by weight Min.	61.5	61.5	61.5	NRL : 2
iii)	Non-rubber solids, percent by weight, Max	2.0	2.0	2.0	—
iv)	Coagulum content, percent by weight of total solids, Max.	0.08	0.08	0.08	NRL : 3
v)	Sludge content percent by weight, Max.	0.10	0.10	0.10	NRL : 5
vi)	Alkalinity as ammonia, percent on water content	1.6 Min. but below 1.6	Above 0.8	0.8 Max.	NRL : 7
vii)	KOH Number, Max.	1.0	1.0	1.0	NRL : 8
viii)	Mechanical stability, seconds, Min.	475	475	475	NRL : 9
ix)	Volatile fatty acid number, Max.	0.15	0 15	0.15	NRL : 10
x)	Copper content, ppm of total solids, max.	8	8	8	NRL : 13
xi)	Manganese content, ppm of total solids, Max.	8	8	8	NRL : 15

rubber to the poor

a novel scheme for malanadu farmers

The Malanadu Development Society has initiated a number of schemes for the expansion of rubber cultivation among poor farmers. The objective is to assist the weaker sections of the society to overcome their economic backwardness through rubber cultivation in available land. The society has recently organised a few seminars to educate their farmer-members the need for familiarising with modern scientific rubber cultivation.

The seminars have been found to be of immense help to the participants. The following review prepared by the Project Officer of the Society reveals how far the seminars have been usefull to their farmers.

S. T. VARKEY

Rubber as a means of economic development for the poor—is the guiding principle behind the new and vigorous campaign launched by the Malanadu Development Society, for augmenting production of natural rubber by the small and marginal land holders, with particular emphasis to the very weaker sections who own even the namesake 10 cents of land. The objective is to assist the weaker sections of the society to overcome their economic backwardness through intensive and scientific cultivation of rubber in their available land, no matter howsoever small or insignificant the holding be. Ever since making a break-through in this line with the 'Co-Operative Rubber Cultivation Project at R. P. Colony near Mundakayaim the Malanadu Development Soc-

Bishop of Kanjirapally Mar Joseph Powathil inangurated the Seminar

The Participants of the seminar at Parathodu

ety which operates in the lush rubber belts of Kanjirapally-Peermede – Pathanamthitta – Vazhoor taluks, has been making earnest efforts to popularise rubber among the marginal land owners. A fillip was given to its attempts by the Rubber Board to build up a permanent laision with the Rubber Board and Malanadu Development Society.

Organisation of Seminars

Since any programme that has to be ultimately implemented by the people has to carry conviction with them, the initial efforts of the Society in this field was to organise rubber production seminars at various places, and present exhaustively to the participants the proven and scientific methods of increasing natural rubber production. The Rubber Board has been of immense help to us in this direction. Seminars were conducted at Thekkemala, Elangulam, Melorem, Azhangad, Umikkuppa,Thulapally and Kanayankavayal. A primary, yet informative knowledge on the various aspects of natural rubber production, viz, selection of planting materials, preparation of polybag seedlings, manuring and care of plants against diseases, rubber tapping, processing and Board's assistance to the planters, was given to the rural farmers of these villages. The society succeeded in bringing around about 1500 farmers to the urgent need of adapting the most scientific and proven methods for increasing rubber production, which would ultimately be a bonanza to their economic uplift.

One-Day Seminars

These conscientization programmes were crowned with three One-Day Seminars conducted at St. Mary's Church, Kanayankavayal, St. Thomas Church, Chemmannu and MDS Training Centre, Parathode. The Rubber Board officials actively took part in the proceedings. 350 farmers at Kanayankavayal, 150 at Chemmannu, and 325 at Parathode, took part actively in the day long deliberations which covered all topics on natural rubber production.

The Seminar at Parathode was jointly organised by the Malanadu Youth Forum, and the Rubber Board. The inaugural meeting began at 9 AM on 27.11.1981, and His Excellency Mar Joseph Powathil of Kanjirapally Diocese inaugurated the seminar and Rubber production Commissioner Shri P Mukundan Menon presided over the inaugural meeting. The meeting which was started with an introduction by the Public Relations Officer, got off to a formal starting with the welcome address by Rev Fr.Mathew Vadakemuryil, the Secretary cum Treasurer of Malanadu Development Society. Father Vadakemuryil while welcoming the delegates and resource personnel, emphasised the basic approach of the whole programme making rubber as a means of economic uplift of the poor. Shri P. Mukundan Menon recorded his happiness at the steps being taken by the Malanadu Developments Society for accelerating rubber production, and committed himself to provide all possible support from the Rubber Board. While inaugurating the Seminar, His Excellency the Bishop conceded that there existed a strong case for doing something tangible for the farmer, especially the poor farmer who bears most brunt of the modern economic fluctuations. As a step that will eventually relieve this strain of the poor farmer, the Seminar is a commendable programme, noted the Prelate who is the spiritual Head of over 200 thousand Catholics.

The need for expansion

The Seminar deliberations commenced exactly at 10 AM. Shri M. G. Jagadish Das, Joint Rubber Production Commissioner, spoke on the different varieties of clones, the Rubber Board has developed and recommended for plantation. He gave a comparative elucidation on the merits or demerits of such popular clones as RRII 105, GT-1, RRIM-600 etc. and pointed out the need to select the right type of clone suited to the particular agronomic conditions prevailing in each area. Shri V. Parasuraman, Deputy Rubber Production Commissioner, introduced a relatively new method of seedling preparation in the polythene bags, which he accomplished to the satisfaction of all present. Evidently he succeeded in this effort as was obvious from the fact that none of the participants had a second opinion on the polybag seedlings and their benefits. Shri K. K. Ramachandran Pillai Field officer dwelt extensively on the twin topics of manuring and caring of plants against diseases.

Tapping

After the lunch break at 1.30 during which time, the participants took a break off to view the other activities of the Society, the seminar resumed sessions at 2.30 PM. The first afternoon session was conducted by Shri P. K. Narayanan, who handled the subject 'Rubber Tapping' the scientific way of extracting the latex through 'controlled wounding' of rubber trees. Shri Narayanan exposed all the technical and practical aspects of rubber tapping and spoke convincingly on the need for adapting scientific ways, such as continuance of tapping in the summer. Shri C. P. Gopalakrishnan Nair, the Assistant Development Officer of Kanjirapally, explained the strategies to be employed for increasing rubber production through rain guarding and use of stimulants. The last session was handled by Shri PS Kuriakose the Deputy Rubber Production Commissioner, who explained the duty of every farmer to increase the production of rubber. He further explained the various schemes of assistance the Rubber Board has launched in order to assist the marginal farmers. The President of the Malanadu Yonth Forum, proposed a vote of thanks.

Plan of Action

With the orientation programme, the Society has made only a beginning in the proposed programme of intensive rubber plantation. The Society is going ahead with its plan of organising the project in 15 villages, covering 2000 farmers. With its trained supervisors managing the project in every village, the Malanadu Development Society will arrange for these farmers all the supportive services like supply of fertilizers, pesticides, and equipments through banks and other financial institutions. Wherever possible, the Society will also open its own common processing centres, where the participating farmers will be able to sell their produces, and fetch better prices. The trained supervisors will in addition give the farmers complete technical guidance on manuring, tapping, disease control, and processing. This master plan for rubber production being unfolded in the foothills of High Ranges, is therefore an integrated approach, involving a number of development agencies and institutions, which should spell a boon to the collective efforts of these 2000 poor farmers for economic independence.

TAPPING TO BE CONTINUED IN SUMMER TOO . . .

news and notes

AN "INTERACTION" WITH PLANTERS

The Rubber Board had organised a technical interaction with rubber planters on "what is new in rubber production and processing" at Cochin on 14th November 1981 at a session held to precede the Annual General Meeting of the Association of Planters of Kerala. While mooting this idea the Rubber Board was attempting to avail of the assembly of farmers to disseminate certain new results of research and also to have feed back from planters on some of the innovations they tried.

Senior Technicians from the Research and Development Departments of the Rubber Board literally interacted intimately with plantation managers

Dr. M. R. Sethuraj, P. N. Radhakrishna Pillai, Dr. A. O. N. Panikkar, M. Mathew, Dr. K. Jayaratnam and K. Kochappan Nair from the Rubber Research Institute of India and P. Mukundan Menon and M.G. Jagadish Das from the Rubber Production Department talked to the planters on specific R & D topics, while Shri C. M. George of Rubber Processing Department of the Rubber Board spoke on the relevance of new process rubbers.

From the Planters' side, Shri Rajendran of Mangadu estate, Shri Edwin Alexander of Rajagiri estate and Shri P. K. Madhava Menon of Thirumbadi estate made response statements based on what they observed while practising innovations related to rubber production and processing.

Several senior managers also came out with revealing observations which provided real food for thought to the participants.

Shri K. R. Menon and Shri James Makkil welcomed the participants while Shri P. K. Narayanan of Rubber Board expressed vote of thanks and argued for holding more frequent interactions of the type in view of its utility.

A view of the participants at the Annul General Meeting of the Association of planters of Kerala.

WORLD BANK REVIEW MISSION

A World Bank Review Mission comprising, Mr. S. Thillairajah and Mr. Alan Green visited Kerala from September 15 to 25, 1981. The Mission visited the Central Plantation Crop Research Institutes, Kasaragod and Kayamkulam, Agricultural University, Trichur; SADU Units in Cannanore, Kozhikode, Idukki and Trivandrum districts, Crumb Rubber Factories, Calicut, Palai and Kanjirappally; the Rubber Board and the Plantation Corporation Kerala. Mr. Alan Green, a tree crop specialist visited a few farm holdings in coconut root (wilt) disease affected areas and had discussions with farmers and scientists on the problems.

PROJECT ON PESTICIDE RESIDUES

What happens to pesticide residues in soil is an important area about which not enough is known according to Dr. Ivan Mac Rae, Reader in Microbiology, University of Brisbane, Queensland, Australia. He is conducting a two year research project on this subject. During his research, Dr Mac Rae will try to establish whether soil characteristics such as structure, pH level or the degree of aeration affect the process of degradation of pesticides in the soil by microbes. One of the values of the information from this study is that it might provide early warning of environmental and public health hazards which could decrease productivity or marketability of produce. (Australian Information Service)

CASHEW PROPAGATION

From the Cashew Research Station, Vridhachalam comes the news of a simple technique of propagating cashew. The terminal soft wood cuttings of Cashew with two or three leaves are planted inside a polythene tent. Water is provided at hourly intervals using a rocker sprayer. Root formation takes place in 40 days from the time of planting and rooted cuttings are ready for planting in ninety days. The success of rooting was 36 per cent in June -set cuttings. It is comparable to that of a normal seedling and better than that of air layers. (Intensive Agriculture)

BIOGAS DEVELOPMENT BOARD

The Government of India has approved the constitution of a National Biogas Development Board to boost the Biogas Gas Project for the Sixth Plan period. The Board will be an autonomous body and its programmes will be integrated with that of 'Operation Flood II'. One million biogas plants have been proposed during the Sixth Plan period. The operation flood is expected to provide crucial support to the biogas programme (Intensive Agriculture)

IDA CREDITS FOR AGRICULTURAL EXTENSION

The International Development Association (IDA), the World Bank's soft-loan affiliate, announced credits totalling $ 88 million for Agricultural Extension Projects in Tamil Nadu, Madhya Pradesh and Maharashtra States. The projects will introduce Training and Visit system (T & V) in Tamil Nadu and Maharashtra States and help expansion of this system in Madhya Pradesh. The IDA credits are for 50 years, including 10 years of grace and bear no interest.

PESTICIDE HAZARDS IN DEVELOPING COUNTRIES

According to U. S. Government registers, one fourth of the pesticides that cause problems and are not used in that country, are marketed in developing countries. A publication of Banana Exporting Countries in Panama city has reported, that pesticide manufacturers in United States use developing countries as testing ground for their products, posing a serious health hazard. The British review of International Agricultural Development says, a product especially hazardous to human life, "DBPC", is widely used today in Central American Countries. Another toxic pesticide, 'phosphel', which caused serious damage to nervous system of workers in Texas, is being extensively used in Indonesia. The World Health Organisation (WHO) says, that every minute a person in the Third World is being poisoned with pesticides. Though the exporters are required to inform their foreign customers of the risk discovered in pesticides banned in the United States, there is no legal disposition for enforcing them. However, the United States adopts measures to make sure, that the poison it exports do not re-enter that country. (The Hindu)

A WONDER COW

Ubre Banca is an extraordinary second generation (F2) Holstein Zebu cow, kept in the Special Municipality of Isle of Youth, Cuba. She produced 107.3 litres of milk in a single day in four milkings and established a world record for her in milk production. Her total yield in 160 milking days was 10474 litres of milk. Put on a three-time daily milking regime, her average daily production, since September, 1981, was 90.1 litres. This Cuban cow is a wonder! (The Hindu)

EMERITUS SCIENTIST

Shri V. K. Bhaskaran Nair Retired Director of Research has been appointed as emeritus scientist in the Rubber Research Institute of India. He joined the post on 18th December, 1981.

treephysindia'82

INTERNATIONAL WORKSHOP ON SPECIAL PROBLEMS IN PHYSIOLOGICAL INVESTIGATIONS OF TREE CROPS TO BE HELD AT KOTTAYAM: 26-28 AUGUST 1982

Objectives

The main objectives of the Workshop are:

* to provide a forum for the Physiologists working in tree crops and perennial crops in various organisations to exchange their expertise, experience and knowledge;
* to assess and evaluate the current methodologies adopted on several physiological investigations in different tree crops;
* to identify and discuss the special problems involved in the studies and to suggest measures for solving them.

