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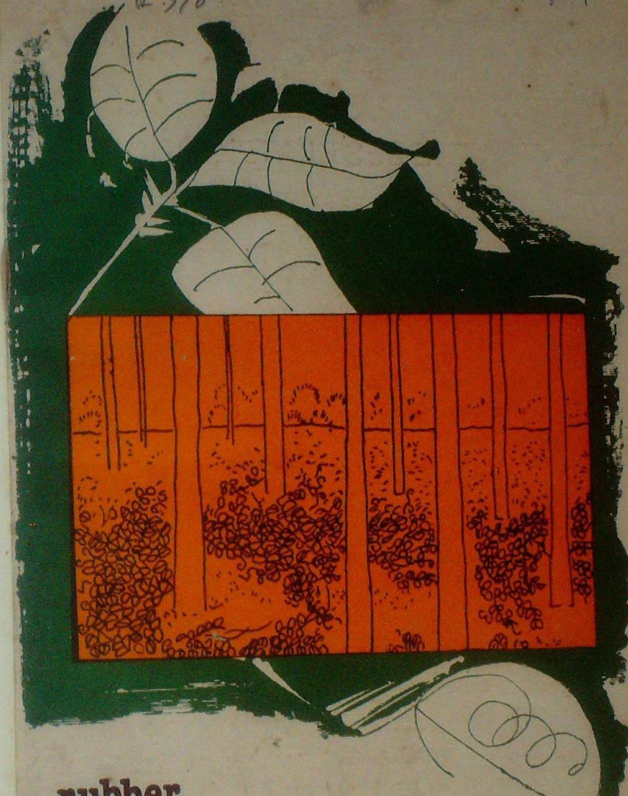

rubber board bulletin

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RUBBER BOARD BULLETIN

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RUBBER BOARD BULLETIN
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THE QUARTER

To create an awareness among the public for massive programme for rubber development, the 102 meeting of the Rubber Board was held at Gauhati on 17th October 1984. This is a clear evidence to prove the dedication and earnestness of the Rubber Board to take timely action for the speedy implementation of the scheme for accelerated development of the rubber plantations in North Eastern States. The proposal for the development of rubber plantations there involves an outlay of over Rs. 6 crores. While rubber is a deficit agricultural commodity in India, the efforts in identifying new areas for rubber, will certainly brighten the prospects of natural rubber. It is hoped that the new attempt would further reduce the gap between demand and supply and save valuable foreign exchange.

RUBBER IMPORTS

(The news of rubber imports have captured prominent positions in some of the leading newspapers and journals. The views expressed mostly favour the need for increasing the indigenous availability of natural rubber rather than merely pleading for imports. Following are the views expressed by Financial Express and the Planters' Chronicle in their editorial comments:)

1

Since 1978, India has imported over 1,64,000 tonnes of natural rubber. As the demand is much in excess of the production, imports have become unavoidable. Yet, imports are being planned only on an ad hoc basis. Consequently, "imports have not had the positive impact either on the availability of natural rubber or its prices", as pointed out by Dr. Modi. It has been found from experience that every year issues relating to the quantum of imports, the rate of the import duty, the price to be charged by the State Trading Corporation through which imports are canalised, etc., delay imports inordinately. This only makes the market rule firm. Dr. Modi has rightly suggested that "one of the ways to ease the situation could be to allow at least large consumers, both in tyre and non-tyre sectors, to import directly and the Government could monitor such imports". Considering that the working group set up by the Government to project natural rubber imports during the Seventh Plan and beyond has feared that the shortfall would gradually widen to a staggering level of three lakh tonnes by the turn of this century, ad hoc imports must give way to planned imports. The building up of a buffer stock needs to be considered for stabilising prices. If the Government takes the initiative in maintaining prices between "the maximum and minimum price bands" by implementing the buffer stock scheme, interests of both growers and consumers can possibly be protected. The industry, for its part, can adopt certain self-help measures for removing uncertainty about the supply of its basic raw material and containing the price rise. The industry ought to reach an understanding with producers of synthetic rubber. By stepping up the consumption of synthetic rubber, the industry can help the Government reduce imports of natural rubber and keep the prices of the latter in check. The industry must also respond positively to the suggestion of the Government "to play a positive role in increasing the indigenous availabiity of natural rubber rather than merely pleading for larger imports". The industry should come forward with schemes for rubber cultivation; in its own interest as well as in the interest of the nation.

2

Several reports have recently appeared which give a distorted version of the rubber situation in the country by exaggerating the domestic shortage and over-emphasising the import needs.

The extent of shortage of natural rubber in India is relatively small, being only of the order of about 10% of the demand. For an agro-based enterprise with an outstanding record of production growth of 9% per annum, the output of rubber could be easily augmented to meet the deficit. In fact, this is possible merely by increasing the productivity of the wide section of the small growers by 150 kgs per hectare from their existing level of about 750 kgs per hectare. Furthermore, with the increasing emphasis placed in the Seventh Plan on expanding the area rubber cultivation both in traditional and non-traditional regions, there is little likelihood of any potential shortage in the future.

In the limited context of bridging the temporary gap in rubber availability, the growers have accepted the position that imports could be resorted to as a stop-gap arrangement. They are, of course, anxious that the quantity involved is minimal and it is also important to evolve a systematic import management policy which incorporates matters relating to its timing, pricing, grades, distribution and so on. By now importing 30,000 tonnes, as reported in the press, it is feared that their arrival will coincide with the heavy cropping months commencing from September, thereby adversely affect market sentiments. Surely, any arrangement for imports could have been planned in advance and staggered in small quantities.

or its equivalent, subject to fulfilment of prescribed requirements. Similarly, exporters of these items with a good track record may also apply to Reserve Bank for general permission to accept personal cheques from overseas buyers for an amount upto US $ 500 or its equivalent in payment of export value.

Legal Expenses

The limit upto which authorised dealers can reimburse expenses incurred by their overseas branches/correspondents for instituting legal action in respect of dishonoured export bills has been enhanced from US $ 500 to US $ 1,000 or its equivalent per dishonoured export bill.

Export of Gift Articles

The monetary limit prescribed for authorised dealers to issue certificates authorising their regular constituents to export gift articles not involving any transaction in foreign exchange has been enhanced from Rs. 500 to Rs. 2,000 per capita per annum.

Advance Remittances Towards Imports

Under the new procedure, authorised dealers will be able to remit in advance where necessary full value of a commercial import upto US $ 1,000 or its equivalent. In the case of imports by post and import of books, the monetary limit on advance remittances has been enhanced from US $ 1000 to US $ 2000 or its equivalent per transaction.

Private Imports

In respect of private imports, the regulations have been liberalised to allow authorised dealers to effect remittances towards the cost of import of *complete instruments* or *gadgets* required for bona fide personal use of the applicants, provided such imports are permitted under the prevailing Import Trade Control regulations. As against the existing limit of US $ 200 applicable to private imports (including imports of educational, scientific and technical books) by *individuals*, authorised dealers may remit in advance an amount upto US $ 1,000. The monetary limit for private imports by *eligible institutions* has been raised from US $ 1,000 to US $ 2,000 subject to compliance with provisions of the prevailing ITC policy.

The Reserve Bank has issued detailed instructions and guidelines to authorised dealers about the implementation of the revised liberalised procedures with effect from September 1, 1984. Exporters and importers desirous of obtaining full details about the revised regulations may contact any bank authorised to deal in foreign exchange.

NR CONSUMPTION

US natural rubber consumption will total 800,000 tons in 1988. Natural rubber latex consumption will rise 4%/yr in the next 5 yrs, vs 53,000 tons in 1983. Synthetic rubber consumption rose 2% in 1983 due to increased demand for rubber products. Synthetic polymer imports totaled $ 200 mil in 1983. Improvements in the automobile market led to a 4% rise in molded and extruded rubber goods shipments in 1983. This industry will grow 3-4% in 1984, provided automobile production continue to grow. Auto analysis predict 8 mil cars will be sold in 1984, up 14% vs 1983. Tyre imports are expected to reach 40 mil units in 1984.

(Contiuned from page 4)

case of budwood nursery, locate the pits in the area where fertilizers have been applied.

For leaf sampling from nursery, the sampling technique to be adopted is the same as for unbranched trees. However, for effective comparison, it is better to collect separate composite leaf samples from plants showing poor as well as good growth.

For areas to be planted with rubber

Collect representative composite soil samples from two depths, following the same method as described above.

Despatch the samples of soil and leaf to the laboratory as quickly as possible. Along with the sample, send the case history of the area represented by each sample in the prescribed proforma (Appendix IV).

For testing of soil and tissue samples in the Mobile Soil and Tissue Testing Laboratory of the Rubber Research Institute of India, collect soil and leaf samples, following the same technique as described. However in the case of leaf samples, bring them to the laboratory the same day without detaching the petioles. The samples of soil and tissue should be accompanied by filled up case history sheets.

rubber output could easily be augmented to meet deficit.

Mr John argued that general level of prices had negative effect on rubber prices as the commodity's terms of trade are not improved. "It is in a climate of such uncertainty that rubber grower seeks protection by demanding a price incentive. Whereas annual crops are more responsive to changes in demand rubber is far less flexible and represent an additional risk. Rubber had strategic significance going beyond present shortage. Any further expansion of synthetic rubber would act as deterrent to rubber grower who should get confidence he will continue to earn good income from his crop and he could undertake an investment to reap benefits after eight years.

Referring to cardamom Mr John said studies had shown average productivity was hopelessly low and called for vigorous research and extension efforts. "We believed India's superior quality will protect India's market share but experience has shown that this is no longer true. Our prime markets in Middle East have got used to Guatemalan produce. In past five years market preference for India has changed. Mr John thought with certain shortterm action India could still regain the lost ground.

LIBERALISATION IN EXCHANGE CONTROL REGULATIONS RELATING TO EXPORTS AND IMPORTS

The Reserve Bank had appointed in November 1982 an Expert Committee under the Chairmanship of Shri M. S. Patwardhan to review Exchange Control regulations and procedures relating to exports and imports. Other members of the Committee were drawn from industry/industry associations, Government of India, Reserve Bank and commercial banks. The Committee submitted its final report to the Bank in December 1983. Several important recommendations of the Committee have since been accepted by the Reserve Bank. As a sequel to the acceptance of the Committee's recommendations and in line with the Bank's policy of delegation of powers and decentralisation of authority, revised instructions have been issued to, authorised dealers in foreign exchange in several areas. The following are some of the important changes being introduced in the Exchange Control regulations relating to exports and imports with effect from September 1, 1984:

Reduction in Value of Export Shipments

At present, all applications for reduction in the invoice value of export shipments require Reserve Bank's prior approval. Under the liberalised procedure, those exporters who hold blanket permits (issued under the RBI Scheme or the ITC Scheme) will be permitted to accept, with the approval of their bankers, demands of their overseas importers for reduction in the value of export shipments subject to a ceiling of 10 per cent of invoice value or Rs. 10,000, whichever is less, and subject to compliance with prescribed conditions. Authorised dealers may agree to accept demands for reduction in the value of shipments in this manner only in cases where the importers have refused to clear the goods and/or refused to retire the shipping documents on grounds such as delay in shipment and apparent damage to goods in transit.

Export Claims

At present, only exporters holding blanket permits issued under ITC Scheme are allowed to remit through authorised dealers amounts towards export claims upto 10 per cent of the f. o. b. value of a shipment or Rs. 10,000, whichever is less. In order to ensure expeditious and amicable settlement of small value export claims, such remittances can be effected by authorised dealers on behalf of all exporters irrespective of whether they hold blanket permits or not upto 10 per cent of the f.o.b. value of a shipment or Rs. 20,000, whichever is less.

Agency Commission on Exports

The Reserve Bank has delegated powers to authorised dealers to effect remittances towards agency commission on exports subject to a monetary ceiling of Rs. 50,000 in respect of "Select List" export products and Rs. 25,000 in respect of "Non-select List" export products. Detailed guidelines have been issued to authorised dealers to deal with exporters' applications in this behalf.

Methods of Receipt of Export Proceeds

The methods prescribed in the Exchange Control Manual for realisation of export proceeds have been relaxed in respect of exporters of semi-precious stones, non-gold jewellery, handicrafts and artware. Exporters of such items will be permitted to receive payments from their buyers by means of banker's drafts and pay orders issued by overseas banks upto a value of US $ 10,000

"And Yourself Become The Guiding Light"

Indira Gandhi is no more. But she lives in the hearts of millions all over the world. Her love for poetry is universally known. Her most favourite was Rabindranath Tagore's "Ekla Chalo Re" which she could recite in the original Bengali, and a personal translation of this, she sent as a return gift to a young foreign girl who had recommended to her a poem which she had been inspired by.

Mrs. Gandhi called for several translations of the poem and made changes in pencil and wrote her own version to bring to the fore the poem's spirit and underlying message. She daspatched the English translation with a personal letter saying "This is my own rough translation of a poem written in the Bengali language by Rabindranath Tagore".

Following is Mrs. Gandhi's translation:

"If no one listens to your call,
Walk alone.

"If in fear, they cower mutely facing the wall,
Oh, hapless one,

Open your mind and speak out alone

If, as you cross the wilderness, they turn away and desert you,

Oh Hapless one,
Tread firmly on the thorns along the bloodlined track,

And travel alone.

If, in the storm-troubled night, they dare not hold aloft the light,

Oh, hapless one,
Ignite your own heart with the lightning and pain,

And yourself become the guiding light".