Subject

All aspects of the problems encountered in the physiological research in tree crops will be discussed at the Workshop. The emphasis will be on the methodologies employed. To be more specific, the main areas of study will be:

* Photosynthesis and productivity
* Growth and development
* Partition of assimilates
* Water relations
* Early selection criteria
* Nutrition physiology and recycling of nutrients
* Physiological aspects of intercropping systems

Original papers or reports on projects in progress on any of

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Original papers or reports on projects in progress on any of the above topics in relation to tree crops or perennial crops can be presented at the concerned session of the Workshop. Details regarding presentation of papers can be had from the Convener.

Venue and Dates

The Workshop will be held from 26 to 28 August 1982 at the Rubber Research Institute of India, Kottayam.

The Institute is just 8 km drive from the Kottayam town of the tiny State of Kerala situated in the South West part of India. Kottayam is connected by rail and road to the nearest air ports at Cochin (75 km) and Trivandrum (160 km).

Accommodation: Comfortable hotel accommodation is available at Kottayam town at moderate rates.

Weather and Clothing: The climate in Kottayam during August will be pleasant with an atmospheric temperature of around 30° C and therefore no warm clothing will be required.

Registration

Each participant has to pay a nominal registration fee of Indian Rupees Fifty and this will entitle the participant to

* a complete set of papers
* lunches and tea/coffee served during the Workshop.

Attractions

Guest Lectures: Many eminent tree physiologists have already agreed to participate in the Workshop and deliver guest lectures. They include Prof D M Gales (USA), Dr F T Last (UK), Prof P G Jarvis (UK), Dr Margaret C Anderson (Australia), Dr WR Stern (Australia), Dr EF Brunig (W Germany), Dr Tatuo Kira (Japan), Dr J Catsky (Czechoslovakia) and Dr EF Eckardt (Denmark).

Some of the topics for the Guest Lectures will be

* Quantitative analysis of growth in tree crops
* Canopy architecture and light relationship
* Computation of canopy photosynthesis
* Water relations and tree growth
* Source-sink relationship
* Recent developments in methodology for measurement of photosynthesis and water relations with special reference to tree crops.

Pre-Workshop Training: A short-term training programme is proposed to be arranged prior to the workshop. It is expected that experts in the various branches of plant physiology will impart knowledge on the latest developments in the respective fields to the young scientists to prepare them in the modern methodologies for physiological investigations in tree crops. The next circular will include the details of the programme.

Post-Workshop Tour: Immediately after the workshop, a sight seeing tour to Trivandrum and Cape Comorin will be arranged for those delegates who will be interested to join. The time coincides with the festive Onam celebrations of Kerala and it would enable the participants to enjoy a cultural feast of Kerala during their visit to Trivandrum. The details are being worked out and they will be sent to those who would desire to join.

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I. FUNDAMENTALS OF MANAGEMENT

PU GEORGE

Management signifies realisation of an objective through group activities. Fundamentals of management are applicable and are important in all spheres and sizes of purposeful group work and undertakings in society-business or non-business big or small.

The major elements of management are planning, organising, staffing, directing and control.

Planning is the conscious determination of courses of action or a statement of objectives to be attained in future and an outline of the steps necessary to reach them. The purpose of planning is to obviate uncertainty. Budget is a plan of action, generally prepared in most of the industrial organisitions.

Perspective planning, forecasts and budgets, standards, projections and project reports etc. are aids commonly used in the process of planning.

Organising

Organisation comes into being only when two or more persons are associated in an endeavour. The fundamental principles of organisation are authority, responsibility and accountability. Authority is the right to decide or act independently in the discharge of responsibility. Responsibility is an obligation to perform and Accountability is an obligation to inform. Since organisation involves in the collective effort of a number of persons, co-ordination of various activities is essential.

Staffing

Staffing refers to placement of personnel to fill in the roles in the organisational structure through proper and effective selection, appraisal and development.

Directing

The purpose of direction is to create an internal environment that will induce subordinates to work at the level of their full capabilities. The employees should be made to understand the goal of this position, its scope, purpose and authority. Order, motivation, leadership and communication are important aspects of direction.

Controlling

The purpose of control is to find out whether what is done is what is intended to be done Establishing standards of performance is the first step of control. The standards are intended to measure the results and the measurement would involve detecting and correcting deviations from the agreed path. The familiar control techniques are:

1. Standard Cost
2. Budgetary Control
3. Statistical Analysis
4. Audit
5. PERT

Some classical principles of management are listed below:

(1) Authority

The organisation must have a supreme authority and clear lines of authority should run from that person down through the heirarchy. Such a line may run from the Chief Executive to the Manager to the Foreman to the superviser, to the rank-and-file factory employees. This hierarchy is known as the "Chain of Command."

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Authority should be commensurate with responsibility that is when anyone is made responsible for achieving a given objective he should have enough authority to take steps necessary to reach it.

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Decisions should be made at the lowest competent level. Responsibility and commensurate Authority should be delegated as far down in the organisation as possible. In delegating authority, the functional relationship should be clearly defined and the authority relationships clearly outlined. There should be a chain of direct authority relationships from superior to subordinates throughout the organisation.

We are publishing two lecture notes by Shri PU George, Cost Accounts Officer, Department of Rubber Processing prepared for the small scale latex goods manufacturers. The lecture notes were later compiled and published. Cost Accounting plays a vital role in the management of rubber plantations and as such the two notes would certainly be useful to those who are at the helm of affairs in plantation management. The two notes are (I) Fundamentals of Management and (II) Elements of costing.

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(4) Unity of Command

Each person should be accountable to only one superior.

(5) Span of Control

The number of subordinates a superior can effectively control is limited. This is usually between four and seven. Several of factors influence the span of control.

(6) Authority Relationships

Formal relationships in an organisation fall under three categories. Direct, Lateral and Functional. Direct relationship exists between a superior and his subordinates Sometimes, this relationship is called line relationship. The working relations between executives or supervisors at the same level or responsibility and holding parallel authoty is known as lateral relationship. Functional authority is the power of one manager over certain specified processes, practices, policies relating to the implementation, activities undertaken by line personnel of other departments. This power arises because of his specialised knowledge.

(7) It is the relation between the executive officer and staff who were to assist the former. Member of the staff has no authority of his own. The information he furnishes or the plans he recommends flow upwards to his superior. If they are to be transferred into line action, it is for the superior to decide so. The distinction between line and staff in business is that the line organisation is made up of those whose work contributes directly to the achievement of the fundamental goal, whereas staff are those who assist the line in some way, either by providing services or by developing plans, giving advice, or auditing performance. Those who perform or supervise the production or selling goods or services are members of the line organisation. □

II. ELEMENTS OF COSTING

Introduction

Costing may be defined as the technique and process of ascertaining costs of products or services. Accountancy treats costs, but financial accounting treats costs very broadly while Cost Accounting treats costs in much detail. Cost accounts show by analysis and localisation, the unit costs and profits and losses of different product lines. Costing technique is a tool of management which provides the management with data for planning, operation and control.

Elements of Cost

Analysis and classification of costs are necessary for cost control. The major elements of cost are, materials, labour and overheads.

Materials

Material cost consists of cost of direct materials and indirect which becomes a part of the product. It is the material which can be measured and charged directly to the cost of products. eg: Cost of Latex, Zinc Oxide, Sulphur, Titanium dioxide etc. Indirect material is that material which cannot be traced as part of the product. It comprises of materials required for operating and maintaining the plant and machinery. Eg: lubricants, cotton waste, grease etc.

Labour

Wages paid to workers engaged in production is labour cost. Direct wages are the wages that can be indentified with, and allocated to cost centres and units. It is the labour expended for converting the raw material into finished products. Eg: wages to workers for creaming, compounding of latex, extruding, etc. Indirect labour cost is the cost of labour which connot be identified with any particular job or process, but which contributes generally to all jobs and processes.

Salary of Manager, Technologist, Supervisors, Foremen and wages to unskilled workers are examples of indirect labour.

Cost of direct material, direct labour and direct expenses, if any, put together, is termed as prime cost.

Overhead Expenses

Overhead is the cost of indirect labour and other expenses including services which cannot conveniently be charged direct to specific units. The main groups into which overhead may be subdivided are:

1. Production expenses like maintenance and repairs of machinery, consumable stores etc.
2. Administration Expenses eg: Licence fee, audit fee, interest on capital.
3. Selling expenses eg: Advertisement, Salary of salesmen.
4. Distribution Expenses. eg: Cost of maintenance of delivery van.

Cost Unit and Cost Centre

A cost unit is a unit of product, service or time in relation to which costs may be ascertained or expressed. Eg; per tonne, per bag of rice, per tonne Kilometre, machine-hour, per Kg. drc.

A cost centre is a location person or item of equipment for which costs may be ascertained and used for the purpose of cost control. Eg, a machine or a group of machines, a service shop.

Method of Cost finding

Two main systems of cost finding in use are: Job Costing and Process Costing.

Job Costing

This method is applied where the items of Prime cost are traceble to specific jobs or orders, as in house building, ship building, furniture etc.

Process Costing

This method of costing is used where it is impossible to trace the items of prime cost to a particular order because its indentity is lost in volume of continuous production. Example of industries where process costing is adopted are:– Oil Refinery, Sugar, Cement, Rubber latex products etc.

Marginal costing and breakeven analysis

Marginal costing is a costing technique used to show the effect of fixed overhead over the total cost of production. The overhead expenses can be analysed, into variable overhead, semi-variable overhead and fixed overhead.

Fixed cost, is a cost which tends to be unaffected by variations in volume of production.

Semi-fixed cost, (Semi-variable) is a cost which is partly fixed and partly variable.

Variable cost, is a cost which tends to vary directly with variations in volume of output.

Marginal costing is the ascertainment of margina l cost and the effect on profit due to changes in volume or type of output by differentiating between fixed costs and variable costs.

Marginal cost = Direct material + Direct Labour + variable expenses.

Fixed expenses are excluded to find out the marginal cost. Contribution is the difference between sales value and marginal cost.

Contribution = Sales − Marginal cost.

Breakeven analysis and construction of break even charts are generally used along with marginal costing technique. A breakeven point is the sales volume at which there is neither profit nor loss, costs being equal to revenue. A breakeven chart can be defined as an analysis in graphic form of the relationship of production and sales to profit. □

RUBBER PRODUCTION BOUNCING UP

Like everybody else, Africa's natural rubber producers have been suffering from world recession. The continent is a relatively small producer, accounting for less than 5 per cent of the world total. But plans are under way for major expansion in several countries. In Cameroon and Ivory Coast this is geared to exports - particularly to France - but in Nigeria and southern Africa, governments are looking to local output to meet growing demand for tyres and rubber products.

Expansion Programme

Ivory Coast and Cameroon are planning major expansion programmes. The Ivory Coast has recently begun a $ 10 million planting programme to raise output from 21,000 tonnes in 1980 to 77,000 by 1990. Cameroon has a similar scheme. In the past two years, hectarage and production have increased. Like Zaire, which has been increasing output, both countries sell mainly to France. Because the export market is so difficlut, some African countries keen to expand production - are gearing output to domestic needs. This is particularly true of Nigeria, where production dropped from 65,000 tonnes in 1970 to an estimated 40,000 tonnes this year. The country - which will use an estimated 32,000 tonnes of rubber this year - is Africa's only significant consumer. It now plans a large-scale expansion to meet growing demand, particularly for tyres

Export—another aim

Malawi and Zimbabwe plan to expand rubber production, both to meet domestic demand and to export to neighbouring countries. African Lakes Corporation (ALC) is expanding its Vizara estate. With more than 1,200 hectares suitable for rubber, the crop is expected to rise to 4.5 million pounds a year. ALC is also expanding its processing factory on the estate from its present daily capacity of 2,000 pounds to 18,000 pounds largely to meet demand in Zimbabwe, Zambia and Kenya. At present, rubber imports cost Zimbabwe Z$3.5 million–4.5 million ($4.9 million–6.2 million) a year. Dunlop (Zimbabwe) is now planning to start production in Zimbabwe. Dunlop's Ian Broughton told AED that hopes centre on the guayule bush, which is suitable for semi-arid areas. Seedlings were imported in 1977 and experiments are under way in Matabelel and the Midlands. Broughton says the crop needs no cultivation beyond weed control, and could become a cash crop for peasants. On average yields, Zimbabwe would need about 14,000 hectares under guayle to meet total rubber demand. (African Economic Digest)

METHODS TO CONTROL DRYNESS ON SMALL HOLDINGS

Panel dryness of rubber trees causes anxiety among planters. Wherever intensive tapping systems are adopted, there the malady is widely prevalent often resulting non-production. Control measures are essential to check up this especially when the dryness is heavily felt. We are reproducing an article on the subject appeared in "PLANTERS BULLETIN". The article will give guidelines to control panel dryness.

Panel dryness of rubber trees is of economic importance as it renders the trees non-productive. Dry trees grow faster than the neighbouring trees and compete for light and nutrients. Traditionally prominant on stands of old rubber, it has become increasingly prevalent on young mature rubber of high yielding cultivars or in areas where intensive tapping systems are practised.

In smallholdings, trees are tapped too frequently or with double cuts and hence stress is induced. Besides, farm upkeep is poor. Fertilisers are applied irregularly and not based on the nutrient requirement of the tree. These factors result in a high incidence of dryness.

In a recent survey of 989 smallholdings covering 1437 ha the number of untapped dry trees ranged from 12% to 32% The incidence of dryness would have been higher if the number of trees with partially dry cuts, and the earlier dry trees now retapped, were included.