While collecting soil and leaf samples from rubber plantations for the purpose of discriminatory fertilizer recommendations, it is necessary to take some precautions. The most important point to be kept in mind is that the samples collected should be truly 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 the soil, lie of the land, manurial history, age of the rubber tree and growth of rubber and cover crop, two composite samples of soil from 0-30 and 30-60 cm depths and one composite leaf sample would suffice for an area upto 20 ha. But, if there are marked differences in the above factors, take separate samples for the different areas. It is also necessary to have separate leaf samples for each clone.

METHODS OF COLLECTION OF SOIL AND LEAF SAMPLES FOR IMMATURE AND MATURE RUBBER

If soil and leaf samples are to be simultaneously collected, the suitable period would be between August and October. But, if soil sample alone is to be collected, the period between December and March would also be suitable. For collecting soil samples, select at random 5-20 spots (depending on the total area to be sampled) and dig 60 cm deep pits at these spots. In slopy areas, however, take care to locate more pits along the slopes where variations in soil properties are likely to occur. As it is necessary to ascertain the effect of past manuring on the fertility of the soil, locate pits at the site of past manurial applications. Do not sample road margins, labour line sites, neighbourhoods of cattle shed or compost pile, areas recently fertilized, old bunds, marshy spots, vicinity of 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 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 250-500 g of soil is obtained. Prepare composite sample from 30-60 cm depth also in a similar manner (Fig. 10.9—10.12). Dry the samples in shade, 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 or ball point pen and never in ink as ink will spread from the moisture in soil.

Leaf samples are collected during August-October. During this period leaves would be six to eight month old. Depending on the area to be sampled, select 10-30 trees at random (up to 5 ha select 10 trees, for 20 ha select 30 trees and between 5 and 20 ha seleet 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 tree (Fig 10.13). Four basal leaves from 'spur leaves' (small off-shoots with only one whorl from the trunk or main branches—Fig. 10.14) are also suitable for sampling mature rubber. Whorls with new flushes and leaves infected by Odium and other leaf diseases are unsuitable for sampling. Leaves formed during the onset of southwest monsoon are also not mature enough for sampling. In the case of unbranched young trees with storeys, select plants without new flushes (without flushes Fig 10.15, with flushes Fig 10.17). Detach the leaflet from the petiole using a sharp knife or blade. If 30 trees are selected collect only the middle leaflet, from each leaf (Fig 10.18), if 15 trees, collect the two leaflets on either side (Fig 10.19) and if 10 trees, collect all the three leaflets so that about 120 leaflets would be available in one composite sample. Bring the leaf samples to the analysing laboratory within 24 h. If this is not possible, dry the samples in the sun continuously for five days before despatch to the laboratory. Alternatively, press each leaflet on the upper side with a hot iron, adopting a single slow stroke at the cotton range (for electric iron) or at the heat used for pressing cotton fabrics with non-electric iron (14, 14).

For seedling and budwood nurseries

Follow the same basic principles, as described above, in collecting soil samples from nursery. In the case of seedling nursery, sample as many beds as possible for the preparation of composite soil sample. In the

(Contiuned on page 36)

The European Rubber Journal celebrated one hundred years of its existence by bringing out an anniversary issue. The articles featured in this issue provide a good deal of information on many aspects of rubber plantation industry. The following article on the "Magic of chemistry" describes how vulcanisation helped to improve the quality of rubber.

The magic of chemistry

AN early issue of *India Rubber and Gutta Percha Journal* reports the introduction of a new chemical for the industry. The item strikes a prophetic note by commenting that the new chemical, called 'Vulcoleine', was designed to replace carbon disulphide, a material IRJ said it considered 'so seriously prejudicial to health' that it should be 'tabooed' in the industry.

Vulcoleine, introduced by Typke and King, of 110 Cannon Street, London, was designed to improve the so-called 'cold-curing' process, the technique developed by Alexander Parkes and patented by him on March 25, 1846. Under it, single texture garments and some other small articles could be vulcanised without the aid of heat. Instead, they could be immersed in a solution of sulphur monochloride in carbon disulphide.

The *Journal* notes approvingly that the same price is maintained and examination of samples submitted— waterproof-coated fabrics, tobacco pouches and other small articles cured with the new chemical and chloride of sulphur—shows them all to be of high standard.

By the end of the 19th century, though there had been little development on Goodyear's original vulcanisation process of using sulphur and heat, conditions were reaching the point at which additives would be incorporated in a rubber compound for the technical properties which they conferred.

Until then, the use of fillers had been overwhelmingly to reduce the cost of the compound, and provide some guard against the constant fluctuations in price of rubber. Where the earlier 'quote' from IRJ is perhaps prophetic, looking forward as it does to the present when there is real concern over the health hazards of rubber chemicals, a more typical note for the times is struck by a tart comment: 'Some rubber imports are .. not rubber, but dirt and mud with just sufficient rubber to keep it together...' (IRJ, July 10, 1899).

The earliest chemical research on rubber had been to find solvents which would render the material processable. Francois David Herrisent, a physician, and Pierre Joseph Macquer can be credited with discovering the use of turpentine and pure ether as solvents for rubber in the 18th century. It was by this simple but expensive means that some of the earliest surgical instruments were made.

But the main progress was made by Macintosh and Hancock in Britain where, in about 1820, the former discovered the use of coal tar as a cheap and effective solvent, building on this the foundations of a textile waterproofing business which translated his name into the language.

Hancock's contribution, however, was more in the field of practical production engineering, and it was particularly his invention of the 'masticator' (he called it a 'pickle' to keep the technique secret from competitors) which laid the foundations of the rubber industry as we know it today. In mid-century, the technique was still well-used: Moulton certainly used solvents at the outset of his pioneering rubber manufacturing in the West of England, but in 1851 his insurance policies were amended to cover a process which 'did not make use of Camphene, or any similar oil, or Naphtha ..'

All early manufacturers saw, however, that vulcanisation with sulphur was the key process (though there were some who disputed Goody·ar's 1839 discovery). Hancock, for example, never mentioned the name Goodyear and, in fact, filed his own UK patent on November 21, 1843, eight weeks before Goodyear belatedly applied for his UK patent (January 30, 1844).

Nevertheless, it was clear that mere vulcanisation with sulphur was not the whole answer to high-quality rubber products. Moulton felt the most critical and exasperating problem was vulcanisation and, although he used hyposulphite of lead (he patented its use in 1847) to reduce the risk of sulphur bloom and scorching, he found it was not possible to predict accurately the durability of the manufactured product. This fact is borne out in his correspondence with disappointed users of some of his railway springs.

Mastication, however, proved of some value in producing a more homogeneous mix of the rubber and a typical formula for a high-quality compound for mechanicals, published in the *Mechanics' Magazine* in 1856 runs as follows:

Para rubber	25 lbs
Java rubber	5 lbs
Zinc oxide	16 lbs
Magnesia	6 lbs
China clay	3 lbs
Red lead	2 lbs
Sulphur	$1\frac{7}{8}$ lbs
	$58\frac{7}{8}$ lbs

A list of chemicals purchased by Moulton in the 1850-60 period indicates the practice at the time: sulphur and sulphurette, white lead, whiting, carbon lamp black, lead hyposulphite, litharge, oxide of zinc, black lead, camphene, magnesia, French chalk, fine soda, talc and turpentine. The general guideline of the industry was, for example, that the toughening properties required in a shoe compound would be provided by adding relatively large proportions of French chalk, whiting or china clay. Meanwhile, the strength and resistance required for a mechanical compound could come from lamp black, magnesium carbonate or zinc oxide.

It was, in fact, zinc oxide—or a lack of it—which precipitated the widespread use of carbon black as a reinforcement in the early years of the 20th century. At the India Rubber Gutta Percha and Telegraph Works Co. Ltd, in Silvertown, London, a remarkable programme of research had been put in motion at the beginning of the century. General Manager CH Gray had given standing instructions to SC Mote and his colleagues 'to try the effect of *everything* in rubber...'

The essential feature of the work was that, although those responsible for it had no formal scientific training, careful measurements and records were taken of each mix and the results. In 1904 a mix containing carbon black was tested with very good results. Gray was also a close friend of WBG work, who as then president of BF Goodrich Company in Akron. When Work told him during a visit to Silvertown in 1906 that he was unable to obtain supplies of zinc oxide (he feared that Goodyear had established a 'corner') Gray told him about Mote's work.

Chas. Macintosh & Co.'s display at the Great Exhibition of 1851.

Again, other pieces of the jigsaw had to fall into place before carbon black came to be used as the *sine qua non* that it subsequently became. A vital part was played by George Oenslager, chief chemist of the Diamond Rubber Company in Akron. More famous for his discoveries of accelerators, Oenslager noticed that these had a discolouring effect in tyre mixes and, to offset it, he added carbon black, choosing a gas black which had especially strong properties as a pigment. In fact, his compounds were superior in abrasion resistance to those produced by Mote, but the significance was not readily appreciated because of the short lifetime of tyres then in use.

Improving tread life

It was not until cord casings greatly increased the life of the carcass that interest focussed on improving the life of the tread, and the carbon black-containing compounds were reexamined. Neither Mote nor Oenslager patented the idea and in 1912 Goodrich acquired Diamond and used its compound for tyres. In 1917, when the US entered World War I, Goodrich disclosed details of the compound to the other US tyre manufacturers. The shortage of zinc oxide during the war also served to stimulate use of black.

Rubber mechanicals in 1857 (from Thomas Hancock's book.)

Mote's original discovery had been made with lamp black, which is large in particle size, but deficient in reinforcing properties. So the accent in development switched firmly to the US. Furnace blacks were introduced there in 1922 by Columbian Carbon, and later the HAF blacks were developed, offering higher abrasion. Other types were developed for specific purposes, such as for electrical conductivity, and in 1927 a Canadian named Wiegand, working in the US, claimed invention of a dustless black, which was subsequently produced in pellet form.

Between the two wars, and immediately after World War II, development of blacks was primarily dependent on sources of raw materials and the US industry held the lead it had established originally. Research was directed mainly into improving the reinforcing effect of carbon black, especially by modification of the structure to produce the maximum surface-to-volume ratio.

With production of carbon black based on petroleum feedstocks or natural gas, the oil crisis of 1973-74 produced a fundamental reappraisal in the industry, which is still continuing. In particular, the efficient use of energy has become paramount-not only in manufacturing black but also in using it.

On the one side, there has been fastgrowing interest in masterbatch, employing concentrates of black and other chemicals. This put emphasis on new forms of black more suitable for that intermediate process, the aim being to reduce the amount of work (and hence energy) which must be expended by the rubber processor.

On the other side, there has been the move towards rationalisation of the number of blacks on an individual manufacturer's list, with the development of grades for more general purpose application.

However, the difference is primarily dictated by the different value and nature of the two materials: carbon black and polymer. Whereas the latter is relatively compact and offers a high value-to-volume ratio, with no serious problems in shipment and storage, carbon black is notoriously difficult to transport and store. However, the relative ease with which it can be produced makes it possible to build a large number of small plants, all located close to the main customers. In Europe, a distance of some 350km has been taken as the optimum distance from plant to customers.

Future development of carbon black will largely be dictated by economic considerations, with cleanliness and pollution hazard likely to play a significant role. Packaging methods are under constant examination and there will certainly be further movement towards in-plant mixing with polymers and other compounding ingredients, as a measure to save energy and minimise pollution. Economics will also encourage further development of joint ventures for constructing plants, bearing in mind the apparent desirability of locating plants close to customers.

Although, overall, there is no evidence that the fortunate combination of materials discovered by Mote in 1904 will undergo any radical change in the foreseeable future there are forces at work.

One such was demonstrated vividly by Continental Gummi-Werke at last year's Frankfurt International Automobile Fair–the call to economise on oil-based materials. It answered this call by showing a truck tyre in which some 15kg of the 70kg overall weight which would normally have been carbon black, had been replaced with silica. Conti calculated that, as it alone produces some 2m truck tyres a year, if it replaced all the black in them, the potential saving in this switch from oil-based sources to mineral sources would be the equivalent of about 50,000 tonnes of crude oil per year.

This latest development—which is not universally endorsed by the rest of the tyre industry—traces its origins back to World War II when, also in Germany, research was commenced into possible replacement of scarce carbon black by silicas. Resumed immediately after the war, the development was subsequently taken up also in the US, and has resulted in production of finer particle size silicas, which produce harder compounds with improved tensile strength and resistance to tear and abrasion.

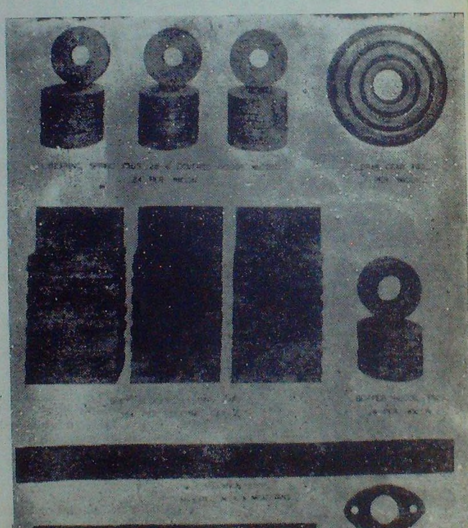
Other potential substitutes for black have been developed, including precipitated silicas, surface-treated calcium carbonate and special clays, but the fine-particle silicas are considered the most satisfactory substitutes-although still inferior to carbon black in some respects, particularly dynamic performance (which has to be high in a modern tyre).

At about the same time as carbon black was first discovered, however, there occurred another major break-through, with the development of organic vulcanisation accelerators, again from research carried out in the US and Germany.