Methods to control dryness are therefore important. Recently prophylactic methods were developed to control the dryness. These measures are discussed in this article

Features and Symptoms of Dryness

There are several characteristic features associated with the spread of dryness. The main features are:

* Dryness spreads rapidly

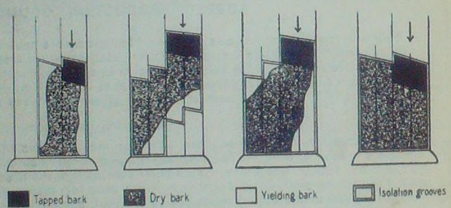


Figure 1. Spead of dryness with downward tapping

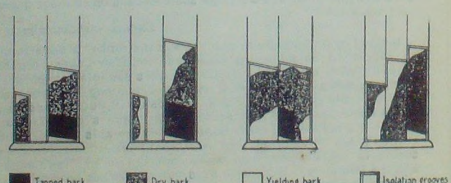


Figure 2 Spread of dryness with upward tapping

Within two to five months entire panel can be effected.

* Left unchecked, dryness spreads to the adjacent panels.
* Spread of dryness follows the latex vessel orientation and direction of tapping. On downward-tapped cuts, dryness spreads downwards. With upward tapping, dryness progresses upwards *(Figures 1 and 2)*
* When dryness is deep-seated the disorder spreads from virgin to renewed bark.

Early symptoms of impending dryness are:

* premature coagulation of cuts
* Lower d. r. c. of latex
* Profuse yields or late dripping
* Outer bark dry but inner vessles yielding
* Paleness or light discolouration of tapped bark.

Isolation of Pre-tapping Panel

Initially, pre-tapping isolation grooves were made on both sides of the tapping cut up to tapping depth. Although the grooves did contain the spread of dryness, it was not effective on all trees. At most, dryness was curtailed on 60% of the trees. On examination it was observed that dryness had progressed beneath the grooves suggesting that a complete discontinuity of latex vessels was necessary. Also, since dryness invariably spread towards left in the case of downward tapping, the second isolation groove on the front guideline appeared superfluous.

Therefore, a single groove was made upto the wood on the back guideline. Subsequent observations showed that out of the twenty-six trees which had turned dry, dryness had not spread on the adjacent panels on twenty-two trees. Of the remaining four trees, scraping away the diseased bark revealed that dryness had spread to the next panel *via* the unisolated bark at the base.

On follow-up projects, isolation grooves were made right down to the base of the tree. To ensure a clean incision, a chissellike instrument was run over the groove up to the wood. The results of this treatment are given in *Table 1*. On Panel A, dryness was confined to 101 trees (97%) whereas, without isolation, dryness had spread to the adjacent bole on 57% of the trees. On the remaining 3% of the treated trees, the bases of the adjacent panels were found to be affected. Most likely dryness had spread into the roots and then spread upwards to the second panel.

On Panel B, treatment was effective on all trees while without isolation, dryness had spread to the adjacent renewed panel on 58% of the trees. Case histories are shown in *Figures 3* and *4*.

Where comparisons are possible yields of trees with and wihout isolation are given in *Figure 5*. There appears to be a slight initial yield depression with isolation grooves for two to three months.

Table 1. Results of Isolating Pre-Tapped Panels

Site	Panel	Clone	Period (month)	Control		Isolated	
				Trees dry	Dryness Confined	Tress dry	Dryness Confined
1	A	RRIM 600	42	8	3	3	3
		RRIM 703	42	7	5	7	7
		PB 252	42	20	4	14	12
		PB 235	42	21	4	15	14
2	B	PB 217	30	26	12	24	24
3	B	RRIM 600	30	81	41	41	41
		Total		163	69(42)	104	101 (97)

Figures within brackets indicate percentage.

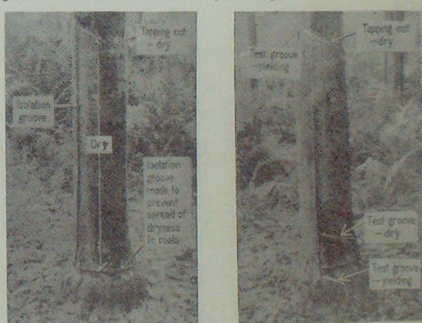


Figure 3. Panel isolation (Panel 4) on commencement of tapping (left) and six months later (right).

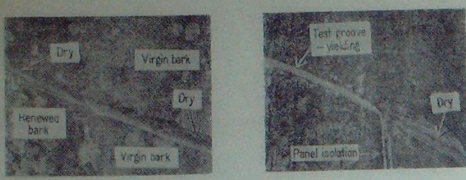


Figure 4: Spread of dryness without isolation (left) while with isolation the dryness is confined (right).

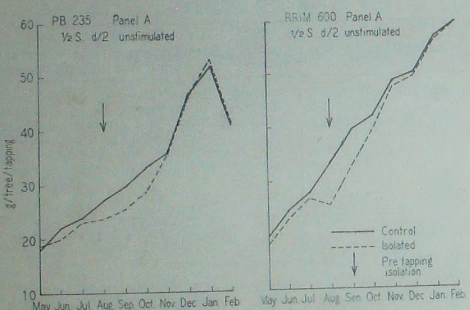


Figure 5. Effect of panel isolation on yields.

Control of Post-tapping Dryness

The method of treatment to control post-tapping dryness involves demarcation of diseased bark and isolation of the affected area with grooves.

When post-tapping dryness occurs, the tapping cut is partially dry in the initial stages. With time, the entire cut and subsequently the pannel turn dry. Thus, isolation treatments aim to curtail the further spread of dryness on both partially and totally dry panels.

Treatment of Partially Dry Cuts

The ends of the dry patch on the tapping cut are marked out Beginning from the top end of the dry patch and 1 cm away, a vertical test groove is made extending below the cut. If yielding, the groove is extended until dry bark is transversed. A new test groove is then made 2 cm away from the yielding bark. Otherwise, a second test groove is made 2 cm away. The process is continued until all diseased bark on the left hand side of the panel is demarcated. Similarly, a test groove is made 1 cm away from the lower end of the dry bark to delineate all affected tissues on the right hand side of the panel.

When dry bark is demarcated on both sides of the dry patch the affected segment is isolated (*Figure 6*) by deepening the isolation grooves up to wood.

The advantage of isolating the dry patch is shown in *Table 2*. There was no recurrence of dryness with treatment. Without isolations, there was recovery on only 8% of the diseased panels. The remaining trees turned completely dry.

Treatment of Totally Dry Cuts

On virgin bark, the extent of dryness with totally dry cuts will vary with individual trees. Nonetheless, four categories can be observed. They are:

- Tapped panel dry, adjacent panel yielding
- Tapped panel dry, adjacent bark partially dry
- Both lower panels dry
- Entire bole dry.

Possible treatment for the first three categories are aimed to save the remaining unaffected bark. Typical case histories with the appropriate isolations are shown in *Figure 7*.

Yields and recurrence of dryness of these treated dry panels are given in *Table 3*. There was no recurrence of dryness on 84% of the trees. Examination of tree with recurrence of dryness showed no clear pattern. On some trees dryness had spread from the previous tapped panel while on a few trees dryness recurred after six to twelve months of tapping.

Yields obtained from the treated dry trees were satisfactory (see *Figure 8*) although they were lower than those of the normal trees.

On older rubber, dryness is normally extensive and deep-seated. Hence low panels of dry trees should be isolated. Such a practice was found to be beneficial in restricting the spread of dryness when upward tapping was introduced.

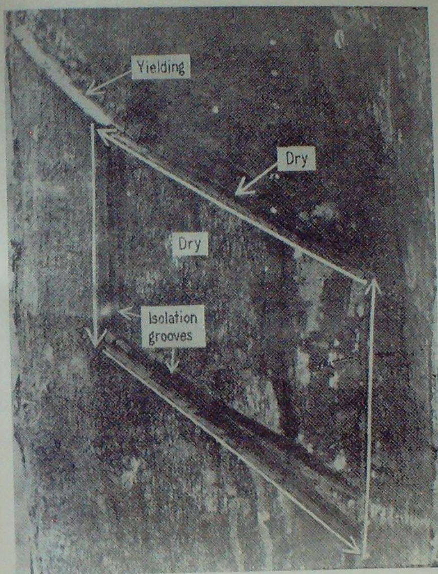


Figure 6. Isolation of partially dry cuts.

Table 2. Recovery from drynees of partially dry cuts with and without isolation

Site	Panel	Cultivar	Period (month)	Control No. of trees	Control Recovery	Isolated No. of trees	Isolated Recovery
1	A	Mixed buddings	18	22	2 (9)	28	28 (100)
2	A	RRIM 600	24	—	— —	20	20 (100)
3	A	PB 217	18	26	0 (0)	22	22 (100)
		RRIM 600	18	40	4 (10)	48	48 (100)
4	B	RRIM 600	18	46	6 (13)	34	34 (100)
		Total		134	12 (8)	152	152 (100)

Tapping of brown bast trees

On partially dry cuts, tapping should resume preferably on the entire cut so that with time the isolated segment is tapped off (*Figure 9 A*). Where this is not possible, the yielding portion of the cut may be tapped (see *Figure 6*) or below the isolated segment, if yields are low (*Figure 9B*).

When Panel A is totally dry, the second panel should be opened and tapped periodically. One practical method is to tap dry trees on one half of the holding from May to October and the other half from November to April. An alternate method is to tap one quarter spiral continuously on the entire holding. This system not only reduces panel exhaustion, but also reduces bark consumption, enabling the cuts to be maintained longer.

If dryness on Panel B is not extensive the remaining unaffected bark should be tapped with periodic rest. But when the entire panel is dry it is preferred to resume tapping when cuts are on first renewed bark.

On older trees with renewed panels (Panels C and D) it will be benefical to subject all dry trees to upward tapping. The practical difficulties involved with upward/downward tapping can be minimised by:

- Introducing upward quarter spiral tapping with stimulation on half of the holding alternatively for four months and discontinuing tapping during wintering.
- Changing upward-tapped panels yearly to keep the cut within reach (this renders tapping convenient.)
- Using bidirectional knife which allows for both upward and downward tapping.

Yields obtained from this system of exploiting dry trees have been good.

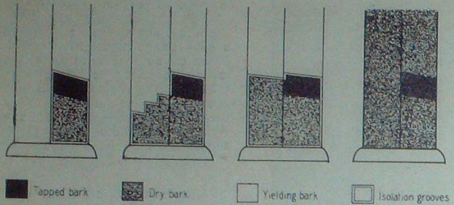


Figure 7. Typical patterns of dryness and treatment

Conclusion

Isolation of pre-tapping panel on virgin bark limits spread of dryness. When dryness develops it is confined to the tapped panel. The adjacent panel is thus saved for future tapping. Since dryness can spread upwards from the roots, an additional isolation groove at the base may be necessary. This has been found to be very effective *(Figures 3* and *4)* but has yet to be evaluated widely.

Table 3. Results with continuously tapped isolated panel (Panel A)

Dryness	Smallholding 1 No. of Yielding trees			48 months Dryness recurred	Smallholding 2 No. of Yielding trees			30 months Dryness recurred
On tapped panel	32	29	(91)	3 (9)	27	20	(74)	7 (26)
On tapped panel and partially on adjacent bark	4	4	(110)	— —	15	15	(100)	— —
On both lower panels	4	2	(50)	2 (50)	2	2	(100)	— —
	40	35	(88)	5 (12)	44	37	(84)	7 (17)

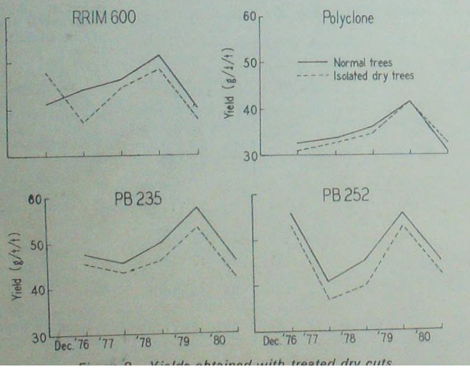


Figure 8. Yields obtained with treated dry cuts

In the meantime, a single isolation groove appears suitable for adoption where areas are brought into tapping. For good results the isolation should be made up to the wood on the back guideline and from the tapping cut to the base of the tree. Preferably the treatment should be introduced three months before tapping commences to minimise the initial yield depression. The method is simple, relatively cheap and is easily adopted by small-holders.

Post dryness control is aimed to curtail the spread of dryness so that tapping can be continued on the unaffected bark. The treatment should be introduced mimediately after a patch of dry discoloured bark is observed. Done accordingly, this will render treatment easier. Besides, loss of bark will be minimal. Yields obtained from treated trees are satisfactory. The costs incurred are recovered with a few days tapping.

The method is not complicated as it appears. It can be acquired with some practice. Some elderly villagers have adopted this control measure with success. Spread of dryness on affected panels were curtailed and the trees were continuously exploited.

If necessary dry panels on virgin bark can be restored for future tapping by scraping away the diseased bark. When this is done, the diseased tissues must be completely removed. Dry panels thus treated yielded on retapping *(Figure 10)*. This practice may be of value in holdings where dryness is extensive.

Dry trees should be tapped with periodic rest to minimise recurrence of dryness. Tapping should be staggered so that the period of exploitation can be extended. A summary of exploitation can be extended. A sumary of exploitation practices for dry trees is given in the *Appendix*.

(Source: Planters Bulletin.)