For some years around the turn of the century, aniline was used to aid vulcanisation—the process which Moulton regarded as so critical and yet so frustrating—but results were not satisfactory. In 1905, however, George Oensilager, a chemist with some experience in the pulp and paper industry, but none whatever in the rubber industry, joined the laboratory of Diamond Rubber Company, and his first commission was to look for a method by which the cheaper 'wild' rubbers could be made to vulcanise as rapidly and effectively as the higher-grade rubbers.

He soon discovered the advantages of thiocarbanilide over aniline as an accelerator and, within six months, he had discovered two organic compounds which reduced the time required for vulcanisation and also improved the quality of the compound. After a year's research, he had uncovered hundreds of potential accelerators, and Oenslager's work on accelerators is regarded as being second in importance only to Goodyear's fundamental discovery of sulphur vulcanisation.

Bayer in Germany was working on similar lines, and in 1911 filed its first patent on the use of organic accelerators In fact, the workers in Leverkusen



Rubber used on train sleeping cars and wagons. (from 'Rubber and Railways') were looking for antioxidants and, as is well-known now, some chemicals act both as accelerators and antioxidants, so that early research often overlapped the two. Following World War I, a great amount of research went into accelerators, and the action of zinc oxide as an activator (Dunlop's DF Twiss was a pioneer in this research) was also the centre of much attention.

Specific properties

The importance of the discovery of organic vulcanisation accelerators was not merely that they speeded up the process. Indeed, with hindsight, one might conclude that this was of secondary importance to their effect in homogenising the vulcanisation in the rubber, improving the performance of the lower-grade rubbers, and producing a compound which was consistent and predictable. From here on, it was possible to think in terms of specified properties being met, and rubber entered its 'modern' period as a material which could be used safely and confidently by industry.

Introduction of accelerators also brought the concept of control into the vulcanisation process. Zinc oxide (as noted above) was introduced as an activator and in the 1930s there was much work on delayed-action accelerators. Targets for development became more specific, as knowledge improved. In particular the properties of accelerator and antioxidant were separated and pursued separately, with the result that more ingredients for compounding were developed giving specific properties.

The introduction of more than one active ingredient in the compound led to concepts of synergism and, in 1928, a patent on the synergistic effect of mixed amines in the production of aldehydeamines was taken out by CJT Cronshaw and WJS Naughton of British Dyestuffs Corporation, which was later incorporated into ICI. About the same time, Du Pont and Goodrich discovered the antioxidant properties of secondary aromatic amines. The 1920s and 1930s, in fact, were very much the years of rubber chemicals, as one development led to another, with the growing rubber products industry providing a strong impetus. They were also years, however, in which the price of rubber dropped catastrophically, and consequently the demand to economise on material costs was not as strong as it became later. The objective of chemical development, rather, was to stabilise compound costs, while maintaining technical properties.

The improvements in vulcanisation produced a new interest in pigments. As Oenslager himself had first used dense blacks to offset the discolouration caused by early accelerators, so his own development of improved accelerators opened the door to greater choice of pigments. Previously only inorganic pigments could be used, as these were the only pigments which could withstand the long process of vulcanising. Now, however, the organic lakes could be used safely, with much brighter colours resulting.

Use of titanium dioxide for white pigmentation was introduced when commercial manufacture commenced in 1916, following the development of production methods in Norway and the United States. Previously the best chemicals for whites had been zinc oxide, zinc sulphide or lithopone, but titanium dioxide offered much greater opacity. Large-scale production began in the UK in 1933.

Whereas development of rubber chemicals in the 1920s and 1930s was dictated by the rubber available—and the need therefore to adjust the properties to the main commercial applications—the period after World War II is one in which horizons were greatly extended with the introduction of synthetic which brought rubber into a great many applications previously undreamed of.

Properties such as electrical conductivity (or elimination of static electricity), flame retardance and improved properties both at high and low temperatures are now the aim of the chemical additive researchers. Economics have been partly met by the development of oil-extension techniques—but the next step forward in chemical formulation must inevitably centre on making possible new and more productive rubber processing techniques.

Changes in rubber processing, particularly the introduction of continuous vulcanisation, microwave curing, liquid formulations, reaction processing and the overall implications of the still elementary use of microprocessors will have a profound effect on rubber chemicals in the foreseeable future.

Another major influence (some believe the most significant and farreaching) will be the growing need for better industrial hygiene and easier handling with greater control of rubber and its ancillary chemicals in the factory. This is a movement at present seen only in the most sophisticated of the industrialised nations—factory regulations in Scandinavia are probably tougher than anywhere in the world today—but it will certainly spread to the rest of the industrialised world and then, inevitably, to the developing nations. There, local production of natural rubber and other industrial raw materials is now being balanced with local production of the end-products derived from them. While these countries at present benefit from low labour costs, it is unimaginable that improvements in industrial safety will not follow in due course.

These trends are leading to considerable research today not only into chemicals which are inherently safer, but also to techniques in which they can be packaged and presented, to render them safer and more convenient to use. Different suppliers are adopting different approaches to this end. Bayer, for example, is moving towards production of microgranular forms at its rubber chemicals plant in Antwerp, Belgium; Monsanto is developing milling pellets; and Vulnax Inter-national is offering wax-bonded chemicals.

But, as industry experts are not slow to point out, the increasingly specific requirements laid on industrial materials such as rubber chemicals, in themselves slow down the pace of development. After discovery or evolution of a new rubber chemical, it will take 18 months or more to test it at the raw material end—and almost certainly a major potential user will take at least as long with its own tests before it dare commit itself to using the new material in its own production. Legislation on health and safety and also on product liability cannot but lengthen that process—even though companies such as Bayer have automated their whole testing procedure and can even simulate test programmes on a computer. □

RUBBER TRADE TO ORGANISE TWO MISSIONS ABROAD

The Malaysian Rubber Exchange and Licensing Board is organising two rubber trade missions this year, one to the Eastern European countries and the other to East Asia.

The first mission to the USSR, Poland, Hungary and East Germany is scheduled for early next month while the second mission to China, Japan and South Korea will be from October to November.

Primary Industries Minister Datuk Paul Leong said the missions were aimed at establishing closer rapport and strengthening the Malaysian natural rubber trade.

Eastern Europe has always been a very important market for Malaysian natural rubber, he added.

In 1977, the USSR, Poland, Hungary and East Germany collectively imported 150,983 tonnes or 9.1 percent of total Malaysian natural export exports.

Gone down

The figure however has dwindled to 114,631 tonnes or 7.3 per cent of total natural rubber exports last year.

The average market share for Malaysian natural rubber in these four countries has also gone down from 47 per cent to 34 per cent in the same period, due to aggressive competition from other countries.

On the second mission, Datuk Leong said the members comprising those from the trade and various Government bodies would be led by MRELB Chairman Datuk Ahmad Sabki Jahidin.

He added that China had always been a valued client while South Korea has become a major consumer of Malaysian natural rubber in recent years. Japan too is becoming an important customer.

Total direct exports of Malaysian natural rubber to these countries has increased from 196,900 tonnes or 11.9 per cent of total natural rubber exports in 1977 to 280,600 tonnes or 18 per cent last year.

However, the average market share of Malaysian natural rubber to these countries has gone down from 41.3 per cent in 1977 to 38.9 per cent last year.

Datuk Leong hoped that a long term contract could be signed when the trade mission meets the Chinese National Chemical Import and Export Corporation in Peking.

The mission would also take the opportunity to thrash out some trade matters with South Korean and Japanese buyers.

CRISIS FOR AGRICULTURE'S CINDERELLA

Shifting cultivators in the tropics are now being recognised increasingly as a legitimate target group for agricultural development. Who are they? What are their problems? And how can their environmental and social circumstances best be improved? Following a meeting of experts at the Food and Agriculture Organisation in Rome in December 1983, Dr Michael Stocking of the Overseas Development Group, Norwich, UK, reports on recent initiatives.

As a traditional form of land use, shifting cultivation is in crisis. It is the Cinderella of agriculture. On one side, foresters, conservationists and environmentalists castigate the system for its wanton destruction of natural vegetation; they cite the clearance and burning of the last remaining patches of tropical hardwoods. On another side, agronomists and soil scientists see a farming system with apparently low productivity exhausting the already nutrient-deficient soils. On yet another side still, politicians and planners view with concern large dispersed populations occupying vast tracts but bringing relatively little benefit to national economies.

In some countries, shifting cultivation is completely banned—but, perforce, continues. In most countries, this sub-sector of the economy receives no recognition and no assistance. While other systems of land use expand their areas, shifting cultivators find their space ever more restricted. And as the fallow period in the total cultivation cycle **(see inset)** decreases—because of both population increase amongst the shifting cultivators themselves and also competition for land from outside—a spiral of degradation begins. As the soil becomes poorer, more land must be cultivated; as more land comes under the hoe, the fallow becomes shorter; as the fallow shortens, the soil gets even poorer.

According to how one defines shifting cultivation and how the surveys are conducted, some 250 to 500 million people depend upon it. The higher estimate comes from a United Nations Environment Programme study, which says that 42 per cent of the total population of 90 tropical countries is directly engaged in shifting cultivation. About 36 million square kilometres, or 30 per cent of the world's exploitable soils, supports some sort of long fallow agriculture From

What is shifting cultivation?

The system of shifting cultivation involves the clearing of a plot of land, usually under some sort of forest cover, its use for a few years, and then, as fertility declines, its abandonment in favour of another newly-cleared plot The relationship between the cultivation period and the fallow period is crucial

At Ibadan Nigeria, in 1982 an FAO workshop agreed a definition:

'Shifting cultivation is a system in which relatively short periods of continuing cultivation are followed by relatively long periods of fallow

To describe the relationship between cultivation (C) and fallow (F), Ruthenberg and others devised a ratio R,

where $$R = \frac{C}{C + F} \times 100\%$$

Using R as a yardstick, shifting cultivation can be seen as part of a continuum from extremely low-density, pioneer forms of agriculture through to permanent cultivation. The table below gives one commonly-accepted division:

R	Agricultural System
< 33	Shifting cultivation/long fallow — fallow at least twice as long as cultivation period.
33-66	Short fallow/semi-permanent cultivation — this includes systems which have fallows or grass leys within a settled rotation.
> 66	Permanent cultivation. Where R 100, there is multiple cropping

The R-factor is not entirely satisfactory today Shifting cultivation is being forced into shorter and shorter fallow periods, thereby increasing R but at the expense of extremely low productivity an FAO survey by J. P. Lanly of the Forestry Department, the percentage is highest in nine countries of West Africa (Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin and Nigeria), and also high in continental South East Asia.

Shifting cultivation has a long pedigree. Certainly it was practised throughout Europe prior to the commercialisation of agriculture. It is often the pioneer form of agriculture in new lands. Discounting these transitional forms, it is generally accepted now that under some environmental conditions—high rainfall, or acid, nutrient deficient soils—shifting cultivation is a reasonable and effective method of maintaining fertility and productive output under difficult circumstances. Without the provision of inputs and high technology, long fallows are an appropriate, nondestructive use of the land. It is also recognised that many intricate inter-crops and agroforestry systems are utilised which are not only beneficial to long-term productivity but also from which commercial agriculture could well benefit.

Conditions are changing fast in all shifting cultivation areas, and it now seems that the era of stable shifting cultivation societies is at an end. If pressure is put on the system, a whole host of interrelated problems arise. They can be summarised under the following eight headings:

* **Development problems** These do not arise from shifting cultivation *per se*, but from its degraded form through factors such as erosion, land tenure, or government policy (or lack of it).
* **Labour constraints** One of the system's major advantages is that weeding is minimised. Increase the cultivation period and labour requirements are enhanced.
* **Role of women** Women carry out most of the food crop tasks. Attempt to change the agricultural system and, almost certainly, the burden on women will be greater.
* **Imported technologies** They often bring more problems than relatively simple adaptations to indigenous technology.
* **Agronomic questions** The Ultisols or Acrisols of Amazonia and other similarly deficient soils which abound in shifting cultivation areas are probably physically and chemically incapable of intensification of agriculture without massive expenditure in inputs.
* **Remoteness** Most shifting cultivators exist at the literal margin, remote from roads, communication, education and technical advice.

Spectacle of destruction? Tropical forest is cleared to make way for the shifting cultivators' plots.

- **Economic issues** Development will usually mean the greater integration of shifting cultivation societies into the national economy. Is this feasible, or even desirable? The shaky economies of many developing countries would suggest not.
- **Political problems** Shifting cultivators have the least political clout of any major group. There is just no political capital to be had in helping these people.

There is much to be said for the view that the problems of shifting cultivators are similar to those of rural development as a whole, only more so. Indeed, rural society in developing countries is a complex set of flows and fluxes; alter one part and harmful effects will crop up elsewhere. A hopeful sign is the continuing support for farming systems programmes. At the International Institute for Tropical Agriculture, Nigeria, on-station experiments into alley cropping and other alternative systems are supported by on-farm research where the constraints actually operating on the farm are analysed with regard to the introduction of new technologies. Similarly, ICRISAT (India), ICARDA (Syria), CIMMYT (Mexico) and other international efforts all have substantial farming systems programmes.

Elsewhere, experiments on individual 'taungya' plots look hopeful, and the International Council for Research in Agroforestry (Kenya) has a major exercise in inventorying multiple-purpose land use systems which show the many possibilities for productive agriculture in the tropics.

Moves like these do, however, have to be tempered with caution. To the riposte that the technical solutions are known, many experts—such as the 18 meeting at FAO headquarters in Rome in December 1983 to look at the educational needs in shifting cultivation—answered that we have what is essentially a social, political and demographic problem on to which carefully-designed technical solutions must be grafted.