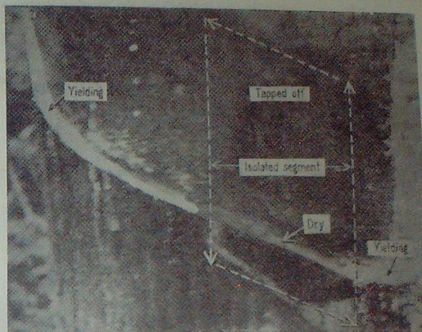


Figure 9 A. A partially dry tree—isolated and tapped for eighteen months

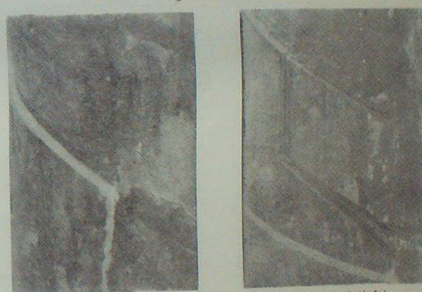


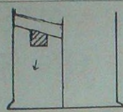
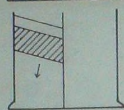
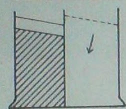
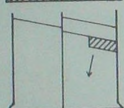
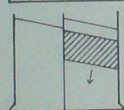
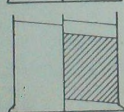
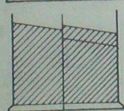
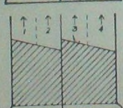
Figure 9 B. Tapping resumed on yielding panel (left). Tapping resumed below the isolated segment (right).

Panels totally dry four months after tapping

Retapped after removal of diseased bark

***Figure 10** Restoration of dry panels for re-tapping by scraping away diseased bark*

Appendix: Schedule of Exploitation Practices for Dry Trees

Panel	Extent of dryness	Recommendation	
A (0-1)	Cut partially dry		Continue tapping on entire cut. Rest trees during refoliation.
	Panel partially dry		Continue tapping of dry trees on half holding alternately for six months.
	Panel completely		Open half spiral on new panel. Tap half holding alternately for six months. Or tap quarter spiral on entire holding continuously.
B (0-2)	Cut partially dry		Continue tapping on entire cut. Rest trees during refoliation
	Panel partially dry		Continue tapping on yielding panel for six months Tap plots alternately.
	Panel completely dry		Tap on new panel when bark renewal is adequate. Tap for six months. Tap dry trees in each half alternately.
A & B (0-1 & 0-2)	Both panels dry		Resume tapping when trees are tapped on first renewal.
C & D (1-1 & 1-2)	Both panels dry		Tap upwards on $\frac{1}{4}$S + E for four months. Tap dry trees in each half alternately. Change panels (1, 2, 3, 4) yearly and in sequence as shown.

APPROACHES TO MINIMISE CONSTRAINTS WITH UPWARD TAPPING ON SMALLHOLDINGS

Majority of smallholders tap the low panels repeatedly. Tapping these panels is difficult and yields obtained are poor, since the bark on low panels are thin and bumpy. Low panels also do not respond to stimulation satisfactorily.

In contrast, the high panels are seldom exploited where the bark is older and productive. Exploitation of high panels can result in substantial increase in yields with high economic returns.

To exploit high panels, ladder-tapping was first introduced. With this system both the high and low panels are exploited. Subsequently, a better system of exploiting high panels was developed, *viz.* upward tapping. Tapping is done from the ground with a special gouge.

Upward Tapping Projects

To popularise high level upward tapping, a large scale project on 1050 smallholdings was carried out throughout Peninsular Malaysia. Smallholdings selected comprised buddings and seedlings tapped on thin renewed bark or with poor yields. Prior to implementation, on-site demonstrations were made of upward tapping. Participants of the project were given the improved gouge.

A good number of smallholdings withdrew from the project during the course. These smallholders reverted to downward tapping on low panels. Under continued demonstration, 556 smallholdings completed the six months evaluation period. Results of yields obtained are shown in *Table 1.*

Table 1. Percentage Responses over Pretreatment yield with Upword Tapping

Yield increase	No. of smallholdings Budding	Seedlings	Total	%
No. response	26	7	33	6
Below 50%	118	20	138	25
51%-100%	229	47	276	49
101%-150%	62	10	72	13
151%-200%	12	8	20	4
Above 200%	13	4	17	3
Total	460	96	556	(100)

Most holdings (69%) gave more than 50% response.

In spite of the profitable yields obtained, many participants reverted to their routine tapping system on completion of the evaluation period. Likewise, in follow-up projects on co-operative smallholdings, a similar feature was observed. Inspite of the additional income derived, smallholders tended to give up high-level tapping after a year or at the most, two years.

Investigations were therefore carried out to ascertain the reasons for the reluctance by smallholders to continue high-level tapping. Interviews with past participants, field checks and test tappings were carried out. Arising from these studies, several constraints were identified which are summarised.

Constraints Associated with Upward Tapping

Difficulties with pole tapping:

- Tendency of knife to move obliquely in line with the direction of the movement of the pole causes deep tapping and thicker bark shavings at the cut end.
- Vision is limited as the cut moves away, resulting in poor tapping.
- Tapping of the corners of the cut is difficult with a long blade.

Physical discomforts:

- Fatigue sets in as the bark on high panels is thicker older and hence harder to tap.
- More force is required to tap the cut from a distance.
- Strain is induced on the neck as the head is titled upwards to carry out tapping.
- Sunglare during wintering hurts the eyes.

- Haphazard falling of bark shavings on the face causes discomfort.
- Additional work involved in guiding latex to the cut and cleaning messy panels delays tapping.

Requirement of special skill:

- Simultaneous pushing of the knife over the cut and shaving off the bark with a pole requires great skill.
- Tapping of acutely angled grooves is quite difficult.
- Correct placement of knife to avoid acutely angled or obtuse-shaped grooves is difficult since thickness of bark varies from tree to tree.

Spillage of latex:

- Spillage of latex is prevalent since bark below is depleted.
- Presence of dry pads of rubber on tapped panels or moist bark accentuates spillage.
- Spillage of latex results in messy panels and loss of crop which psychologically disturbs the smallholder.

From these observations, it was apparent that modifiactions to the tapping technique and the implement was necessary to minimise some of these constraints. Several innovations were therefore made and evaluated in a new series of upward tapping projects.

Periodic Downward/Upword Tapping

The approach adopted here is to tap quarter spiral upwards with stimulation after refoliation and half spiral downwards during wintering *(Figure 1)*. Yields obtained with this system *(Table 2)* were satisfactory. Bark consumption was reduced.

Figure 1. Periodic upward and downward tapping

Upward Tapping with Market Grooves

Grooves were marked 2 cm above the cut following the slope of the cut at two monthly intervals to serve as control markers for bark consumption and as sites for stimulant application. Another system tested was the vertical grooves on the front and back channel.

Slope of cut and bark consumption were better maintained with the marker grooves *(Figure 2)* in terms of yield responses it was found that vertical grooves were superior to parallel grooves *(Table 3)*.

Upword Tapping with Bidirectional Knife

The Jebong knife was redesigned to facilitate upward and downward tapping *(Figure 3)*. This bidirectional knife was found to be suitable for smallholders. Responses of smallholders to this knife were as follows:

- Upward tapping was easier since the blade retained the sharpness for over 800 trees.
- Upward tapping was faster since the corners could be negotiated easily with the shorter blade-length.
- The knife could be used as a gouge or as a Jebong *(Figure 4)*.
- Sharpening was easier in comparison with the gouge.

Conclusion

Upward tapping of high panel provides an effective means of upgrading the uneconomic holdings. The economic benefits derived with this technology have been demonstrated to smallholders in several upward tapping projects. However, upward tapping has not been favoured by smallholders due to the physical difficulties involved.

High-level micro tapping has been evaluated as an alternate method. Yields are lower than with the quarter spiral upward system with stimulation. There is also the difficulty of removal of tree lace with this system. Until these problems are resolved

Table 2. Yield Obtained with Upward and Downward Tapping Systems

Small holding	Treatment	Yield (kg/ha) 24 months	3 months of 3rd year	Total (27 months)
Batu Pahat	½ Sd/2-(Unstimulated)	2 551 (100)	459 (100)	3 010 (100)
	¼ Sd/2 8m/12+5.0%E ½ Sd/2 4m/12	3 749 (147)	537 (117)	4 286 (142)
Kuala Pilah	½ Sd/2-(Unstimulated)	1 505 (100)	200 (100)	1 705 (100)
	¼ Sd/2 8m 12+5.0%E ½ Sd/2 4m/12	2 566 (171)	380 (190)	2 946 (173)

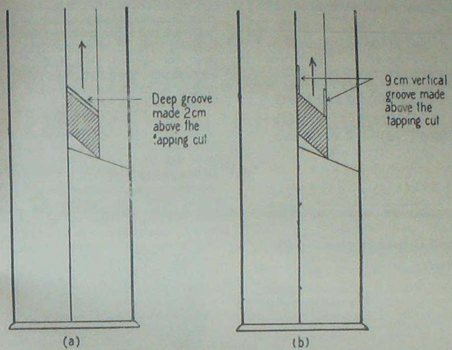


Figure 2. Upward tapping with marker grooves

Eigure 3. A bidirectional knife which facilitates both upward and downward tapping.

conventional upward tapping with stimulation appears to be the only method for increasing yields on holdings with thin renewals or which are due for replanting.

It may be possible to introduce high-panel exploitation on smallholdings with quarter spiral tapped upwards with stimulation and half spiral downward-tapping without stimulation during wintering. For longer period of exploitation on high panels or where elderly villagers tap their holdings, staggered upward-tapping systems may be more suitable. In this approach, one-quarter or one-third of the holdings is tapped upwards at any one period from May to October followed by downward tapping from November to April with stimulation from November to December. The remaining areas are tapped downwards with stimulant applied only from May to January *(Table 4)*. After refoliation, the appropriate plots are tapped upwards successively.

This system has the following advantages:

- Stress is reduced since upward tapping is confined to one-quarter or one-third of the holding at any time.
- No discomforts fo sunglare during wintering.
- Minimum panel exhaustion with periodic rest.
- Tapping cut is maintained within tapping reach thus eliminating the use of a pole.
- Bark consumption is reduced on the high panel.
- Upward tapping is avoided during the monsoon season.

To effect better standards of upward tapping, tapping with quarter spirals could be incorporated with marker grooves made parallel or vertical to the cut where the stimulant is applied. Preferably, grooves should be deep for better yield increases.

* Haphazard falling of bark shavings on the face causes discomfort.
* Additional work involved in guiding latex to the cut and cleaning messy panels delays tapping.

Requirement of special skill:

* Simultaneous pushing of the knife over the cut and shaving off the bark with a pole requires great skill.
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From these observations, it was apparent that modifiactions to the tapping technique and the implement was necessary to minimise some of these constraints. Several innovations were therefore made and evaluated in a new series of upward tapping projects.

Periodic Downward/Upword Tapping

The approach adopted here is to tap quarter spiral upwards with stimulation after refoliation and half spiral downwards during wintering *(Figure 1)*. Yields obtained with this system *(Table 2)* were satisfactory. Bark consumption was reduced.

Upward Tapping with Market Grooves

Grooves were marked 2 cm above the cut following the slope of the cut at two monthly intervals to serve as control markers for bark consumption and as sites for stimulant application. Another system tested was the vertical grooves on the front and back channel.

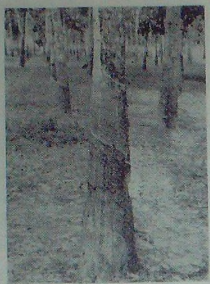


Figure 1. Periodic upward and downward tapping

Table 2. Yield Obtained with Upward and Downward Tapping Systems

Small holding	Treatment	Yield (kg/ha) 24 months	3 months of 3rd year	Total (27 months)
Batu Pahat	$\frac{1}{2}$ Sd/2-(Unstimulated)	2 551 (100)	459 (100)	3 010 (100)
	$\frac{1}{4}$ Sd/2 8m/12+5.0%E $\frac{1}{2}$ Sd/2 4m/12	3 749 (147)	537 (117)	4 286 (142)
Kuala Pilah	$\frac{1}{4}$ Sd/2-(Unstimulated)	1 505 (100)	200 (100)	1 705 (100)
	$\frac{1}{4}$ Sd/2 8m 12+5.0%E $\frac{1}{2}$ Sd/2 4m/12	2 566 (171)	380 (190)	2 946 (173)

Slope of cut and bark consumption were better maintained with the marker grooves *(Figure 2)* In terms of yield responses it was found that vertical grooves were superior to parallel grooves *(Table 3)*.

Upword Tapping with Bidirectional Knife

The Jebong knife was redesigned to facilitate upward and downward tapping *(Figure 3)*. This bidirectional knife was found to be suitable for smallholders. Responses of smallholders to this knife were as follows:

* Upward tapping was easier since the blade retained the sharpness for over 800 trees.
* Upward tapping was faster since the corners could be negotiated easily with the shorter blade-length.
* The knife could be used as a gouge or as a Jebong *(Figure 4)*.
* Sharpening was easier in comparison with the gouge.

Conclusion

Upward tapping of high panel provides an effective means of upgrading the uneconomic holdings. The economic benefits derived with this technology have been demonstrated to smallholders in several upward tapping projects. However, upward tapping has not been favoured by smallholders due to the physical difficulties involved.