The shifting cultivator, for so long marginalised, needs above all to be recognised. Few governments accord any positive recognition. An exception which may well provide a pointer for efforts in other countries is the case of hill farmers in Indonesia. Through farm families and *Kontak Tani* (key farmers), field-leval extension workers are mobilised as the frontline of upland development. They have multidisciplinary in-service training in technical, social, economic and communications skills. By all accounts, this sort of decentralised, local-level participation is far more fruitful than the heavy top-down approach of centralised planning.

What is certain is that shifting cultivation is on the move. If neglect continues, poverty, malnutrition and environmental degradation will get successively worse. If appropriate policies and actions are instituted, then viable alternatives are available to effect a smooth transition. Either way, shifting cultivation will change, and increased discussion about its problems is likely.

(Reproduced from International Agricultural Development)

BRAZILIAN VENTURE IN HEVEA-BRAZILIENSES

Brazil was the world's leading natural rubber producer early this century, and NR was that country's major source of revenue. But not so since a long time. The killer disease - SALB short for South American Leaf Blight - dreaded by rubber planters all over the producing world, devastated Brazil's rubber producing industry. Hevea rubber however continued to be on the Brazilian scene. From an all time peak of 32,000 MT produced in 1921; production declined thereafter. In 1972 Brazilian Government launched a determined effort to revive it.

Between 1972 and 1977, about 28,000 hectares of new land was opened up for rubber cultivation. By the end of 1981 130,000 hectares had been planted. A programme initiated in 1982 and intended to continue to 1987 involves Rs. 10 billion (US$1 billion) meant to open up another 250,000 hectares.

A CAR THAT GETS 3,166 MPG

Ford has claimed a new world record—a vehicle that will travel 3,166 miles on a gallon of gasoline. The Ford is known as UFO2, which stands for Ultimate Fuel Optimizer. It was easily the winner of the annual Shell-Motor Mileage Marathon held at the Silverstone auto racing circuit.

Ford said that the new record exceeds the old one by 21 percent. Officially, the mileage achieved was 3,803 on an Imperial gallon. The equivalent figure for a U.S. gallon is 3,166.6.

The vehicle, which weighs 48.5 pounds, is constructed of aramid and carbon fiber. It has a singlecylinder 15-cc engine

DRIP IRRIGATION HELPS IN EFFICIENT USE OF FERTILIZERS

FERTILIZERS are one of the main factors behind marked increases achieved recently in average yields of several cash crops grown in India such as rubber, pepper, cardamom, coffee, tea, coconut, arecanut, cocoa, cashew etc. The use of certain inorganic fertilizers helped in improving the nutrient content of soils, soil fertility status and quality of many crops The share of organic materials in fertilizers remains important. The varying content of plant nutrients and the uneven distribution of supplies are some of the problems in the case of organic manures.

The most common methods of applying fertilizers to crops are broadcasting in the field, placing the required quantity of the fertilizer in the basins around the trees etc. Considerable lose of applied fertilizers occurs in the soil following heavy rainfall or practising age-old conventional irrigation methods such as flooding, furrow and basin irrigations.

Leaching, runoff, volatilisation, fixation etc. are the different ways by which valuable plant nutrients are lost from the root zone of growing plants. The soil water status is one of the important factors which control the plant nutrient dynamics and its availability in the soil.

Therefore, the management of irrigation water is intimately related to the efficient utilisation of fertilizers by the crops, it is becoming increasingly necessary to develop more sophisticated and comprehensive methods of fertilizing the soil in order to assure an optimum use of fertilizers by cash crops, without deteriorating the environment.

Drip irrigation is one of the latest innovations for applying water and fertilizers near the root zone of individual crops and it reflects a definite advancement in irrigation and plant nutrition technologies. It can be defined as the precise, slow application of water at low pressure in the form of drops, tiny streams or miniature sprays through mechanical devices called emitters fixed at desired points according to the spacing of the plants, along water delivery lines.

The increased efficiency of fertilization through drip irrigation system can be attributed to (1) decreased quantity of applied fertilizer, because fertilizer is applied only to the root zone (2) better timing of fertilization, because the more frequent applications make it possible to meet plant requirements at various growth stages, and (3) improved fertilizer distribution with minimum leaching beyond the root zone, or runoff. In addition to fertilizers, many other chemicals such as insecticides, fungicides, nematicides, herbicides and carbon dioxide can be supplied to improve crop prodution.

Fertilizers applied through a drip irrigation system besides improving efficiency, can save labour, and increase flexibility in scheduling of applications to the crop needs. However, the fertilizers must satisfy the conditions mentioned below: They must (1) not decrease crop yield; (2) be safe for field use; (3) avoid corrosion or clogging of the drip system; (4) be soluble and emulsifiable in water; and (5) not react adversely with the various chemicals present in the irrigation water.

The total amount of a fertilizer applied through a drip system will depend on the plant requirements, growing period, soil type, cropping season etc. The final chemical concentration of the drip irrigation water should not be allowed to become excessive, normally limiting upto 100 mg/litre.

Nitrogen, one of the major plant nutrients most commonly deficient for crop production can be supplied through drip irrigation systems. Nitrate nitrogen moves readily in the soil with the irrigation water and can be applied separately or in mixtures with urea, ammonium sulphate and ammonium nitrate.

Calcium nitrate can be used when bicarbonates are low. Ankur-a-nitrogenous liquid fertilizer can be mixed with irrigation water for application through drip system. Other compounds such as ammonium phosphate, and anhydrous ammonia often cause clogging problems. Selection of the nitrogenous fertilizers should be based on its reactions with the irrigation water and the soil.

In general the first five compounds mentioned above will not cause precipitation problems in drip irrigation systems. Nitrate will move to the periphery of the wetted soil mass with repeated drip irrigations. Nitrate concentrations remain higher in the plant root zone with frequent drip irrigation than with the conventional irrigation methods.

There is evidence to show the absence of denitrification in soil if the soil water tension is higher as characterized by a drier soil. Studies conducted in these lines in some countries outside India have revealed that high frequency nitrogen application with drip irrigation improved the efficiency of nitrogen use by crops more than double that of conventional fertilization methods with drip irrigation.

Phosphorous, because of its tendency to cause clogging and limited movement in the soil, has not been recommended for application in drip irrigation systems. High contents of calcium and magnesium in irrigation water may cause precipitation of insoluble calcium and magnesium phosphates in presence of applied inorganic phosphate.
Attempts are being made to apply phosphorous in the form of glycerophosphate, and orthophosphate. Organic phosphates like glycerophosphate will not precipitate unless the compound is hydrolyzed to the inorganic phosphate in the water or the water pH is high.

Potassium compounds can be safely applied without clogging problems in drip irrigation systems. Potassium sulphate, potassium chloride, and potassium nitrate are the commonly used potassium salts and are readily soluble in water. These fertilizers move freely with water into the soil and some of the potassium ions are exchanged on the clay complex and are not readily leached away.

Micronutrients such as zinc, copper, iron and manganese can be applied as chelates or sulphates in drip irrigation water. Plants require these nutrients only in very small quantities and therefore their application through drip systems requires precise control.

Drip irrigation technology offers the possibility of applying carbon dioxide saturated water for providing additional carbon dioxide around the plants thereby improving their photosynthetic efficiency leading to significant improvements in yields of certain crops especially in alkaline soils.

The frequent nutrient applications by the drip method have improved the fertilizer application efficiency, and the crop response to this technique has heen reported to be excellent. Fertilizer saving to the extent of 25 to 50 per cent using drip irrigation as compared with surface broadcasting has been worked out in several countries with no yield reductions.

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CONTACT SHADE TECHNOLOGY FOR CROPS

A concept of contact shade technology (C. S. T.) has been developed at the centre for Water Resources Development and Management,Calicut, Kerala by which shade-loving crops can be artificially shaded by direct application of reflectants on the leaf surfaces.

Plantation crops like Cardamom, Coffee and pepper require moderately thick shade during post-monsoon season for protection from injury on exposure to direct solar radiation. Usually shade is provided by fast growing shade-trees.

Regulation of shade by pruning and lopping during rainy season and by planting new shade-trees during post-monsoon season are expensive and time consuming operations. Moreover the shade trees compete with the main crops for the soil moisture and nutrients.

Studies were conducted at the CWRDM, Calicut to find out whether artificial shading of plants using surface reflectants could import protection from direct solar radiation during the post-monsoon season. The preliminary studies were conducted on irrigated pepper plants.

It was found that the plants growing exposed to sunlight for a month showed yellowing of leaves with development of necrotic patches (plants growing under natural tree shade had healthy dark green leaves with 45% higher chlorophyll concentration).

Another set of plants exposed to direct sunlight were observed for 30 days after artificially shading them by spraying 20% lime solution containing starch or glue as binder. The photo induced yellowing could be prevented by this treatment and the leaves were greener with 40% higher chlorophyll concentration as compared with the exposed plants.

The promising results on pepper indicate that the same can be successfully adopted to prevent solar radiation injury to other shade-loving crops such as Coffee, Cardamom, Clove etc.

(K.R. Vijayakumar, P.N. Unni, V.K. Vamadevan - CWRDM - Hindu, July 4, 1984)

REPORT OF SURVEY MADE IN VAKATHANAM VILLAGE

VK BHASKARAN NAIR

The Modi Rubber Limited launched the Rubber Development programme in Akalakunnam village of Kottayam. During a very short period the project created an awareness among the small rubber holders of the region. The marked increase in productivity in the Project area is the result of timely adoption of manuring, spraying and other cultural operations. The significant role played by the Rubber Development Project of Modi Rubber Ltd in this process of modernisation of the rubber holdings there is evident from the progress made by the small holders in respect of production and productivity. The following is a report of the survey conducted in Vakathanam village. Shri VK Bhaskaran Nair is the Project Officer, Rubber Development Project, Modi Rubber Ltd.

INTRODUCTION

The Modi Rubber Limited launched its pioneering programme of Rubber Development in April 1979. The main objective of the Rubber Development Programme has been increasing the productivity, as well as improving the economic viability of the rubber small holders, who represent 99 per cent of the rubber planting community of the country and occupy 75 per cent of the area under rubber.

The Rubber Development Programme was launched in Akalakunnam village of Kottayam District, 25 kilometres away from the district headquarterst. Within the short span of implementation, the Project could create a new awakening in the field of rubber cultivation among the small rubber holders of Akalakunnam village. This was evident from the marked increase recorded in the adoption of timely manuring, spraying and other cultural operations. Significant improvement has been noted in the tapping practices also. As a result the productivity of the holding sector in the Project area showed steady increase, an increase of 81 to 100 per cent in yield level within a period of four years. Further, the programme could also kindle keen interest among the small holders of nearby villages as well towards modernisation of their holdings by the adoption of scientific methods of rubber culture.

Encouraged by this success, it was decided to extend the activities further, by adopting new villages under the Project. The village thus chosen now is Vakathanam, in Changanacherry Taluk of Kottayam District, having an area of 2406 hectares. This village is predominantly a land of annual crops and, of late, the people have shown interest in the cultivation of more rubber.

Preliminary to the implementation of the extension work, a comprehensive survey was undertaken in the village with a view to gathering all details regarding the rubber area, cultivation practices, exploitation methods, yield pattern, disease aspects, economic status and other related problems. All units in the village were covered for the purpose of this survey.

Personal contacts were made with the cultivators and their holdings were visited by the extension staff of the Project.

The details were recorded in a standard proforma specially prepared for the purpose. The data collected were collated and transferred to tabulation sheets, which were used for the analysis. This report is therefore a summary of the elaborate observations made in the field and the data collected thereupon. The survey work was started in April 1983 and was completed in November 1983. Tabulation and summarisation of the data took another three months.

1. Area and Number of Holdings

Vakathanam village has an area of 2406 hectares. There are 1820 rubber plantations all of them being small holdings, their total area is 924.71 hectares. The average size of a holding is just 0.5 hectare. Rubber occupies 38.4 per cent of the total area of the village. Therefore there is enough scope for further expansion of area under the crop in the village.

Rubber Act—1947 requires that every holding in the country should be registered with the Rubber Board. An application in Form A (in duplicate) has to be made by the owner for each holdings. A register number will be allotted to the estate or holding. The authority for grant of planting licences and registration of estates or holdings is vested with the Deputy Development Officers in charge of the regional offices, concerned.

However, there are a number of growers who have not yet registered their area under rubber (Table-1).

Table—1: Registration of rubber areas

Whether registered or not	Number of holdings	Percentage	Area (Ha)	Percentage
Registered	572	31.43	(M 209.95	45.83
			(I 248.11	54.17
			(T 458.06	49.53
Unregistered	1248	68.57	(M 146 53	31.40
			(I 320.12	68.60
			(T 466.65	50.47
Total	1820	...	924.71	...

(I: Immature — M: Mature — T: Total)

The percentage of unregistered holdings is found to be 68.57 per cent. This is rather high. The reasons that can be attributed are:-

1) A small percentage of holders are not aware of the significance of registration
2) Some feel that the procedure is cumbersome
3) Some have applied but not followed up
4) A high percentage of unregistered holders have planted unapproved clonal seedling material and those who have planted these materials after 1970 are not liable to get registration unless the material are budded, which they have not done. It is noted that an extent of about 169.19 hectares of immature area supports such unapproved material.

However attempts have to be made to register as much holdings as possible so that they comply with the provisions of the Rubber Act (1947) and the Rubber Rules (1955).

2. Year of Planting

The year of planting varies from 1956 to 1983 of which 59.91 per cent was planted during the period of 1977 to 1983 and 40.9 per cent before 1977. This indicates that over 60 percent of the planting is young and the productivity of the village will largely depend on the quality of these materials and their standard of maintenance.

The following tables [2 and 3] indicate the extent of immature and mature area and their yearwise planting.

3. Planting Materials

More than half of the area is planted with seedling materials, popularly known as clonal seedlings (mostly unapproved). A very small area is under unselected materials, which may be old and ready for replanting (Table-4). These indicate that greater efforts are needed to replace the seedling material with budgrafts, either by field budding or replanting this with budgrafts as such

Table—4: Planting materials used

Planting material	Area under cultivation in hectares	Percentage
Bud	430.34	46.54
Clonal seedlings	391.07	53.10
Unselected	3.30	0.36
Total	924.71	...

Table—2: Mature and Immature area

Maturity	Area in hectare	Percentage
Immature	568.23	61.45
Mature	356.48	38.55
Total	924.71	...

Table—3: Immature area

Immature, area yearwise planting	Area in hectares	Percentage
1981—1983	250.25	44
1977—1980	303.85	53.5
Pre 1977	14.13	2.5
Total	568.23	

(About 14 hectares although planted before 1977 have not attained tappable girth and hence included under the category immature.)

4. Topography and Soil

The general terrain of the land is moderately slopy or undulated. Flat areas supporting the crop is only about 13 percent (Table-5).

The soil is highly variable. Most of the area is laterite, are well drained but poor in plant nutrients, which warrant scientific agro-management practice.

Remaining areas are low lying

Table—5: Topography

Type	Extent in ha.	Percentage of the total area
Level land	119.61 ha.	12.94
Moderate slopy	775.95 ha.	83.91
Steep slope	29.15 ha.	3.15
Total	924.71 ha.	...

field budding should be arranged wherever practicable. This situation should be corrected in future as well. The stand per hectare is generally high, between the range of 494 to 618 per hectare.

9. Manuring

Majority of the holdings are

Table—7: Area under interplanting

Inter planted	Area	Percentage
Inter planted	241.19	26.01
Exclusively planted with rubber or with allowable number of other trees	683.52	73.9
Total	924.71	

lands adjacent to streams or paddy fields. This soil is alluvial in nature with a higher percentage of clay but more or less satisfactory in plant nutrients

5. Intercrop

71 per cent of the area is intercropped (Table-6). Generally intercropping and interplanting in rubber are harmful. However, as a compromise to supplement the income in small units this intercropping, is allowed for the first two to three years. Planting of banana, ginger, pineapple etc. are recommended But it is found that most of the areas are planted with tapioca and other tubercrops which are reported to be soil-exhaustive crops.

Table—6, Area under intercropping (immature)

Intercrop	Area (ha.)	Percentage
Intercropped	403.45	71 00
Not intercropped	164.78	29.00
Total	568.23	...

6. Inter Planting

Tree crops such as Coconut, Anjili, Arecanut, Mango etc. are interplanted with rubber, However the survey indicates that only 74 per cent of the rubber area is either exclusively planted with rubber or with other trees limiting to the minimum numbers allowable (Table-7).

7. Ground Cover

Only 20 per cent of the young area planted is seen to have good ground cover. The advantage of establishing a suitable cover under young rubber should be emphasized in this context.

8. Planting Techniques

As per modern recommendations planting of seedlings in field and budding them in situ is considered as an obsolete practice. On the other hand, raising the planting materials in polybags and transplanting them in the field is considered as the most modern method. The survey shows that 53 per cent of the area is now planted with seedling stumps (Table-8) which includes both mature and immature plants. In case of immature areas

being manured (Table-9). It is, however, equally important to see that the applications are made judiciously to obtain the optimum results. Farm manure cannot be treated as a balanced fertiliser. Even for those who apply fertiliser mixtures, the optimum dosage and proportion could be assessed only on the basis of soil/leaf analysis. The facilities for the same are available with the Rubber Board and other agencies and the same should liberally be made use of. The discremenatory method of fertiliser usage has come to stay as the most efficient and economic one for rubber and it offers many advantages over the blanket recommendations otherwise practised. The advantages of this approach are (a) ensures optimum growth and yield of rubber, (b) most often reduces the cost of manuring, (c) prevents the problems resulting from unbalanced nutrition such as

Table—8: Planting techniques.

Techniques	Area	Percentage
Field Budding	42.17	4.56
Polybagging	1.41	0.15
Budded stumps	386.76	42.82
Seedling stumps	494.37	53.47
Total	924.71	...

Table—9: Manuring practice

Manuring	No. of holders	Percentage	Area	Percentage
Single application	432	23.74	208.74	22.57
Twice	1077	59.18	600.38	64.92
Farm manure	221	12.14	83.30	9.01
Nil	90	4.94	32.29	3.50
Total	1820	...	924.71	...

wind damage, pre-coagulation and inducement of brown bast.

10. Plant Protection

a) Spraying—It was found that over 57 per cent of the area is to be sprayed (Table-10) against the incidence of abnormal leaf fall disease. The damages caused by leaf disease is reflected in several ways. In young rubber, leaf fall and shoot rot cause extensive die back resulting in retardation of growth. In mature rubber loss of yield to the tune of around 30 to 50 per cent is reported in high yielding cultivars, due to the occurrence of the disease. The facilities available with the Rubber Board and other agencies should be made use of and all rubber areas should be brought under proper protection.

Table—10: Prophylactic spraying.

Spraying	No. of holding	Percentage	Area (ha.)	Percentage
Sprayed	821	45.10	534.62	57.81
Unsprayed	999	54.90	390.09	42.19
Total	1820	...	924.71	..

b) Pink disease treatment:—Pink affected trees were recorded in 66 per cent of the holdings visited. Only a few of the growers had taken correct preventive measures. The disease is more damaging for plants in the age group of 3 to 12 years and plants will be affected severely if appropriate measures are not taken up timely.

c) Panel protection:— Various diseases like black stripe, patch canker, mouldy rot, dry rot and bark necrosis are reported for rubber. Occurence of these diseases is to be prevented effectively by taking appropriate protection measures. In our observation only 48 per cent of the cultivators are giving emphasis for panel protection for rubber (Table-11). Negligence in the proper upkeep of the tapping panel and bark may lead to poor standard of tapping, resulting in low yield. This may also affect proper bark renewal.

d) White washing:— Sun scorch is of common occurrence in young plants during the summer months. Over 50 per cent of the cultivators are practicing white washing as a preventive measure for sun scorch in their young holdings (Table-12). The rest of the holdings should also be brought in. Maintenance of uniformity in young plants is an important factor in rubber cultivation. Sun scorch if not prevented, may lead to drying up of young plants, necessitating frequent gap filling.

e) Mulching and shading—Mulching and shading are not commonly practised. Mulching should be undertaken in young plantation after fertiliser application and before the onset of the regular summer.

This could be done around the plants with dry leaves, grass cuttings and cover crop loppings. Provision of bamboo baskets or plaited coconut leaves affording shade for the plants will be helpful in reducing sun scorch in the young stage.

11. Exploitation

The most commonly recommended exploitation system for young bud materials is half circumference, alternate daily tapping, and that for clonal seedlings half circumference third daily tapping. Incidence of dry trees is related more to the frequency of tapping than to any other consideration in tapping practices. But it was seen that in the project area, irrespective of the type of material concerned, in 69 per cent of the area daily tapping is followed (Table-13). This warrants the need of scientific approach in tapping and the small holders should be taken

Table—11: Panel Protection for treees under tapping.

Panel protection	Area in (ha.)	Percentage
Protected	169.99	47.69
Not protected	186.49	52.31

Table—12: Plant protection against Sun scorch
(immature area consisting of 2nd, 3rd and 4th year of planting.)

White washing	Area in (ha.)	Percentage
White washed	120.56	51.00
Not white washed	115.84	49.00
Total	236.40	

Table—13: Tapping systems

Tapping system	Area in (ha.)	Percentage
S/2 d/1	245.97	69.10
S/2 d 2	94 55	26.3
2S/2 d/1	15.96	4.6
Total	356.48	...

into confidence regarding the correct practices of tapping and their advantages.

12. Yield

The average productivity in India in the small holders' sector is now 770 kg per hectare per year, while that of the estate sector is nearly 1040 kg. From the table given below (Table-14) it may be seen that 78 per cent of the holdings in the Project area are achieving only 165 to 750 kgs per hectare per year, which is below the national average recorded for small holdings in the country. The situation should certainly have to be improved. A hundred per cent increase in this low yielding areas could be possible with in a period of 3 to 4 years, if scientific development works are undertaken correctly, and this would be our major goal though it is not an easy task.

Table—14: Yield levels (Kg/ha/year)

Yield	Holdings	Percentage
165 kg to 350 kg	131	18
351 kg to 500 kg	197	27
501 kg to 750 kg	254	33
751 kg to 1000 kg	137	18
1000 kg to 1770 kg	33	4

stand per hectare BG = 300 trees CS = 350 trees.

13. Labour

58 per cent of the holdings are utilising hired labour. 23 per cent are managed by family labour. The rest of the persons are using both (Table-15)

14. Source of Income

It is seen that the main source of income of the 1820 families is agriculture. However, a few have other source of income also, either from business or from employment (Table—16).

15. Processing and Marketing

It is revealed that only 72 holders have their own facilities for sheeting. Others are making use of hired facilities. Processing is done by sun drying and kitchen smoking. A small percentage of holders (about 10) have smoke house facilities.

The sheets are mostly sold as lot that is without grading. The nearest rubber Marketing Co-operative Society is located at Karukachal about 10 kilometres away from Vakathanam and hence holders are selling their crops to private dealers. 60 per cent of the holders are members of village Co-operative Society.

16. Assistance Needed

About 41 percent of holders have indicated the need of assistance by financial aid Rest of them have sought both financial as well as technical assistance.

17, Summary

Preliminary to the adoption of Vakathanam village by the Rubber Development Project of M/s. Modi Rubber Limited, a detailed survey was conducted The village has an area of 2406 hectares of which 924.71 hectare are under rubber. Many holdings are yet to be registered with the Rubber Board, Over 61 per cent of the area under rubber is immature. More than half the area is planted with clonal seedlings which are not approved for commercial cultivation. Planting of budgrafts should be popularised. Over 70 per cent of the area support intercrops or interplants. Modern method of raising planting materials in polybags and their planting in the field is not at all popular. Uniform stand, very low percentage of loss in the field etc. will compensate for the higher cost involved. The advantage of using these advanced planting

Table—15: Type of Labour

Type of Labour	Holdings	Percentage
Family Labour	424	23
Employed Labour	1050	58
Both	346	29

Table—16: Source of Income

Source of Income	Holdings	Percentage
Agriculture and local Employment	600	32 98
Agriculture and business	128	7.03
Agriculture alone	1020	56 04
Employment abroad	72	3 95

material should be publicised. Correct methods of plant protection, manuring practices, exploitation procedure etc. need popularisation. Manuring on the basis of soil and leaf analysis data is the most efficient and economic method of fertiliser usage for rubber. For the benefit of small growers facilities are being provided at Rubber Research Institute of India for offering fertiliser recommendation based on soil and leaf analysis. Besides creating an awareness of the modern agro-techniques of planting and development works among the small holders our project is working as a catalyst for the quick implementation of the development programmes already launched by the Rubber board. The average yield level is below the national average and efficient modernisation of the small holdings on scientific lines as indicated above will be highly rewarding.

18. Acknowledgements

S/Shri N. Rajkumar, Baby Augustine, T. J. Ravindra Panicker and N. Suresh Kumar, extension staff of the Rubber Development Project of Modi Rubber Limited have carried out this survey. S/Shri K. Janardhanan Potty and K. Ramachandran Nair of the Project also joined them at a later stage for completing the field work and tabulation and summarisation of the data.

Thanks are due to Shri P. Mukundan Menon, Rubber Production Commissioner, Shri. P. K. Narayanan, Public Relations Officer, Shri. R. G. Unni Dy. Director (Statistics & Planning) Dr. AON Panicker, Dy. Director (Botany), Dr. S. N. Potty, Dy. Director (Agronomy), Shri. A. V. Thankappan Nair, Dy. Development Officer and Shri K. K. Kurian, Assistant Development Officer, for their helpful suggestions in the preparation of this report. □

RUBBER GOODS: A CHANCE FOR MALAYSIA

MALAYSIA has the opportunity to build a second reputation as a supplier of manufactured rubber goods based upon the excellent image it already has as a high quality producer of natural products and commodities.

A rubber products consultant from the United Kingdom, Mr F.J. Charlton, said Malaysia however had to look into several problem areas critically before it could achieve this target.

Mr Charlton, who is now attached to the Malaysian Export Trade Centre (MEXPO) under a Commonwealth fund technical co-operation programme, said he had identified problems relating to the size and structure of the present rubber manufacturing industry, its varying degree of expertise plus the high cost of rubber products as needing immediate attention.

He said a study he carried out recently on the local rubber industry showed a relatively small number of large rubber manufacturing companies, some of which were joint ventures with international groups and more than 100 smaller companies.

These manufacturing companies concentrated on the home market and merely fill up their capacity with irregular export orders.

They did not commit resources to production capacity for export, produce in ranges and quality standards to meet export requirements or give detailed attention to the production requirement of successful competitors in Japan, Korea and Taiwan.

Failure

Mr Charlton said this was because some of the large companies were inhibited from making full use of their group's international marketing network by group marketing and production policy. The smaller companies, on the other hand, did not have export strategies, lacked knowledge of overseas markets for their products and had no representatives overseas to gather detailed information about opportunities and to sell their products on a continuing basis.

Mr Charlton also pointed out that manufacturers must bear in mind that the cost of rubber in Malaysia was not cheap compared with synthetic or even lower grade sheet rubber from Thailand and Indonesia which was used extensively by competitors in Japan, Korea and Taiwan.