High-level micro tapping has been evaluated as an alternate method. Yields are lower than with the quarter spiral upward system with stimulation. There is also the difficulty of removal of tree lace with this system. Until these problems are resolved

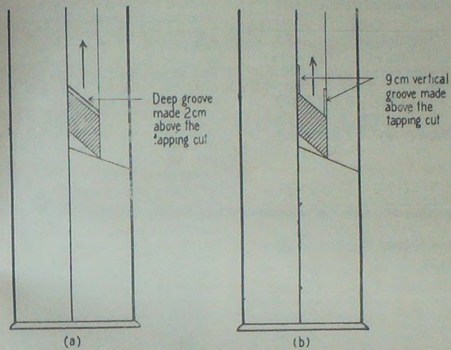


Figure 2. Upward tapping with marker grooves

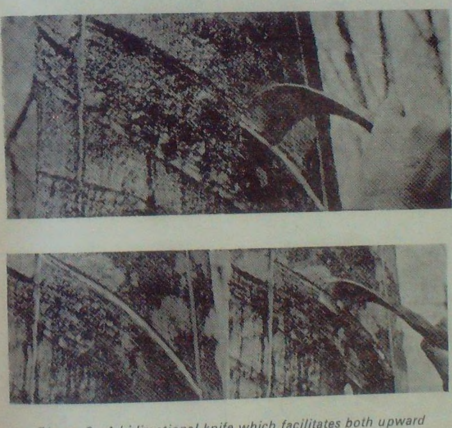


Figure 3. A bidirectional knife which facilitates both upward and downward tapping.

conventional upward tapping with stimulation appears to be the only method for increasing yields on holdings with thin renewals or which are due for replanting.

It may be possible to introduce high-panel exploitation on smallholdings with quarter spiral tapped upwards with stimulation and half spiral downward-tapping without stimulation during wintering. For longer period of exploitation on high panels or where elderly villagers tap their holdings, staggered upward-tapping systems may be more suitable. In this approach, one-quarter or one-third of the holdings is tapped upwards at any one period from May to October followed by downward tapping from November to April with stimulation from November to December. The remaining areas are tapped downwards with stimulant applied only from May to January *(Table 4)*. After refoliation, the appropriate plots are tapped upwards successively.

This system has the following advantages:

- Stress is reduced since upward tapping is confined to one-quarter or one-third of the holding at any time.
- No discomforts fo sunglare during wintering.
- Minimum panel exhaustion with periodic rest.
- Tapping cut is maintained within tapping reach thus eliminating the use of a pole.
- Bark consumption is reduced on the high panel.
- Upward tapping is avoided during the monsoon season.

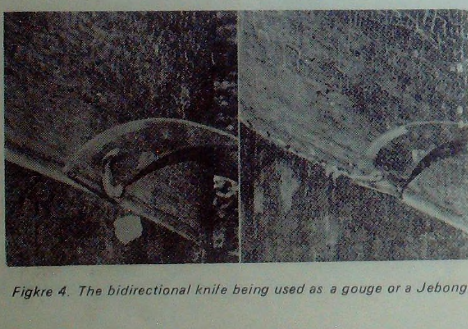
To effect better standards of upward tapping, tapping with quarter spirals could be incorporated with marker grooves made parallel or vertical to the cut where the stimulant is applied. Preferably, grooves should be deep for better yield increases.

Table 3. Yield Obtained with Stimulation on Marker Grooves

Teatment	Yield (kg/ha) 12 months	6months of 2nd year	18 months
Nil–Tapping cut + E	2 590 (100)	1 033 (100)	3 623 (100)
Parallel groove above cut + E	2 173 (84)	804 (78)	2 977 (82)
Vertical grooves + E on front and back channel + E	2 394 (92)	1 171 (114)	3 565 (98)

Table 4. Schedule of Staggered Upward Tapping on High Panels

System	Plot	May to October Tapping	Stimulation	November to April Tapping	Stimulation
Seedling					
Staggered upward tapping on ¼ area	A	1/3S+E	May, July, Sept.	⅓S	November
	B	⅓S+E	June	½S	November
	C	½S+E	August	½S	December
	D	½S+E	October	½S	December
Budding					
Staggered upward tapping on ⅓ area	A	¼S+E	May, July, Sept.	½S+E	November
	B	½S+E	June, August, Oct.	½S+E	December
	C	½S+E	June, August, Oct.	½S+E	December



Figkre 4. The bidirectional knife being used as a gouge or a Jebong.

The bidirectional knife facilitates ease of tapping. This knife can be either used as a draw or as a push knife on cuts tapped upwards. Since this knife can also be used for downward tapping, the need for two sets of knives does not arise.

Upward tapping incorporating these approaches is being currently extended in nation-wide development projects. However, the two major problems, *viz.* stress and the requirement of special skill, are yet to be resolved. These constraints, no doubt, limit wider application of upward tapping. Methods to overcome these constraints merit attention and are being evaluated.

(Source: Planters' Bulletin.)

□

MALAYSIA HAS HIGH RUBBER HOPES

Malaysia aims to become the world's top producer of manufactured rubber goods by the end of the decade, according to its Deputy Prime Minister Datuk Musa Hitam. He said recently that investors should move into more shphisticated processing for products such as surgical gloves, rubber catheters and moulded engineering products. Malaysia is already the largest manufacturer and exporter of rubber gloves, foam rubber and rubber bands, but she uses only three per cent of the country's raw materialp roduction. Datuk Musa added that Malaysian manufacturers have the advantage of an assured raw material supply and a material price which is 30 per cent lower than on the international market since it is exempt from transport and insurance costs.

INSTITUTIONAL SUPPORT FOR DEVELOPMENT PROGRAMMES: THE RUBBER BOARD MODEL

SG SUNDARAM

The author Shri SG Sundaram IAS, who guided the destiny of the Rubber Board for 3 years from 1978 to 1981 is examining how the natural rubber economy got strengthened in the country with particular emphasis on the broad spectrum of activities undertaken by the Rubber Board since its inception in 1947. After discussing the organisational setup and functions of the Rubber Board Shri Sundaram analyses the progress made by the Natural Rubber Plantation Industry in India. In his analysis he agrees that there is close and continuous interaction between Rubber Board and the growers facilitated by well-calibrated machinery for cross fertilization of ideas. He concludes that the growth in the natural rubber industry has been the out come of careful, conscious decisions by individuals and institutions to invest (and reinvest) in this crop. Shri Sundaram is presently Managing Director, Kerala State Industrial Development Corporation Ltd., Trivandrum.

I Introduction

Perhaps no other agricultural crop of the country has undergone such a tremendous improvement in the last couple of decades as natural rubber. Area under rubber has increased from 1.15 lakh hectares during 1957-58/1959-60 (three year average) to 2.37 lakh hectares during 1977-78/1979-80, an increase of 107%. Productivity gain during this period was a handsome 117%. Production naturally shot up by 491%, from 2.43 thousand tonnes to 143.6 thousand tonnes. The Index Numbers of agricultural production (base: Triennium ending 1969-70=100) during 1963-64 to 1977-78 show that *rubber recorded the highest growth in production among all the crops*. Index Numbers of wholesale price (Base: 1970-71=100) of rubber registered an increase of 99.4% between 1970-71 and 1978-79 higher than all other major crops, barring export-oriented commodities like cashewnut, pepper, cardamom and tea.

Obviously, no single factor can explain or account for the remarkable, almost dramatic, growth of the natural rubber industry. It has been the outcome of a host of factors; some of them fortuitous, some reflecting the response of farmers to market forces. But, nothing would appear to have had as profound an impact as the responsive and dynamic leadership of Rubber Board (RB). The operative word is 'Responsive,' for, RB evolved and implemented policies to suit the changing situations, to meet the emerging challenges.

This paper attempts to examine how RB went about the task of strengthening the natural rubber economy. The purpose being to demonstrate how an institution armed with adequate autonomy, financial as well as administrative, and guided by definite long-term goals can achieve results.

First, let us take a look at the organisational set up and functions of RB.

II Functions & Organisation of Rubber Board

RB was established in 1947 with the overall mandate of development of natural rubber. Its principal functions are:

- undertaking, assisting or encouraging scientific, technol ogical or economic research:

- imparting technical advice and training for improving all aspects of rubber cultivation;
- improving the marketing of rubber;
- functioning as a source of authentic and up-to-date data on rubber;
- enhancing the working conditions of rubber plantation workers; and
- providing advice to the Central Government in all matters relating to the rubber industry including import and export of rubber.

RB is attached to the Minister of Commerce of the Central Government and has a full-time Chairman appointed by the Central Government. The Chairman is the principal executive officer responsible for the functioning of the Board which has 24 members. The members represent rubber producers, manufacturers, labour, Parliament and nominees of the Central Government.

The activities of the RB are organised under four departments: administrative, production, research and processing.

i) Rubber Production Department:

Rubber production department is responsible for licensing and registration of rubber estates, implementation of various development and extension service schemes, carrying out economic research and management of rubber plantation projects. The field services are rendered through 15 regional offices and various offices of Field Officers located at important centres throughout the rubber growing areas.

ii) Rubber Research Department:

The Research Department is represented by the Rubber Research Institute of India (RRII) which was established in 1955. It has five research divisions concerned with botany, agronomy, pathology, plant physiology and exploitation and chemistry and technology. Broad areas of research undertaken by the different divisions are:

- improvemet of rubber tree and related botanical problems;
- fundamental and applied aspects of latex flow, yield component analysis, tapping methods, chemical stimulation of yield etc;
- classification of rubber growing soils and investigations into nutritional and cultural problems of rubber under varying conditions;
- problems of pests and diseases and their control; and
- processing, chemical and technological aspects of natural rubber.

RRII started a Central experiment station in 1966 for conducting experiments on botany, agronomy, pathology, and plant physiology. A Demonstration Plot on commercial planting has also been established in 1980 in order to ascertain actual cost of rubber planting.

As part of the effort for introducing rubber to non-traditional areas, RRII has established in 1979 a Regional Research Centre at Tripura. A Seedling Nursery and a Bud-wood multiplication Nursery are under establishment at this Centre.

RRII has put into service a mobile soil and plant tissue testing laboratory for giving on-the-spot fertilizer recommendations to small growers based on soil and plant tissue analysis. This is a free service.

RRII also offers training facilities for short-term courses on rubber cultivation, processing and estate management. The facilities at RRII have been made available to the University of Cochin for conducting a two-year post-graduate course in rubber processing and technology leading to a B. Tech Degree.

RRII maintains a fairly large Technical Library and Documentation Centre.

iii) Department of Rubber Processing:

This department was established in 1977 for the implementation of the rubber processing component of the Kerala Agricultural Development Project financed by the World Bank. This department is concerned with planning and implementation of modern rubber processing projects, offering advisory and training services on modern methods of rubber processing and operating the RB's Crumb Rubber pilot plant.

iv) RB-The Source of Information on Rubber:

One of the key roles of RB is collection, processing and dissemination of authentic and up-to-date information on all aspects pertaining to rubber. It has five regular publications besides advisory pamphlets.

v) The Source of Funds for RB:

RB is financially self sufficient. Its principal source of income is an excise duty (Cess) paid by the manufacturers of rubber products on the natural rubber consumed by them. RB is also collecting the difference between the landed cost of imported natural rubber and the Indian controlled price whenever the former is less than the latter.

The major items of expenditure are development and extension expenses including subsidies, research, labour welfare, cost of the department of rubber processing and general administration.

The annual revenue of RB has always been in excess of its expenditure. The Board enjoys a high degree of financial autonomy, although its budgetary proposals need the clearance of the Central Goverment.

vi) Rubber-A Controlled Item:

Rubber is a controlled item. Its production, sale and manufacture have to be carried out under licenses. Every estate or holding must be registered. Any person wanting to plant or replant rubber must take out a license. Every license holder has to furnish to RB all information about the area planted or re-planted from time to time.

What is most striking about the functioning of RB is its concern with the total spectrum of activities relating to rubber, from fundamental and applied research into evolving new strains to rubber processing and beyond. While looking for clues to understand the enormously satisfying performance of natural rubber, this all pervasive involvement of single institution and its policies appears to be the most overriding.

III. PROGRESS OF NATURAL RUBBER IN INDIA

i) Overall Trends

The following numbers present the overall growth of natural rubber in India in perspective.

(3 Year averages)

Period (Triennium ending)	Area ('000 Hectares)	Area (% increase)	Prodctivity (t/h)u	Prodctivity (% increase)	Production ('000 tonnes)	Production (% increase)
1950-51	67.4	—	307	—	15.7	—
1960-61	123.2	82.7	352	14.7	24.7	57.2
1970-71	195.8	59.0	615	74.7	81 7	231.1
1979-80	237 4	21.3	750	21.9	143.6	75.7
Total Period	—	252.2	—	144.3	—	814.6

Index Numbers (Base: triennium ending 1969-70=100) of agricultural production and productivity show that rubber registered the highest growth in production and productivity among all the crops during the period 1963-64 to 1977-78.

The above statistics underscore few significant pointers:

- Natural rubber has been attracting investments of a high order as reflected in the massive area expansion;
- Investments have been flowing into this sector primarily due to the attractive returns offered by the crop*;
- The contribution of productivity improvement to increase in production is found to be pronounced; in fact, more pronounced than nearly all other crops; and
- Late Seventies witnessed a levelling off of growth in area, production and productiity.

It would be instructive to isolate the underlying casual links between these trends. The Land Ceiling enactments of Kerala (which accounts for an overwhelmingly large share of the total area and production of rubber in the country) prompted a shift in land utilization in favour of plantations essentially rubber. New planted area under rubber averaged 1379 hectares during the first half (five years) of the Fifties, wheras it shot up to 11, 213 hectares during the second half of the Fifties. This burst of area growth, however, could not be maintained since then.