The cost of other components and services, including freight, was also high, partly because of the relatively small scale of the industry.

Mr Charlton, who is formerly the commercial director for Dunlop Estates Malaysia Sdn. Bhd., said rubber products manufacturers had failed to understand that their products did not consist of rubber alone.

MECHANICAL WEED CONTROL METHODS IN RUBBER PLANTATIONS

P JOHN JOSEPH

Weed control is one of the most important field maintenance practices to ensure vigorous growth of the crop cultivated. As far as rubber plantation is concerned, weed control plays an important role, for increasing the growth of plants and enhancing productivity.

Weed - The Undesirable Plant

Of the several definitions of the term 'weed' the simplest and generally accepted one is "a plant growing where it is not desired."

As in other crops, weeds compete with rubber for nutrients, water, light and space. Weed can be described as a 'controversy', with a good rubber plantation. Weeds cause retarded growth of rubber plants and reduce its yield If weeds are controlled effectively using most modern techniques and tools available, growth and yield of rubber plants can be improved. The common weeds found in the rubber plantations in India are Impertata, Cylindrica, Mikania micrantha, Eupatorium odoratum, mimosa pudica, and a variety of other plants.

Characteristics of Weeds

In order to control weeds effectively, we have to understand their special characteristics. Based on their life history weeds can be classified as annuals, biennials and perennials. Annuals live in a single season of about a year or less and die after seeding. Biennials have a lifespan of about 2 years. Perennials on the other hand survive at least for three years.

The following are the main charecteristics.

1. Production of vast amounts of seeds.
2. Possession of structures on seeds or fruits to aid dispersal of seed by air, water, animals etc.
3. Competitive and aggressive and able to survive under poor conditions which are unfavourable to crops.
4. Presence of protective mechanisms such as bristles, thorns, repulsive odour etc.
5. Possession of effective methods of vegetative reproduction.
6. Ability to resist chemical action.

Methods of weed control

The ideal method of fighting weed is of course to prevent them becoming established. Once weeds have become established they may be combatted through mechanical methods of control such as hoeing, ploughing, tillage, through ecological methods of control such as crop competition, and through chemical methods of control. The methods used in fighting weeds depend on the crop cultivated, and species of weeds present. In most cases a combination of several different weed control methods gives the best results.

Weed control in rubber plantations

Weed control in rubber plantation has its origin ever since man started planting rubber scientifically. In a perennial crop like rubber clean weeding is not encouraged. Weeds are generally controlled rather than eradicated, because eradication is expensive and difficult and sometimes this may cause soil erosion especially in hilly terrain, and areas receiving heavy rainfall. However, some of the noxious weeds like Impertata cylindrica, Eupotorium odoratum etc are being eradicated since they are found to be very competitive with rubber.

Mechanical control methods

Among mechanical methods of weed control in rubber plantations, may be mentioned hoeing, cutting and slashing, smothering with mulcheses and burning.

At the time of preparation of the land, unwanted young trees, bushes etc. are cut and removed. Various weeds like grasses and other perennial weeds are slashed and removed. Burning is also practised in order to kill the green shoot growth.

Hand weeding, hoeing

In the rubber nurseries hand weeding in planting rows and hoeing in inter rows are usually carried out at monthly intervals. Weeds which have been pulled out or hoed are removed so as to prevent further regeneration.

In the young immature rubber plantations plenty of sunlight is available and encourages weed growth. Many types of annuals and perennials are found here. Hand pulling, hoeing and slashing of weeds, engaging labourers are practised in most of the rubber plantations. Manual slashing is utilised to cut down the top growth of weeds like eupatorium, lalang etc

Fire

Fire is used to clear the remnants of felled trees, debris and weeds at the time of preparation of the land for newplanting and replanting of rubber. It is one of the cheapest and efficient methods. A good burn clear the land from weeds for sometime and provides easy access to land for preparation for planting.

Mulching

Mulching is practised in rubber nurseries. Proper mulching with dried up leaves, straw, paper etc. prevent light penetration and suppress weed growth.

Cropping and Competition Method

Crops which are competitive to weeds have great effect in weed control. This is practised by planting leguminous cover crop like Pueraria phaseoloides, Mucuna bracteata, Centrosema pubescines, Calopogonium mucunoides, during first year of planting in the inter rows. These cover crops grow quickly and form a thick cover on soil surface. Their rapid growth and broad leaves suppress weed growth by competing with them for light nutrients, water and space.

Short term crops like ginger, banana, pineapple etc are also cultivated in the inter rows. They also help to check weed growth besides providing extra income during immature period of rubber.

Chemical Methods

In the chemical methods, different weedicides depending upon the type of weed growth are being used.

The studies conducted by Rubber Research Institute of India however clearly show that a single weedicide is not effective in controlling weeds of rubber plantations and that the cost involved in control by using combinations of weedicides are pretty high. □

COCONUT TISSUE CULTURE HOLDS OUT PROMISE

Scientists at the Central Plantation Research Institute in Kasaragod, Kerala have made a significant break-through in producing Coconut Plantlets in test tubes through tissue culture, the technique of growing an entire plant from a few cells of the plant. This is the first time in the world that Coconut Plantlets have been obtained from the embryoids grown directly from the tender leaf segment of the plant.

Dr. K. V. A. Bavappa, Director of the Institute said, with the technique it would be possible to vegetatively multiply rare palm varieties which yield 200-400 nuts a year against 30 nuts of the Indian varieties. The vegetative multiplication of disease-free and high yielding plants could be an answer to the major problem of root-wilt disease afflicting many plantations in the south. The farmers could hope to replant the senile and the disease-affected gardens with elite palms increasing production.

A FREE GROWING NON-TRADITIONAL FODDER LEGUME

Most of the fodder grasses available are low in protein content which do not meet the nutritional needs of the livestock. A judicious blend of the grasses with protein leguminous fodder will offset this nutritional imbalance. There are many legumes grown for feeding animals and the most popular among them are berseem, lucern, Cowpea etc. These crops require good management for excellent growth and demands special attention. In such situations farmers would prefer to take up any other leguminous fodder crop that is free-growing even under minimum care.

Siratro (Macroptillium atropureum) a non traditional fodder legume can aptly meet such requirements. This can be easily grown with less care. With wider adaptability it is suitable for drier tracts and regions of varied soils and climates. This is very robust in growth and fits well in tall grass pastures and almost free from pests and diseases: Its rooting habits allow for good nodulating which help in enricning the soils with fixed nitrogen. It can be grown as a pure crop or in combination with the grasses.

The traditional areas of Kerala, Tamil Nadu and Karnataka are almost saturated and therefore we have to find out new areas in non-traditional belts for rubber cultivation. The North Eastern States have been identified as the potential areas for rubber development as these states have extensive stretches of virgin lands ideally suited for rubber. An accelerated programme of development in this region has been approved by the Government to be completed in the next 6 years. The Project involves an outlay of Rs. 6 crores.

To elicit support and instil awareness for the massive programme of rubber development, the 102nd meeting of the Rubber Board was held at Gauhati on 17th September 1984. Shri PJ Thomas, Chairman, Rubber Board presided: Following is the full text of the speech delivered by Shri PJ Thomas.

A Challenging Task Ahead

PJ THOMAS

You would be delighted to know that I have carried the entire Rubber Board with me to Gauhati including the Vice-Chairman, members, a few selected special invitees, heads of Departments, and senior officials of the Board. I cannot offer you a better testimony than this to convince my friends in the North Eastern States of our genuine concern and commitment for ensuring expeditious implementation of rubber development programmes in this region.

As you are aware, it has been established beyond doubt, through successive exploratory surveys and trials undertaken since 1963 that the North Eastern Region holds out great promise for large scale cultivation of rubber. Though this region falls outside the traditional rubber belt, the agro-climatic conditions obtaining here resemble features of the tropics. The commercial scale plantations now being progressively undertaken in Assam and Tripura by Public Sector Corporations, in Meghalaya and Mizoram by Soil Conservation Department and State Forest Department in Manipur have brought out encouraging results. In Nagaland and Arunachal Pradesh rubber is still being grown on an experimental basis.

Vast area

Earlier surveys had revealed that over 1,00,000 hectares could easily be earmarked in the North Eastern region for planting rubber. Out of this 50,000 hectares is estimated to be in Assam, and 30,000 hectares in Tripura, while the remaining area is shared by other States and Union Territories in this zone. This could be more.

As against this, the actual area planted is only a little over 8,000 hectares. Of course a lot of constraints have operated as factors inhibiting development such as lack of awareness on the cost benefit aspect of rubber cultivation, inadequacy of infrastructure, difficulty to procure inputs, problem of institutional finance, peculiarity of land tenure systems etc.

In order to ensure a more comprehensive and organised schedule of rubber development, the Board has proposed a 16 year accelerated programme in three phases exclusively for the North Eastern Region. The first and second phases each of 3 years duration, are commencing from this year and is up to 1989-90 while the third phase is for a period of 10 years from 1990-2000 AD. During the first two phases it is targetted to complete fresh planting in 24,000 hectares. The target for the 3rd phase is to newplant in another 70,000 hectares in 10 years.

Scheme approved

The first and second phases of this programme of 6 year's duration and outlay of over Rs. 6 crores have been cleared by the Government of India. With a view to facilitating speedy implementation of the proposals, the following infrastructural amenities also have been envisaged.

(a) Establishing a full-fledged and self contained Zonal Office of the Rubber Board at Gauhati with adequate powers, under a Joint Rubber Production Commissioner, to cater to the needs of the whole North Eastern region.

(b) Opening new Regional Offices at Silchar, in addition to the ones existing in Tripura and Gauhati, besides opening several field extension centres.

(c) Establishing a Nuclear Rubber Estate-cum-Training Centre at Tripura in 1,000 hectares which is intended to be developed as a demonstration farm and training ground for the personnel of North Eastern Region. This farm will be controlled by a senior official of the Board with the rank of a Joint Rubber Production Commissioner.

(d) Strengthening the existing Rubber Research Centre at Tripura and establishing new sub-centres at Meghalaya, Assam and Mizoram. The research activities of these centres will be co-ordinated by an officer of the status of a Joint Director of Research.

Steps are already afoot to implement these proposals and it is expected to have the whole infrastructural facilities laid out before the close of this year.

Socio-economic problems

The peculiar land tenure systems and the socio-economic settings obtaining in the North Eastern States call for a special deal, more so as they lack what is called the 'Rubber Culture.' Intention of the Government of India and the Rubber Board is to utilise the extensive stretches of virgin lands lying fallow in these states for cultivating rubber with the full participation of the respective State Governments and the people here. Shifting cultivation, popularly known as 'Jhumming', has done irrepairable damage to the arable lands in these region, resulting in denudation of forests and gross destruction of mother earth.

Rubber planting is being suggested also an effective alternative to Jhumming'. Besides increasing production of natural rubber, if adopted on large scale, rubber cultivation will help to conserve land and soil, ensure round the year return, generate more employment and upgrade the economic condition of people and the exchequer. I would even go to the extent of observing that adoption of rubber planting on an extensive scale, is the only acceptable course of action to ameliorate the economic backwardness of the North Eastern Region, where there is a proliferation of tribal community. This has to be got done with the blessings, involvement and active participation of the people in these region, fully consistent with the socio-cultural traditions and values cherished by them.

Block planting

Block planting of rubber, on the pattern of Federal Land Development Authority and Sarawak Tribal Project in Malaysia and the Nuclear Estate Scheme in Indonesia is being considered appropriate for effective land utilisation and rehabilitation of tribal families. The programme envisages development of large blocks of plantations to the level of maturity which are subsequently divided and distributed amongst educated, landless and unemployed persons in small units of economic size. This is viewed as a model, worth-emulating for solving the social malady of unemployment, ensuring proper land utilisation and effective control of shifting cultivation. The workers to be engaged in such block plantations will be the ultimate beneficiaries of the resettlement scheme. The families to be settled are selected in advance before clearing of the block-pattern area for planting and engaged as wage earners until the parcel of plantations is handed over to them. Common facilities like group processing, marketing, housing, schools, hospitals, centres of worship and similar other community development amenities will have to be organised within each Block Plantation Unit, to make it self-contained and compact.

A study team headed by the Hon'ble Union Deputy Minister of Commerce Shri. Purno A Sangma and comprising of Shri. Albinston Sangma, Hon'ble Meghalaya Minister for Soil Conservation, Shri. UP Singh, Director from the Ministry of Commerce, Shri. P. Mukundan Menon, Rubber Production Commissioner of the Rubber Board and myself had toured Malaysia, Thailand and Indonesia last month to acquaint with the structure and organisation of certain Block Planting Schemes in these countries, so as to propose the best among them for the North Eastern Region. We are convinced beyond doubt that Block planting is quite feasible for tribal welfare in this area. Such proposals could also attract assistance from the World Bank or NABARD. Detailed plans for this would be drawn up after instituting an indepth study into the working of these Block Planting Schemes by a team of experts.

Self-Sufficiency

These efforts to boost rubber production should be viewed as a relevant proposition to take the country to selfsufficiency. Against the projected demand for 2,20,000 tonnes of natural rubber in 1984-85, the domestic production is estimated to touch only 1,85,000 tonnes. After 15 years from now, that is by 2000 AD, the rubber goods manufacturing industry in India is supposed to enlarge its consumption capacity to 5 lakh tonnes. To cope up with this, the rubber plantation industry in the country will have to treble its present rate of production by then. This is possible only by replanting the old and uneconomic holdings existing in the traditional areas and introducing rubber to new tracts wherever suitable in the traditional and non-traditional zones.

I would reiterate that all the States in the North Eastern Region should attempt their best for planting rubber in as much area as possible in the shortest span of time and endeavour to maximise rubber production. Finance will never pose a problem as the scale of assistance now offered under the Rubber Plantation Development Scheme as subsidy and loan will be adequate to meet the entire cost of cultivation.

It is gratifying to note that the decision makers in the respective State Governments in this region are fully seized of the imperative need to take up rubber cultivation on a massive scale and improve economic status of these States. This has made the Board's task easier.

A real hurdle

The ban imposed by the Union Government for creation of posts and other requirements which was originally up to 30th September, has subsequently been extended now to 31st March, 1985. This is a real hurdle in implementing rubber development plans in the North Eastern Region. We have appealed to the Government that the ban should not be made binding in respect of the action programme for the North East, so that we could go ahead with the proposals, though we are already behind schedule. We hope that the Government would pay heed to our request and accord necessary exemption.

The State of Orissa is yet another region where large extent of land has been spotted suitable for planting rubber. We have been successful in impressing upon the Government of Orissa of this favourable factor. We learn now that the State Government has appointed a senior IAS official as Nodal Officer with clearly defined tasks for expeditious introduction of rubber cultivation in the State both in the Public and Private Sectors. This is indeed a step in the right direction.

While advocating the cause of natural rubber and the need for adoption of rubber cultivation on large scale, I have often been confronted by a question from certain quarters as to

"Why not face the crisis of shortage for rubber by commissioning a few more synthetic rubber plants with adequate capacity to produce the required quantity"?

Well, a critical analysis and assessment of the comparative advantages and disadvantages of Natural Rubber and Synthetic Rubber, will be appropriate and relevant in this context, more so when the North Eastern Region is all set for a massive programme of rubber development.

The status of NR

Natural rubber continues to reign as "nature's most versatile vegetable product" in view of its 'all purpose' quality. Nature has so graciously endowed natural rubber with built-in properties which no single substitute has been able to reproduce or match. Also, not even a near substitute to natural rubber has been developed till now, though science and technology has made remarkable strides in recent times.

For underdeveloped economies natural rubber is best suited, as it enables exploitation of precious natural resources like land. Rubber planting being labour intensive, can generate greater opportunites of employment. Natural rubber production is an agro-economic activity that could be carried out even on very small scale without any risk. Also this will provide a fairly remunerative return to the producers for about 25 years once the trees start bearing. Rubber planting is an operation which could be done fully with indigenous resources. Rubber is a hardy, perennial tree, ideal for regeneration and conservation of soil and afforestation of denuded areas. As a forest crop it restores the ecological equilibrium so badly upset these days by merciless deforestation. Then again from the utilitarian point of view, rubber trees besides yielding latex, provides valuable timber suited for furniture, building materials and fire-wood. Rubber trees are also a major source of honey. Of late, the dried petioles of rubber leaves have been found good as splinters of matches. Yet another advantage with natural rubber is that, it is a renewable and inexhaustible resource.

Synthetic Rubber

As against this, synthetic rubber is made out of expensive and exhaustible feed stocks like Petroleum. Setting up of a synthetic rubber plant is a highly capital intensive proposition, as it requires large sized plant and machinery installations of high capacity utilisation. The global pattern is, to go in for synthetic rubber factories with annual capacity of over 1,00,000 tonnes. This would be difficult under Indian conditions, as not only plant and machinery but also technical know-how will have to be imported. Huge industrial installations for producing Synthetic Rubber would cause atmospheric pollution.

Cost-benefit wise also, natural rubber production is far less expensive compared to manufacture of Synthetic Rubber. For instance, for erecting a Synthetic Rubber factory of 1,00,000 ton capacity about Rs. 800 - 1000 crores will have to be spent, out of which 50% will be in the form of foreign exchange. On the other hand, if lands are available, it will be possible to reforest 4,00,000 hectares with rubber with the same investment which will produce at least 6,00,000 tonnes of natural rubber per year. In respect of generation of employment on investments, it is 150 times more in natural rubber than in synthetic rubber.

The foregoing analysis will enable to draw the inference that investing in natural rubber production would be far more feasible in the socio-economic setting in developing countries like India. The same proposition eminently holds good for North Eastern Region also.

Utilisation of rubber wood in Thailand

During our recent study tour of the South East Asian countries, we had occasion to see quality furniture and other utility items fabricated out of rubber wood in Thailand. We are highly impressed at quality of these materials. Certain items of furniture looked like white cedar.

We in India have enormous wealth of rubber wood which could be gainfully exploited to our advantage. The example of Thailand is worth emulating in our country as we have started experiencing real dearth for traditional items of timber which has made them highly expensive. Rubber wood is likely to provide us the answer. In fact isolated attempts are being made now in Kerala by certain wood fabricators to use rubber wood for furniture and building materials. But the quality of their products is not comparable to that of Thailand.

It is proposed to avail of this technology from abroad and promote projects for appropriate utilisation of rubber wood in India.

Budget proposals

You will find in the Agenda placed before you, the Revised Budget for 1984-85 and the Budget Estimate for 1985-86, which is Rs. 15.18 crores respectively. The proposals have a high degree of R & D orientation, sharing over 86% of the total budget. About 76% of the total budgets are under PLAN. Almost 70% of the total Plan provisions is earmarked for subsidy for rubber growers.

Pool Fund expenditure meant exclusively for rehabilitation of small growers are budgetted at Rs. 1.4 crores for 1984-85 and Rs. 1.69 crores for 1985-86.

The major R & D schemes provided for in the budget include Rubber Plantation Development Scheme, Accelerated development of Rubber Plantation in the North Eastern Region, Research work on perfecting Tissue Culture technology in breeding high yielding rubber varieties, Developing a GERM PLASM Garden, Establishing High Altitude Research Stations and proposals for improved processing and cooperative marketing of small holders rubber. A notable feature of the provisions is that the establishment expenditure for operating the proposed schemes has been kept as low as 15% of the total in 1984-85 and 12% in 1985-86.

The revenue from cess collection is estimated at Rs. 7 crores during 1984-85 and Rs. 9.35 crores in 1985-86. With effect from August this year the Government has enhanced the cess on rubber to 50 paise per kg. Even with this enhancement, the balance of deposits of cess fund with the Government of India which stood at Rs. 23.61 crores on 1. 4. 1984 would be reduced to Rs. 4.71 crores by the end of March 1985.

Demand and Supply

The Statistics and Import / Export Committee had exhaustively reviewed the Demand and Supply position of rubber yesterday. The notes and minutes of the same are placed before you.

The deficit to be met by import of natural rubber during the year is estimated as 29,000 tonnes. There was some delay in effecting import and distribution this year also. You may recall that I had stressed on several occasions in the past that import and distribution of rubber should be restricted to the lean production months of June - August and February - March. Unless this is rigidly followed stabilisation of rubber prices could not be achieved.

Challenging task

The Rubber Board is fully conscious of the responsibilites cast on it as a result of the multifarious development activities undertaken. Past performance of the Board in boosting rubber production in the country has won wide-spread appreciation from all quarters. This has inspired us to rededicate ourselves to the tasks undertaken. I am sure that we will be able to fulfil our commitments for the future with the goodwill and cooperation of everybody concerned.

In terms of promise and performance, I am indeed glad to place on record that Rubber Board has outpaced all other Commodity Boards. In respect of revenue and expenditure also Rubber Board is at the top of the list.

Despite these impressive gains, I regret to note that the Rubber Board is yet to be accorded the due recognition and status it deserves. I have been repeatedly pleading for this, but of no avail. I hope the Government will pay heed to our appeal and get us the due place as expeditiously as possible. □

NEWS IN PICTURES

AN EXCLUSIVE TRAINING FOR NUNS

An exclusive training programme for Nuns has been arranged under the joint auspices of Rubber Board and MOC at Vidyanagar near Rubber Research Institute, of India. The training programme will be held on 22nd November 1984. Shri P Mukundan Menon Rubber Production Commissioner will inaugurate the programme. The function is to be presided over by Shri NK Gopalakrishnan, Managing Director, Plantation Corporation of Kerala Ltd. The classes on different topics will be handled by S/Shri MG Jagadish Das, KK Ramachandran Pillay, PS Kuriakose, Joy P Korah, Rajendran and Smt. S. Sulochanamma. About 200 nuns from the various dioceses of Kerala are expected to participate in the training programme. Shri VK Bhaskaran Nair of Modi Rubber Project will preside over the concluding session of the training programme on the same day. Shri PJ Thomas, Chairman, Rubber Board will inaugurate The speakers on the occasion include S/Shri Manarcadu Mathew, PK Narayanan, Dr. MV Joseph, and Rev. Fr. George Vavanikunnel.

FARM PAGES AND CO-OPERATIVE BANKS

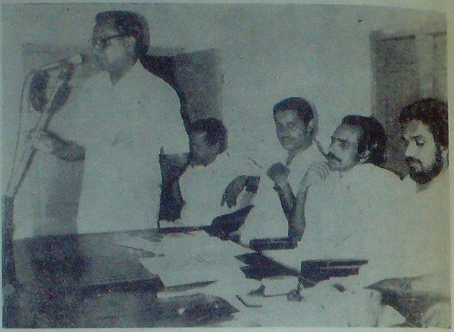
Malayalam and English dailies now-a-days carry farm pages mainly for the benefit of farmers. Useful articles/notes are being published in these pages which among other things give guidance on calendar of operations etc. The columns in farm pages serve as a medium to communicate the innovations in agriculture. To a farmer, his vision gets widened thereby inspiring for new efforts to improve the productivity. Most of the co-operative Banks have now started a novel programme to display the farm pages of dailies in the notice boards as it would enable their members to read the columns when they visit the Bank Office. A page is to be displayed for a week. Displaying farm pages similarly by other organisations, like village libraries, social organisations, nationalised banks etc could popularise farm pages effectively. Such a step would ultimately prove to be a promotional activity in disseminating the latest farm technology.

Rubber growers from Kulathur (Kuravilangad) who attended the 'Sasthradarsan' at the Rubber Research Institute of India with Director Dr. MR Sethuraj. The growers are the members of Farm Exchange Club, Kulathur.

Shri P John Joseph (Asst. Development Officer, Rubber Board) has been nominated as a member of Philatelic Advisory Committee of Govt of India.

RUBBER SEMINAR AT VAKATHANAM

A rubber growers' seminar was held at Vakathanam under the joint auspices of Rubber Board, Modi Rubber and the Co-operative Societies at Nalunnackal and Vakathanam. Shri PJ Thomas, Chairman, Rubber Board inaugurated the seminar. Shri Jacob Joseph Kondody presided.



Shri Jacob Joseph Kondody addressing the concluding session.

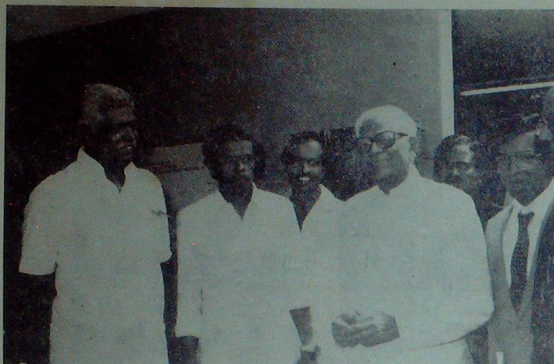
A view of the gathering

Shri VK Bhaskaran Nair presented a survey report. The technical officers of the Rubber Board took classes on various topics. Shri Joseph Monipally inaugurated the concluding session. Shri Kanam Rajendran MLA presided. S/Shri Oommen Chandy MLA, CF Joseph MLA, S. Gopalan IAS, Jacob Joseph Kondody, MV Mathew and Prof. Rajappa Panicker spoke on the occasion. Permits were issued to 18 rubber growers. Shri VK Bhaskaran Nair welcomed the gathering and Shri VM Itty proposed a vote of thanks.

Shri AV Thankappan Nair, Dy. Dev. Officer Changanacherry distributing the permits.

SEMINAR AT BADIADKA

The rubber growers assembled at Badiadka.



Shri R Venkitaraman, Vice President of India visited the Board's pavilion at UPASI.

UPASI EXHIBITION

Shri Joseph Monipally, Vice Chairman Rubber Board presented a paper at the annual meeting of the United Planters' Association of South India held at Conoor.

news and notes

WORLD BANK AID FOR RUBBER IN NE STATES

The Duputy Minister for Commerce. Mr. PA Sangma, who has concluded a two-week visit to Malaysia, Thailand, Indonesia and Singapore, said that land development schemes like that of Malaysia could well be adopted in north eastern India to grow rubber, oilpalm and other plantation crops.

Mr. Sangma's six-member delegation included Mr. Albinston Sangma, a Minister of Meghalaya, which is one of the States selected for rubber plantations along with Assam, Tripura, Mizoram and Arunachal Pradesh. A pilot scheme costing Rs. 6.5 crores to grow rubber is to be launched shortly. The World Bank is expected to offer Rs. 100 crores to the rubber planting scheme.

India imports 35,000 tonnes of rubber a year which is 20 per cent of its requirement, mainly from Malaysia a portion of which goes through Singapore. India plans to be self-sufficiant in rubber by the year 2000. Mr Sangma also studied the rubber plantations in Thailand and Indonesia from which too India plans to buy more rubber to diversify imports.

In Malaysia' Mr. Sangma held discussions with Government leaders to emphasise the necessity of Malaysia buying more Indian goods to reduce the unfavourable trade gap of Rs. 140 crores out of a total trade of Rs. 255 crores mainly because of large purchases of palm oil and rubber.

During the discussions it was suggested to Mr. Sangma that joint ventures that produce value-added rubber goods, food and wood products would be welcome.