The very fact that the climatic conditions and topographic features of part of Kerala were found to be ideal for rubber growing has proved to be quite helpful. In no other State could there have been such enthusiastic and vigorous response to rubber growing. For one thing, Kerala farmers have always been exceedingly receptive to new crops and new agricultural practices. For another, the increasing cost of labour compelled farmers to shift the cropping pattern in favour of high margin crops. Rubber was found to be very appropriate. Not only individual farmers but also companies and even social and religious organisations took to rubber with considerable zeal.

But, in the final reckoning, the principal contributory factor for the impressive performance of natural rubber has been the sheer economics of rubber growing. Rubber cultivation simply turned out to be a highly rewarding business. And RB did a great deal to make it so.

At this juncture, there is need to introduce a cautionary point. It is not being suggested that everything that RB did(or, in fact, did not do) was most effective or appropriate. What is sought to be emphasised is that any objective evaluation of RB's overall performance cannot but be highly positive. Before we turn to such an assessment, let us delineate some of the important features of natural rubber industry in India.

* Two factors reinforce this proposition. First, rubber cultivation is a relatively capital - intensive activity. Hence taking to rubber cultivation is a major investment decision which is normally taken only after careful analysis of the costs and benefits. Unless the returns are high enough, so many individuals and institutions would not have invested so much funds in rubber. Secondly, the gestation period for rubber is long; investment in rubber starts yielding only after a minimum period of 7 years. Hence the returns should include an element of risk premium. That it does is clear.

ii) Natural Rubber Industry-Some Broad Dimensions

In the rest of the world, rubber processing industry is dominated by synthetic rubber. In contrast, in India natural rubber accounts for over 70 per cent of the total consumption of rubber. This is just as well, given the fact that synthetic rubber is a petroleum derivative and the 'Social Cost' of consumption of this material can be severe.

In sympathy with the growth of processing industry, the demand for natural rubber has also been trending upwards. Consumptions has increased from 33 000 tonnes during 1956-57/58-59 (3 year average) to 150,000 tonnes during 1976-77/78-79 (3 year average) registering an average annual growth of nearly 18 per cent.

Demand for natural rubber exceeded domestic production throughout the Fifties and the Sixties necessitating imports. By the Seventies, domestic output caught up with the domestic demand, the exception being the last two to three years of the decade. The following ratios largely bear this out.

Period (5 year averages)	Domestic Prodution as % of Domestic Consumption
1950-51 to 1954-55	85.8
1955-56 to 1959-60	71.8
1960-61 to 1964-65	61.9
1965-66 to 1969-70	85.0
1970-71 to 1974-75	101.9
1975-76 to 1978-79	99.4

Domestic production and demand have not been as finely balanced as is being implied. There have been years of dislocations. Production outstripped domestic demand in 1975-76, 1976-77 and 1977-78 resulting in fall in prices. To arrest further fall in prices, exports were effected; 12,296 tonnes in 1976-77 and 11,078 tonnes in 1977-78. The situation reversed itself pretty soon with demand exceeding domestic production from 1978-79 onwards. In 1980-81 demand was of the order of 175,000 tonnes as against production of 155,000 tonnes, the highest ever. Prices naturally flared up. (Price of RMA Grade escalated from Rs 10.85 per kg. in January 1980 to Rs. 15 per kg. during the middle of 1981) There was an outcry from the consumers of rubber, particularly tyre manufacturers, for imports to meet the supply gap and to stabilize the price.

Despite annual fluctuations, the overall trend in the price of natural rubber has been upwards. Average price for lot rubber in Kottayam market increased from Rs. 4.65 per kg in 1968-69 to Rs. 10.16 in 1979-80, up by 118.2%. The movement of Indices of prices indicate that during 1970-71 to 1978-79, the overall increase in the price of natural rubber was higher than the Indices of prices of all commodities and even rubber products after 1977-78.

The Ministry of Commerce determines (and periodically revises) the minimum prices for the different grades of rubber. Market prices, however tend to move up and down depending upon the demand- supply situation and they need not necessarily to be in line with the prices notified by the Government.

Indian price of natural rubber has been much higher than the world market price. When the Indian price of RMA grade in the middle of 1981 was ruling at around Rs. 15/kg. it was Rs. 7 to Rs 8/kg. in Malaysia and 4 to Rs. 5/kg. in Sri Lanka. The rate of increase in price was also of a higher order in India; average price of RSS-1 at Cochin/Kottayam showed an increase of 273% during 1964-80 as compared to 108% during the same period for the same grade at Kuala Lumpur.

Differences in the cost of production or demand-supply balance seem to be only partially explaining the vast dissimilarity in prices. The bargaining strength and the holding power of the rubber growers of Kerala, which accounts for over 90% of the country's output, have contributed in no small measure to maintain the prices at the relatively high level.

Rubber industry-the natural rubber sector as well as the processing sector-is characterised by strong lobbies. Processing sector has three or four associations to look after the interests of the respective product groups. But, more significant has been the gradual accretion of economic and political clout of the rubber growers. The 'balance of power' has been in favour of manufacturers of rubber products till recently. Not any more.

Now the farmers determine the price and the quantity to be released at different levels of prices. If information is power, the rubber growers have it, thanks to RB. The growers are fed with all the necessary data on a wide range of issues to facilitate the process of decision making. The types of people who took to rubber growing have been such-educated, alert, aggressive-that they are competent to handle and make use of the information. RB has also been instrumental in enhancing their financial stamina (more about which a little later) which enable them to hold back supply to influence prices. Because of their economic power, rubber growers are being assiduously wood by nearly all the political parties which further reinforce their strength.

IV. RB's Development Efforts: A Winning Formulation

RB's development efforts represent an effective lesson for any programe for an agricultural crop. It would, in fact, appear that the basic approaches adopted by RB are relevant for any development programme.

RB's effort have been focussed on three vital areas:

research and development, extension services and financial assistance. Programmes evolved by RB were essentially woven around these aspects.

i) Research & Development

Few agricultural crops in the country have had the benefit of as much fundamental and applied research efforts as rubber. Rubber Research Institute of India(RRII) is an outstanding organisation of its kind and has contributed significantly to the overall growth of natural rubber in the country. Its research programme encompassed nearly everything concerning rubber. Discussion on the fullrange activities and achievements of RB's R & D effrots is outside the purview of this paper. (The scope of work of RRII which is briefly referred to earlier gives a flavour of its research programmes). Suffice it to mention that research rendered rubber cultivation a highly rewarding economic activity in Kerala, the home of Indian rubber.

RB realised that areas suitable for rubber cultivation is limited in the country and, hence, increasing production and productivity on a long-term basis warrants discovering high yielding planting materials and their propagation. RB's achievements in this area is truly admirable. Some of the clones developed by RRII compare with the best in the world.

ii) Extension Services

The extension services maintained by RB are really formidable. In fact, rubber growers are better equipped to handle the situations they encounter on the farm and at the market place than almost all other farmers. Findings at the laboratory are quickly transmitted to the field; field problems, in turn, determine the range of enquiry at the laboratory or research centres.

There is close and continuous interaction between RB and the growers facilitated by well-calibrated machinery for this kind of cross-fertilization of ideas. Demonstration plots, Rubber Tapping Demonstrators, Rubber Tappers' Training Schools, Stations of Field Officers and Junior Field Officers at the important growing centres, mass contact campaigns through seminars, study classes and exhibitions are all part of the scheme of things. An interesting feature of rubber cultivation in Kerala is that it is dominated by Christian community. RB did not hesitate to reach out to the farmers through the well-organised church machinery for imparting knowledge on rubber.

Most of all, RB has been the source of reliable data made available through different publications. *Rubber Statistical News*, a monthly, contains relevant and latest rubber statistics. *Rubber Grower's Companion* is a combined handbook and diary published annually. It is a store house of information on rubber cultivation and processing, on development schemes of RB and statistics pertaining to rubber industry. *Indian Rubber Statistics* published annually, contain data on rubber production, import, consumption, price, manufacturers etc. *Rubber Board Bulletin*, a quarterly, carries articles on research findings and related scientific topics of relevance to growers. *Rubber*, a monthly magazine in Malayalam, is intended for the small growers who are not conversant with modern scientific methods of rubber cultivation and processing. Apart from technical articles, this magazine has columns dealing with matters of practical interest to growers. *Handbook on Natural Rubber Production in India* is an exhaustive manual containing a wealth of information on all aspects of production and processing. *Rubber-From Seed to Market* is a book in Malayalam prepared in the form of lessons on rubber production and processing. *Price* is a fortnightly market information bulletin. In addition, advisory pamphlets are regularly published on various aspects of rubber cultivation and processing.

iii) Financial Assistance

The importance of financial assistance as an instrument for bringing about desired changes in the Indian context was well-recognised by RB, particularly for rubber which starts yielding only after 7 years or so. It has been designing and implementing several schemes, primarily aimed at encouraging the farmers to take to high yielding planting materials; in other words, modernising rubber cultivation.

RB introduced in 1957 a Replanting Subsidy Scheme to encourage growers to undertake clearing of existing low yielding rubber and replanting with high yielding varieties. The subsidy rates were periodically revised upwards and maintained at higher levels for smaller growers. The eligibility criteria and mode of disoursement incorporated in the scheme ensured that the funds were effectively utilised for the purpose they were intended.

Under the Scheme of Additional Assistance, financial support is provided to small holders owning not more than 6.07 hectares of rubber estate for procurement of high yielding planting materials and recommended fertilizers and for adopting soil conservation measures.

Since the introduction of the Replanting Subsidy Scheme, a total amount of Rs. 135 million had been disbursed as subsidy as on 30-9-1980 for replanting a total area of nearly 50,000 hectares. Additional assistance granted to small holders during this period amounted to nearly Rs. 12 million.

RB had also a liberal loan scheme. The scheme was to assist registered small growers with loans to expand their holdings to a minimum size by new planting and also to maintain immature areas. The loans were interest-free up to the end of the 9th year of planting. Additional assistance for procuring high yielding planting materi-

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research and development, extension services and financial assistance. Programmes evolved by RB were essentially woven around these aspects.

i) Research & Development

Few agricultural crops in the country have had the benefit of as much fundamental and applied research efforts as rubber. Rubber Research Institute of India(RRII) is an outstanding organisation of its kind and has contributed significantly to the overall growth of natural rubber in the country. Its research programme encompassed nearly everything concerning rubber. Discussion on the fullrange activities and achievements of RB's R & D effrots is outside the purview of this paper. (The scope of work of RRII which is briefly referred to earlier gives a flavour of its research programmes). Suffice it to mention that research rendered rubber cultivation a highly rewarding economic activity in Kerala, the home of Indian rubber.

RB realised that areas suitable for rubber cultivation is limited in the country and, hence, increasing production and productivity on a long-term basis warrants discovering high yielding planting materials and their propagation. RB's achievements in this area is truly admirable. Some of the clones developed by RRII compare with the best in the world.

ii) Extension Services

The extension services maintained by RB are really formidable. In fact, rubber growers are better equipped to handle the situations they encounter on the farm and at the market place than almost all other farmers. Findings at the laboratory are quickly transmitted to the field; field problems, in turn, determine the range of enquiry at the laboratory or research centres.

There is close and continuous interaction between RB and the growers facilitated by well-calibrated machinery for this kind of cross-fertilization of ideas. Demonstration plots, Rubber Tapping Demonstrators, Rubber Tappers' Training Schools, Stations of Field Officers and Junior Field Officers at the important growing centres, mass contact campaigns through seminars, study classes and exhibitions are all part of the scheme of things. An interesting feature of rubber cultivation in Kerala is that it is dominated by Christian community. RB did not hesitate to reach out to the farmers through the well-organised church machinery for imparting knowledge on rubber.

Most of all, RB has been the source of reliable data made available through different publications. *Rubber Statistical News*, a monthly, contains relevant and latest rubber statistics. *Rubber Grower's Companion* is a combined handbook and diary published annually. It is a store house of information on rubber cultivation and processing, on development schemes of RB and statistics pertaining to rubber industry. *Indian Rubber Statistics* published annually, contain data on rubber production, import, consumption, price, manufacturers etc. *Rubber Board Bulletin*, a quarterly, carries articles on research findings and related scientific topics of relevance to growers. *Rubber*, a monthly magazine in Malayalam, is intended for the small growers who are not conversant with modern scientific methods of rubber cultivation and processing. Apart from technical articles, this magazine has columns dealing with matters of practical interest to growers. *Handbook on Natural Rubber Production in India* is an exhaustive manual containing a wealth of information on all aspects of production and processing. *Rubber-From Seed to Market* is a book in Malayalam prepared in the form of lessons on rubber production and processing. *Price* is a fortnightly market information bulletin. In addition, advisory pamphlets are regularly published on various aspects of rubber cultivation and processing.

iii) Financial Assistance

The importance of financial assistance as an instrument for bringing about desired changes in the Indian context was well-recognised by RB, particularly for rubber which starts yielding only after 7 years or so. It has been designing and implementing several schemes, primarily aimed at encouraging the farmers to take to high yielding planting materials; in other words, modernising rubber cultivation.

RB introduced in 1957 a Replanting Subsidy Scheme to encourage growers to undertake clearing of existing low yielding rubber and replanting with high yielding varieties. The subsidy rates were periodically revised upwards and maintained at higher levels for smaller growers. The eligibility criteria and mode of disbursement incorporated in the scheme ensured that the funds were effectively utilised for the purpose they were intended.

Under the Scheme of Additional Assistance, financial support is provided to small holders owning not more than 6.07 hectares of rubber estate for procurement of high yielding planting materials and recommended fertilizers and for adopting soil conservation measures.

Since the introduction of the Replanting Subsidy Scheme, a total amount of Rs. 135 million had been disbursed as subsidy as on 30-9-1980 for replanting a total area of nearly 50,000 hectares. Additional assistance granted to small holders during this period amounted to nearly Rs. 12 million.

RB had also a liberal loan scheme. The scheme was to assist registered small growers with loans to expand their holdings to a minimum size by new planting and also to maintain immature areas. The loans were interest-free up to the end of the 9th year of planting. Additional assistance for procuring high yielding planting materials and fertilizers were granted to small growers availing new planting loan as in the case of Replanting Subsidy Scheme. The loan scheme was discontinued from 1979 onwards.

The Agricultural Refinance Corporation has a scheme for providing long term loans to rubber planters through scheduled banks with the technical collaboration of the RB. The loan is provided to meet the cost of replanting, maintenance of immature rubber, construction of smoke houses, purchase of processing machines, construction of labour quarters etc.

RB sensed the declining rate of increase in area, production and productivity, towards the end of the Seventies. The impact of the existing schemes appeared to be spending themselves out. With a view to pulling the natural rubber industry back to the plateau of high growth, RB introduced a New Planting Subsidy Scheme in 1979-80. Earlier subsidy scheme was applicable only to replanting of existing holdings with new materials. As per the new scheme this facility was offered to new holdings as well. The scheme was intended to bring about acceleration of the rate of new planting in the small holding sector which has to contribute the maximum to the future development of rubber plantation industry in the country. The Scheme has the following components:

- Capital Subsidy at the rate of Rs. 7,500/-per hectare for growers owning upto 2 hectares and at the rate of Rs.5,000/-for growers owning above 2 hectares and up to 20.23 hectares;
- Input subsidies to growers whose total rubber area including the area new planted under the Scheme will not exceed 6 hectares; this consists of reimbursement of full cost of approved high yielding planting materials used, fifty percent of cost of prescribed fertilizers applied during the first seven years and a subsidy against expenditure incurred for carrying out soil conservation work;
- Interest subsidy at 3% for new planting credit availed from banks as per the provisions of the scheme; soft loan to the extent of a maximum of Rs. 15,000/-per hectare; and
- Free advisory and extension support at all stages of planting, maintenance, tapping and processing.

This scheme has been a great success. During 1979 alone about 32,000 applications covering an area of 28,000 hectares were received.

Meanwhile, RB has designed an integrated scheme for large scale development of rubber plantations. The scheme, which is under implementation since January 1981, envisages new planting and replanting ot 60,000 hectares during the period 1980-81 to 1984-85. It is proposed to treat new planting and replanting with equal importance and to give a package of similar facilities and incentives for both in an integrated manner.

The new scheme which will be known as Rubber Plantation Development Scheme will apply to both small holding sector and estate sector; but the extent of cash assistance given will be more for the former. The principal elements of this scheme will be cash subsidy from the RB (upto Rs. 5,000/-per hectare), input subsidies to small holders, long-term financial credit from Banks, interest subsidy on bank loan and free technical support.

The financial assistance schemes designed by RB at different points in time recognised the fact that every rupee invested in rubber generates income which is several times the initial investment. For instance, the Rubber Plantation Development Scheme under implementation envisages new planting and replanting of 60,000 hectares during 1980-81 to 1984-85. When in full bloom, this area would produce, on a conservative basis, 100,000 tonnes of rubber per annum valued at (at the prevailing price) about Rs. 140 crores. RB would get by way of Cess about Rs. 4 crores annually. The project would generate employment opportunities for a few hundred semi-skilled labour. Thus, the total benefits emanating from this scheme will be so much higher than the quantum of assistance provided by RB and other agencies.

Invoking Co-operative Societies

RB has also involved co-operative societies through a number of schemes with the ultimate objective of increasing production and productivity and improving the quality and marketing of rubber produced by small growers. Share participation in co-operative marketing societies, provision of working capital loan to them and giving them technical and financial assistance to establish processing unites for the production of technically specified rubbers.

A Federation of the Primary Marketing Co-operative Societies was formed at the initiative of the RB. Besides marketing of rubber, the Federation has a Fertilizer Mixing Unit for mixing the fertilizers required by small rubber growers. It has a soil and leaf testing unit and undertakes aerial spraying.

Taking Rubber to Non-Traditional Areas

Recognising the limits to the expansion of rubber cultivation in the traditional areas in Tamil Nadu, Kerala and Karnataka, RB had been attempting during the last 15 years or so to extend rubber cultivation to new areas in other States where agro-climatic conditions are suitable. New tracts have been indentified in Andhra Pradesh, Goa, Gujarat, Maharashtra, Assam, Tripura, Mizoram, Arunachal Pradesh and Andaman and Nicobar Islands. Rubber plantations have been raised on experimental basis on suitable tracts in some of these regions and the initial results are encouraging.

RB's officers stationed in Tripura, Gujarat and Goa are giving the necessary technical advise for the expansion programmes in these areas. The Rubber Research-cum-Development Station was established in the Andaman and Nicobar Islands to serve the purpose of an experiment station and model plantation.

V. Summing up

India has emerged as the world's fourth largest producer of natural rubber; its share in world production increased from 2.9% in 1970 to 4.1% in 1981. The country is presently the world's fifth largest consumer of natural rubber, next only to USA, Japan, China and USSR.

When most of the rest of the world took to synthetic rubber, India settled for natural rubber, a renewable resource. The contribution of natural rubber cultivation in terms of employment generation and ecological benefits is indeed significant. In other words, even the most severe cost-benefit analysis of cultivation of rubber, a meterial of strategic importance, would tend to yield highly desirable results.

Rubber consuming industries, particularly automobile tyres and tubes sector, are poised for a major expansion. Market prospects for rubber would, therefore continue to be extremely robust and the price of rubber would continue to be highly remunerative. There are pretty strong indications that natural rubber industry will stay on a growth path in the foreseable future.

That RB has been extremely effective in accelerating the all-round growth of natural rubber industry is incontestable. This was achieved essentially through modernisation, a level of modernisation no other agricultural crop has achieved. The share of high yielding varieties in the total area under rubber registered a striking increase from 31.1% in 1958-59 to 78.6% in 1978-79.

A close look at this success story reveals four critical contributory factors:

- Research and Development
- Strong extension support including making available authentic and up-to-date data for the growers to take decisions on;
- Imaginative and liberal financial support; and
- An organisational system which has built up the capability to identify (even anticipate) problems and design measures to combat them, within the context of a relatively long time-frame.

The fact that rubber is a controlled item helped matters to some extent. RB could keep a check on most of everything. But, in the ultimate analysis, growth in the natural rubber industry has been the outcome of careful, conscious decisions by individuals and institutions to invest (and reinvest) in this crop. What RB and its multi-dimensional development programmes achieved most was making rubber cultivation worth investing in. And RB could achieve all these only because it had the financial and administrative autonomy to plan, implement and control the development programmes it designed.

Few Observations

The author took charge as Chairman of the Rubber Board (RB) sometime in May 1978 and was confronted with two critical tasks: first, to establish the credibility of RB and secondly to put the natural rubber industry back on the growth path.

Most of the Seventies was a period of turbulence for the natural rubber industry. It went through the full circle; excess production pushing the prices down, attempts at holding the falling prices through exports, market turning around with demand gallopping past domestic availability necessitating large imports in 1978-79 after 8 years of no imports. There was certain degree of uncertainty in the minds of the growers in regard to the long-term prospects of natural rubber.

The rubber consuming industries were highly sceptical of the statistics produced by RB. They felt that the country was heading for a period of shortage and exports were unwarranted. The Government of India also went along with this view to some extent with the production showing a decline of about 12,000 tonnes in 1978-79. Farmers, on the other hand, were greatly upset over the Government's move to import. Imports, they felt, would lead to decline in prices.

RB's task was to combat the hostile postures of growers towards imports, at the same time, to ensure that imports are released in a measured manner so that they do not seriously dislocate farm prices. This called for a high degree of diplomacy, for the problem on hand was to achieve certain degree of consensus among conflicting interest groups. RB could accomplish these through formal and informal means Imports had to be allowed; but they did not arrest the long-term upward movement of domestic price.

Once the credibility gap was bridged, RB went about designing short-term as well as long-term programmes with the principal objective of boosting production. That these programmes have been quite successful is pretty obvious. What is not so obvious is the enormity of the efforts that were involved in making them successful. The earlier parts of this paper explained in detail the development programmes that were part of the total strategy. Nonetheless, the author would want to highlight two factors which appear to be crucial for any development programme, viz. information and involvement.

Management of information as a device for influencing the decisions of people is critical. RB focussed its efforts a great deal on this area. The whole range of media (including audiovisual aids) was made use of effectively to guide farmers, traders and processors of rubber towards the goals RB had carefully determined. Even the policy decisions of the Central Government have eventually come to be determined by the information provided by RB.

With a view to broadening the information base, RB has been keeping close track of the developments around the world.

Senior officials were periodically sent abroad to have an appreciation of the latest developments. RB hosted an international conference at Kottayam and the international meet of the Association of National Rubber Producing Countries at New Delhi during November/December 1980.

Another pre-requisite for the success of any programme is its acceptability by the different constituents concerned with it. There have been several instances of well-conceived programmes falling by the way side due to inadequate efforts for ensuring the acceptability of such programmes. It has been the experience that even people who are going to be the beneficiaries of the programme might not accept it in the first instance. A high degree of imaginative persuasion would be necessary to 'sell' new ideas to any group of people.

To cite an example the Rubber Research Institute of India had developed a wonder clone (RRII-105) which could easily yield 2500kgs. per hectare as against the national average of 800kg. per hectare. Although the tremendous potentialities of this material was known to RB, not enough efforts were put into popularise it initially. In other words, even RB did not fully accept this material as an instrument for increasing the production of rubber significantly. Likewise when schemes were evolved for taking rubber to the new areas in Kerala with the aid of a battery of financial and non-financial incentives, there was considerable scepticism regarding the availability of fresh land for rubber cultivation. In fact, detractors were not wanting even among the staff and grower-members of RB. But when a pilot scheme was implemented with the modest target of 4000 hectares, the actual achievement was nearly 7000 hectares.

The point that is sought to be highlighted is that even the most brilliantly conceived projects need not be successful on merits alone. Strategy for implementing such projects should take serious note of the need for support mobilisation and energising the involvement of policy makers, implementing staff and even of these who are the beneficiaries

The best compliment one could pay to RB is that it has developed the skills to use *information* as a critical input for achieving its goals and to mobilise support for its development programmes. □

MORE FUNDS FOR RUBBER PRICE PACT

The International Natural Rubber Organisation (INRO) has received nearly all of the 200m ringgit (E45.5m) which it requested from member countries last month in a second call-up of funds for its buffer stock operation, informed rubber sources said. Most large contributors, including Malaysia and the U. S., whose payment amounts to about 100m ringgit, have met the 30-day contribution deadline, the sources said. They added that the buffer stock manager, who intervened on the depressed market for the first time early in November, had ample financial resources to continue his purchases. INRO has received about 300m ringgit since its first call-up was made in early October, they said, though they could not give the amount that the buffer stock manager had spent so far to defend the rubber price on the London, New York, Kuala Lumpur and Singapore markets. The Kuala Lumpur-based organisation's five-day moving average stood at 176.64 Malaysian/Singapore cents a kilo on Wednesday, more than two cents below the May buy level of 179 cents.

The buffer stock manager has bought various grades of rubber on the four markets this week according to dealers, but the moving average has remained below 179 cents since November 27. INRO bought rubber for the Feb delivery, London dealers reported. They said RSS No 1 and 3 grades were taken, but in small quantity, and prices were not disclosed.

news and notes

PR MEN CAN FOCUS CRUCIAL ISSUES: SATHE

The transfer of science and technology, the energy crisis and the question of brain-drain can be adequately focussed in a world-wide perspective only by PR men, Mr. Vasant Sathe, Union Minister for Information and Broadcasting said in his valedictory address at the 9th Public Relations World Congress concluded in Bombay. On the economic front, the role of public relations is most crucial, he said.

Mr. Sathe said like specialisation in other fields, the PR practitioners have the opportunity to specialise in the areas of global PR as well. Whatever they do, the foremost consideration before them must be the promotion of good understanding and cooperation among different countries and people in order to bring about an improvement in the quality of life. There must be exchange of technical know-how and exchange between brilliant brains who can render tremendous service to both the developed and developing countries by their expertise.

The Minister said the technological explosion has brought the universe on the threshold of a new era. Rapid developments in science and technology and means of communications have shrunk the world into a small community This can be rightly called an age of public relations. Interdependence has increased manifold. No country is self-sufficient or self-reliant in its needs and requirements. Thus, there has to be give-and-take for the prosperity and betterment of our societies.

Mr. Sathe said the international climate in the last two decades has never been so grim as it is today. A miscalculated step, thus, can bring nothing but a catastrophe. The crisis that the universe faces today must be analysed with a detached realistic and objective attitude. And this can be tackled by bringing out facts in the proper perspective. Public relations can foster mutual understanding and goodwill which is the crucial need of the time. Public relations, thus, assumes great significance and inportance today in promoting interdependence, the Minister said.

Mr. Sathe distributed prizes to the winners of various competitions organised by the world Congress. Mr.Sam Black President of the International Public Relations Association spoke about the deliberations at the Congress. The next Congress would be held in the Netherlands in 1985.

RUBBER GETS BOOST IN NORTH–EAST

North-east India is poised for a big leap in boosting production of natural rubber with the implementation of the massive 10,000 hectare rubber plantation by 1984-85. Fifty per cent of the plantation area will be in Tripura reports UNI.

About 5300 hectares have so far been covered by rubber plantations in this non-traditional region, thus disproving the centuries-old belief that rubber could be grown only in the equitorial belt.

Tripura has taken the lead by bringing 3540 hectares under rubber plantation so far, against the targeted 5000 hectares by the end of the Sixth Plan. The yield of rubber in Tripura is roughly double that of Kerala. Encouraged by the good result, the Tripura government has drawn up a massive scheme to cover the entire border area with Bangladesh by rubber plantations and rehabilitate the landless poor and poor peasants.

The Rubber Board's regional research centre and the newly formed Tripura Forest Development and Plantation Corporation are encouraging the people to take to this cash crop. Last year, 147 new planting licences for an area of 264 hectares were issued. Earlier, only 32 units in 535 hectares have been registered.

The Tripura corporation has 110 hectares of rubber plantation under its control and gets a yield of 400 kg of rubber per hectare. Three private sector units have also come up encouraged by the higher yields.

The Rubber Board, on its part, is operating a rubber plantation development scheme for large scale plantations since 1980-81. Under the scheme, small growers owning rubber plantations upto 20 hectares, are given cash subsidy of Rs. 5000 per hectare. The subsidy is limited to Rs. 3000 per hectare for those owning over 20 hectares. The subsidy is phased out, enabling the growers to get funds till the seventh year when the plants reach lectative stage.

Since introduction of the scheme, a sum of Rs. 5.64 lakhs has been advanced as cash subsidy to 183 applicants, who are raising rubber plantations on an aggregate area of 826 hectares.

(The Economic Times)

NEW BICYCLE TYRE FROM DUNLOP

Dunlop India has developed a bicycle tyre without any petro-based raw material. This innnovation, the company claims is first of its kind in the world.

Addressing a Press conference at the Sahaganj (West Bengal) factory, the managing director of the company, Mr. L. J. Tompsett said that it would be at least a year before the tyre could be marketed. The technology, at the moment, had not advanced enough for it to be used in heavier tyres.

In developing this "oil-free" tyre, the Dunlop scientists used silica recovered from rice husk for replacing carbon black, which is an oil-based compound. The accelerators are recovered from molasses and the anti-odidants-whose discovery was quite accidental-are obtained from mangrove bark. These three compounds, which are now obtained from petroleum, form almost 50 per cent of the tyre compound.

Mr. Tompsett said talks were underway for export of 1 million bicycle tyres to Europe. He said that although the market was not good the company was trying to hit the three million export target of these tyres.

(Business Standard)

MARKET FOR RUBBER TYRES IN BANGLADESH

Bangladesh's current production of bicycle, tyres and tubes is sufficient to meet 70 to 80 per cent of that country's demand. The remaining demand is met by imports from various sources. According to a demand study sponsored by International Trade Centre, Geneva, for promotion of trade among the developing countries, the imports of tyres into Bangladesh have significently increased from 0.8 million numbers in 1976-77 to 1.41 million numbers in 1978-79 and likewise tubes from 0.25 million numbers to 1.27 million numbers during the same period. Over 80 per cent of these imports consisted of auto rickshaw and bicycle tyresand tubes.

China is the major supplier of tyres and tubes to Bangladesh. Its share of the market is about 50 per cent of the total imports of these items. Malaysia, Singapore and Thailnad are the other suppliers. Export from Sri Lanka has been declining. Republic of Korea has made a dent into the market and has been trying to capture this market. India and Pakistan supply tyres and tubes in small quantities.

NEWS IN PICTURES

THE RUBBER GROWERS' SEMINARS

Shri P Mukundan Menon presided over the one day rubber growers' seminar held on 23rd January 1982 at Aryanadu. Shri VN Vijayan IAS, District Collector, Trivandrum, inaugurated. The felicitation speeches were delivered by Shri NP Narayanan IAS, Managing Director of the Kerala State Cooperative Land Mortgage Bank, Shri Rama Iyer, Regional Manager, and Shri G Chandrasekharan Nair. The President of the Society, Shri N Sreedharan, proposed a vote of thanks

SEMINAR AT KANJIRAPPALLY

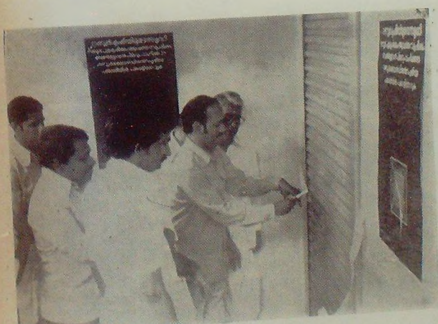
The one day rubber growers' seminar at Kanjirappally held on the 23rd February 1982 was inaugurated by Shri K Mohandas IAS District Collector, Kottayam. Shri Balakrishna Panickar, Joint Director of Agriculture, presided. Capt. E Jayaraman of the FACT delivered the felicitation address.

FASCIATION

Certain deformities of growth resulting in flattened, curved and branched or unbranched shoot growth with many scale leaves and buds are occasionally noticed on rubber plants. The exact cause of such abnormal growth is not fully established. Very often, removal of the fasciated shoot results in normal growth.

RUBBER BOARD WARD

The newly constructed Rubber Board Ward attached to the KVMS Hindu Medical Mission Hospital at Ponkunnam was formally inaugurated by Shri K Mohanachandran IAS, Chairman, Rubber Board, on 28th February 1982. Shri SG Sundaram, Managing Director, Kerala State Industrial Development Corporation, presided. Shri PR Rajagopal MABL proposed a vote of thanks. S/Shri DC Kizhakemuri, KPS Nair and Dr KJ John spoke. A rubber seminar was also held on the same day.



The new building of the Malappuram District Co-operative Rubber Marketing Society was formally inaugurated by Shri K Mohanachandran IAS, Chairman, Rubber Board, at Nilambur on 6th February 1982. Shri Thomas G George, District Collector, Malappuram, and Shri A Krishnan Unni Kurup, former President of the Society, are also seen in the picture.

'HE 'TUDENTS)F THE \GRICULTURAL INIVERSITY

\s part of their studies, he final year B. Sc. students of the Agricult- ural University, Vellani- cara, have undergone a raining in rubber cultiva- ion and processing. The study tour was led by Mrs. PA Nazeema, Asst. Professor of the Univers- ty. The team consisting of 50 students visited a Nursery at Ottupara near Vadakkancherry. Shri P Subramaniam, ADO, Ru- bber Board, took classes on various aspects of nursery maintenance. The officers of the Rubber Board, viz. Messrs John Joseph, Maniyan Nair, Balankutty and Smt Aliya- mma now undergoing a raining at the University, ccompanied the team.

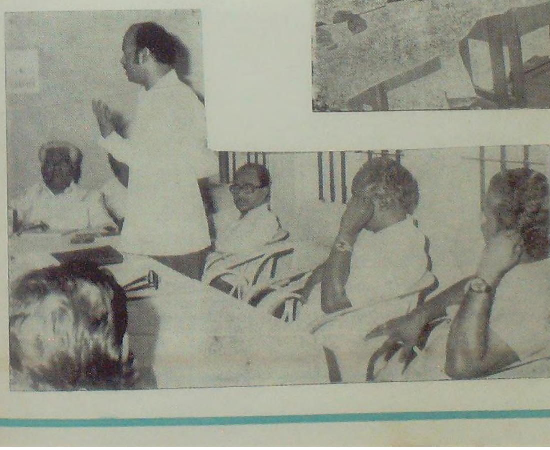
PCK STAFF TRAINING

A reorientation course for the Field Staff working in different estates under the Plantation Corporation of Kerala was held at the Jawahar Balabhavan on 23rd and 24th February 1982. About 300 persons which included Senior Superintendents to Junior Field Assistants participated. The PCK Ltd is a public sector undertaking of the Government of Kerala and it recorded a profit of Rs. 94.15 lakhs in 1981.

Shri TSG Nair, Managing Director of the PCK, inaugurated the course. The officers of Rubber Board viz. S/Shri PK Narayanan, MJ George, KK Ramachandran Pillai and Dr. V Haridasan took classes on different topics of rubber cultivation. Shri NK Gopalakrishnan, General Manager, Production and Planning, was coordinator of the course.

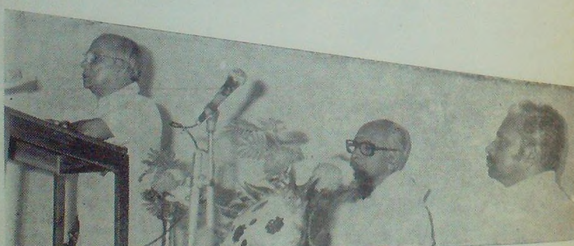
FIB WORKSHOP FOR JOURNALISTS

A four day workshop for the benefit of the journalists in charge of Weekly Farm Feature pages in the newspapers was organised under the joint auspices of the Farm Information Bureau and the Rubber Board from 1st to 4th March 1982 at the Sophia Centre, Kottayam. Besides editors from almost all Malayalam Dailies, a few officers from the Department of Agriculture, Animal Husbandry, Dairy Development, SADU etc, participated in the Workshop. The Workshop could expose various activities going on in the farm front and detailed discussions were also held. The guest speakers on various topics included Dr. Paulose Mar Gregorius Metropolitan, Prof AGG Menon, Dr PK Gopalakrishnan, S/Shri AP Udayabhanu, Mohanachandran IAS and Rascot Krishna Pillay.



participants of the Workshop.

RUBBER SEMINAR AT KONNI



Under the joint auspices of Konni Marketing Cooperative Society and the Rubber Board, a one day rubber growers' seminar was held on 17th February 1982. Shri KG Varghese, President of the society, spoke on the occasion.

METHOD OF COLLECTING SOIL AND LEAF SAMPLES

While collecting soil and leaf samples from rubber plantations for the purpose of analysis, it is necessary to take some precautions. The most important point to be kept in mind is that the samples collected should be truely representative of the area sampled. Moreover, after manuring, two to three months should elapse before samples are collected. If there is uniformity in the nature of soil, lie of the land, manurial history, age of the rubber tree and growth of rubber and cover crop, one composite sample of soil and leaf would suffice for an area upto 20 hectares. But if there are marked differences in the above factors, take separate samples for the different areas. It is also desirable to have separate leaf samples for each clone.

If soil and leaf samples are simultaneously collected, the suitable period would be between August and October. But if soil sample alone is collected, the period between December and March would also be suitable. Take composite soil samples at two depths 0-30 cm and 30-60 cm.

For this purpose select at random 5 to 15 spots (depending on the total area to be sampled) and dig 60 cm. deep pits at these spots. As it is necessary to ascertain the effect of past manuring on the fertility of the soil, locate pits at the site of past manuring application. (For mature rubber, fertilizers are applied either broadcast or in rectangular patches in the middle of every four trees). Do not sample road margins, labour line sites cattle shed or compost pile neighbour-hoods, are recently fertilized, old bunds, marshy spots, very near trees or stumps or other non-representative locations. After removing the surface litter and mulch, cut a thin vertical section of soil from the top to a depth of 30 cm using a sharpedged tool such as chisel. Pool all the samples of 0-30 cm depth from the different pits and mix well. If the size of the composite sample is large, reduce by quartering. For this purpose spread the well-mixed soil into a thin-layered square on polythene sheet or brown paper. Divide the square into four equal squares and discard the soil in the diagonally opposite squares. Repeat this process until about 500 gm sample of soil is obtained. Prepare composite sample from 30-60 cm depth also in similar manner. Dry the samples under shade and pack them in clean cloth bags and never in manure contaminated gunny or alkathene bags. Label each sample giving details of block sampled, depth of sampling and date of collection, and put the label in the bag. (Write the label with pencil and never in ink).

Leaf samples are collected during August to October period. During this period leaves would be 6-8 months old. Depending on the area to be sampled, select 10 to 30 trees at random, (Upto 5 hectares select 10 trees, for 20 hectares select 30 trees, and for area between 5 and 20 hectares select proportionate number of trees). In the case of branched immature trees and trees under tapping, collect four basal leaves from the terminal whorl of low branches in shade from each of the selected trees. Four basal leaves from 'spur leaves' (small off-shoots with only one whorl from the trunk or main branches)are also suitable for sampling mature rubber. Branches with new flushes and leaves infected by Oidium and other leaf diseases are unsuitable for sampling. Leaves formed during the onset of south-west monsoon are also not mature enough for sampling. Do not select Brown bast or root disease affected trees for sampling purpose. In the case of unbranched young plants with storeys, select plants without new flushes, and collect four basal leaves from the top-most whorl. If 30 trees are selected, collect only the middle leaf-let from each leaf, if 15 trees are selected, collect the two leaf-lets on either side and, if trees, collect all the three leaf-lets, so that about 120 leaflets would be available in one composite sample. Place the leaves between sheets of newspaper, and label each composite sample. Send the samples of soil and leaf to the Director, Rubber Research Institute of India, Kottayam-9, Kerala, as quickly as possible, if it is not possible to deliver the samples within 24 hours after collection the samples may be dried by pressing with an elective iron heated to the temperature used for pressing the cotton clothes. Along with the sample, send the case history of the area represented by each sample in proforma given below:

Case History Sheet of the Sampled Area/Estate

1. Name of the estate with postal address.
2. Name of the block sampled along with area in hectares.
3. Sample No.
4. Depth of sampling: 0-30 cm 30-60 cm.
5. Date of sampling.