(The Hindu)

UPASI SEEKS MORE GOVT. SUPPORT

Mr George John, President of the United Planters Association of Southern India (UPASI) pleaded for favourable policy response from the government for a healthy and timely implementation of a Rs. 1,600 crore plantation proposal during the 7th plan period.

Absence of proper interaction between planners and implementors of plans resulted in relative failure of tapping full plantation potential during past five years, Mr John said in his presidential address at the 91st Upasi annual conference. While industry was involved in formulation of the 7th plan for tea, it has not been involved as much for other plantation crops. Mr John suggested an almost one window arrangement for plantation plans relating to taxes and policies relating to land, fuel reserves, inputs, taxation, centre state coordination, grower representation on commodity boards and the like.

Mr John pointed out that the 7th plan involved new planting of tea, coffee, rubber and cardamom on about 1.75 lakh hectares, 95,000 hectares in non-traditional regions, besides replanting 85,000 hectares and infilling in 0.3 lakh hectares. Studies show up large uncovered financial gap after counting financial support from the commodity boards. There was need for depreciation allowance and development fund to be created from pre-tax profits for supplementing finance to enable industry find funds for development from internal surpluses.

Mr John emphasised that there should be no blind enlargement of areas under coffee while such areas could be profitably turned to rubber. He also warned against venturing into non-traditional areas where the cost benefit did not warrant it.

Mr John discussed high Tea prices and pleaded that if at all any controls have to be exercised it is better that they are imposed by industry itself. The government can enter only if the controls are not found to be self-manageable. Mr John pointed out lifting of worst recession was good news and improved prices had had definite influence on production. South India would harvest during current year all-time record crop of 140 million kg of tea, 170,000 tonnes of coffee and 185,000 tonnes of rubber besides remarkably recovering in cardamom producing 3,000 tonnes. Exports of plantation products should fetch Rs 1,000 during current financial year. Benefits will go both to the government and labour.

"One often hears charge about teas so called high prices. I do not intend to take defensive posture against this allegation which stems from comibination of exaggeration and economic disorientation. Admittedly market for tea registered upward trend since 1983 but this is a welcome development and is a global and cyclical phenomenon coming as it does after years of uneconomic and depressed prices.

It may be asked whether press, public and the government would have become sensitive to the issue had tea prices gradually risen in parity with those of other commodities. As it happened tea suffered long period of stagnancy and decline and now a sudden recovery. Current development also masks the fact that during three years to 1982 many estates were deep in the red, many could not meet their debt or pay suppliers bills, many were in arrears of wages and statutory obligations. Public memory being proverbially short travails which tea producers have had to sight of in the present debate. Against this background current market prices for tea was not a matter of jubilation but relief having wiped out accumulated deficit and putting industry back on rails.

Interests to be protected

Mr John agreed that need of consumers' interests should be protected and mentioned that producers have made available some tea at concessional rates for certain segments of domestic market To remove psychology of shortage the industry, particularly in the south, voluntarily augmented sales through auctions. It has loyally adhered to the government's policy of augmenting production to 635 million kg this year. Mr John said these should stabilise prices at customary low levels.

"Additionally there could be a serious upsetting of market forces and a sharp decline in prices consequent on regulation on exports introduced last week. "It is my conviction that free* market will serve public better than a market clustered with controls such as recent orders compelling producers to bring their tea to the auctions or seeking valuation by brokers as a precondition for direct export by producers," Mr John said. Regarding the anticipaed enormous coffee crop, Mr John felt without a very substantial increase in exports from India from the present 40 000 tonnes international coffee marketting arrangement will be of no advantage to India. "our large surplus will have to be sold at heavy discounts as in last two years. It is but contradictory that coffee is sold at a discount in world market and Indian producers are asked to pay penal export duty. There was need for further relaxation of export duty burden." he said.

Mr John said the 7th programme of opening new coffee areas at high costs was drawn up on the assumption that world coffee prices would be maintained at high levels. There is hardly any breakthrough in Indian consumption urgently needed as a corollary to developmental planning Overall price realisation on 1983-84 crop is far less than export auction average. If price average is again the same or less for current year return on coffee would now allow planters to see distant prospects.

In the contest of increasing demand for rubber and increase in domestic rubber production Upasi had never been against stop-gap imports but are anxious that import management should ensure fair play in respect of pricing, timing, distribution, grades and duty structure "Of even more concern to us is suggestion by manufacturers of rubber goods that it was better to rely on imports as long-term solution. Apart from likelihood of world prices exceeding Indian levels as in the past it was inconceivable that India with vast production base and growing manufacturing sector should be dependent on other countries to meet normal domestic requirement Extent of gap is relatively small and for an agro-based enterprise with outstanding record of production growth of 9 per cent annual

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Cover: KP Sreeranganathan

THE RUBBER BOARD
KOTTAYAM 686 001 INDIA

Chairman
PJ Thomas

Secretary
V Bhaskara Pillai

Rubber Production Commissioner
P Mukundan Menon

Director of Research
Dr. MR Sethuraj

Project Officer
CM George

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THE QUARTER

Since very long Rubber Board has been advocating the use of high yielding planting materials with the object of achieving maximum output from the rubber plantations in the country. The demand for rubber is increasing thereby widening the existing gap between demand and supply. In order to meet the ever growing demand, rubber production in the country has to be stepped up by maximising output from existing holdings and introducing rubber to new areas. In this context, more emphasis has to be laid on the use of high yielding planting materials. Rubber Board has now invited applications for the supply of high yielding planting materials during 1985. A notification giving details of cost of planting materials, distribution centres etc has been published in leading English and Malayalam dailies. Applications which come under Board's aid schemes will receive priority in the order of receipts. Small rubber growers would be allowed price concessions also for budded stumps and budwood. Those who avail this opportunity should undertake rubber planting with earnestness and enthusiasm so that throughout the gestation period of this crop proper maintenance and upkeep could be done.

Regional Office at Nilambur

The first planting permit and subsidy cheques were distributed to the growers by Shri. MP. Gangadharan, Minister for Irrigation, Kerala and Shri. Aryadan Mohammed, Member, Rubber Board respectively at the inaugural function held in connection with the opening of the new office at Nilambur. Felicitation speeches were

NEW RUBBER BOARD REGIONAL OFFICES

Two new Regional offices of the Rubber Board have been opened at Nilambur and Trichur. Shri. K. Karunakaran, Chief Minister of Kerala inaugurated both the offices on 13th April, 1985. Shri. PJ Thomas, Chairman, Rubber Board, presided over the functions held at Nilambur and Trichur.

delivered by S/Shri A. Kunheeran, Member, Rubber Board, CM. John, PP. Moosakutty and KR. Purushothama Iyer. Shri. PK. Narayanan, Public Relations officer, Rubber Board welcomed the gathering and Shri MG. Jagadish Das, Joint Rubber Production Commissioner proposed a vote of thanks. A large gathering including the rubber growers from Malappuram District attended the function.

Regional Office at Trichur

The inaugural meeting of the Regional office at Trichur was held in the evening on 13th April, 1985. Shri. VM. Sudhiran, Speaker of the Kerala Assembly released the first planting permit. Subsidy cheques were distributed by Shri. Therampil Ramakrishnan MLA. S/Shri. TP Seetharaman, TP. Anantharaman, PAL. Menon and K Padmanabhan, Member, Rubber Board spoke on the occasion. Shri. PK. Narayanan, welcomed and Shri. PS. Kuriakose, Dy. Rubber Production Commissioner proposed a vote of thanks.

RUBBER CENSUS

Rubber Board has started a census in rubber area of Vaikom Taluk. During the course of the census, details like actual area under rubber, number of rubber trees, number of other trees in the area, production of rubber from April 1984 to March 1985, cultural practices adopted in the rubber plantations, labour employed etc will be collected. Under the rubber Act 1947, all the rubber growers have to register their rubber area with the Rubber Board. But many holdings still remain unregistered with the result in several cases actual holdings vary from the registered area. The census currently undertaken would help to study the difference between the actual area and the registered area in the Taluk.

Inauguration

The programmé was formally inaugurated at a rubber growers meeting on 6th March 1985 at the St. Thomas Sunday School Hall, Arunoottimangalam. Shri P Mukundan Menon, who inaugurated the meeting emphasised the need for a detailed census to assess the actual area under rubber. He hoped that the present attempt would help to compile the basic data required by the Rubber Board. The meeting was jointly organised by the Kaduthuruthy Rubber Marketing Society and the Rubber Board. Shri NE Antony Nedungottil, who welcomed the gathering advised the rubber growers to cooperate with the rubber census sponsored by the Rubber Board. Rev Thomas Vadakkemukalel presided. Shri P Rajendran, Dy. Dev. Officer, Rubber Board Regional Office, Kottayam proposed a vote of thanks.

The rubber growers who participated in the meeting filed the questionnaires there itself and handed over them to the concerned officials.

CRUMB RUBBER IN INDIA MISCONCEPTIONS AND REALITIES

GEORGE JACOB

SYNOPSIS

Many eye brows were raised when the Government of India had finally given the green signal to the Rubber Board to go ahead with the Processing Component of the Kerala Agricultural Development Project (KADP) financed by the World Bank. The Project interalia includes the setting up of ten rubber processing factories in the predominant rubber small holder areas to convert a sizeable share of their crop into technically specified block rubber popularly known as crumb rubber. This move was welcomed by a wide cross section of the people who were concerned about the welfare and well being of the rubber planters significantly small producers. However, the idea did not find favour with certain sections of the rubber community. The crepe mill industry saw in it an attempt to eliminate them from the rubber scene once and for all. The rubber dealers whose profits are heavily dependant on visual grading system viewed the whole concept of organised crop collection and processing with mistrust. The consumers, significantly the major tyre companies knowingly or unknowingly showed only limited optimism on the success of crumb rubber in India. Medium and small rubber goods manufacturers looked upon it with scepticism and considered it as a deliberate attempt to increase the price of raw rubber to benefit the producers only. All these are now things of the past as it happened in the middle of the last decade. The Kerala Agricultural Development Project is already half way through and the rubber industry in general has got reconciled with crumb rubber by now. However, it cannot be said that this polymer has been readily welcomed and widely accepted in the Indian market. Even now there are people yet to be convinced about the need for crumb rubber in India. Similarly there is still quite a lot of ignorance about this rubber, particularly its advantages, among the small and medium consumers. Probably this is due to the lack of appreciation of the need for India to go in a big way into crumb rubber production and also the absence of a realistic assessment of its advantages to the various sections of the rubber community. This article is intended to dispel such doubts if any in the minds of the critics by presenting the whole issue in the correct perspective. A convincing analysis is made through this article to justify the need for India to go into crumb rubber production from various angles and perspectives. The author is the Assistant Secretary (Market Intelligence) of the Rubber Board.

Introduction

India is now on the threshold of a revolutionary transition from the age old conventional system of processing into a modern era of technically specified rubbers and special rubbers. This change is brought about by a growing awareness on the need to develop organised collection, processing and marketing of small holders rubber. The need for revolutionary changes in the field of natural rubber processing was felt as the structural changes taking place

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Crumb rubber

Technically specified natural rubber in block form popularly known as block rubber or crumb rubber is a modern marketable form of dry natural rubber with certain distinct advantages over conventional grades such as ribbed smoked sheets and crepes. It symbolises the notable breakthrough achieved in the processing and presentation of natural rubber. It is a polymer which maintains the intrinsically good and allround properties of natural rubber and presented in a more uniform manner in blocks of convenient size and packing to cater to the specific requirements of the rubber consumers. A striking feature of this rubber is that it has to be graded and marketed as per technical specifications laid down to this effect.

Origin and growth

Crumb rubber is the product of relentless efforts made by the natural rubber producing contriesu particularly Malaysia for presenting natural rubber in a comparable form with synthetic rubber. The fifties and sixties saw the rapid development of synthetic rubbers and the alarming decline of natural rubbers share of the total rubber market. This caused serious concern to natural rubber producing countries. There was widespread fear of the eventual eclipse of natural rubber as indigo was displaced by its synthetic alternative. It is common knowledge that synthetic rubber, being a factory product, can be made to conform to rigid specifications by suitable adjustments in the feed stocks used for its manufacture, whereas natural rubber received from rubber trees has certain inherent properties. Since latex and field coagulam (scrap rubber) received from the rubber trees are the same irrespective of whether it is produced in an estate or a small holding, the quality of the processed rubber by and large depends on the system of processing. This was the starting point for major natural rubber producing countries significantly Malaysia to think seriously on ways and means to make natural rubber comparable with its synthetic substitute. The research work done in this regard in Malaysia bore fruit and they came out with Standard Malaysian Rubber (SMR) in the middle of the sixties. The initiative taken by Malaysia in this regard was followed by other major natural rubber producing countries. Within the last two decades of existence, crumb rubber has won world wide acceptance and recognition as evidenced by the consistent increase in the production and export of it in the major rubber producing countries. In 1982, the total exports of crumb rubber from Malaysia was 42% of the total natural rubber production there. The corresponding percentage in Indonesia was as high as 72. Even during the late seventies and early eighties when the rubber industry the world over was passing through an unprecedented recession, crumb rubber maintained and even strengthened its position in the world market. In 1982, new records were set in the exports of SMR from Malaysia. Experts of SMR increased by 20,000 tonnes in 1982 from the exports in 1981. This bears ample testimony to the growing popularity of this polymer.

Block Rubber in India

Block rubber production started in India in 1974-75. The reason for its late arrival in India can be attributed to the lack of enough rubber production to meet the requirements of the rubber goods manufacturing industry in the country. The rubber produced indigenously is fully utilised by our rubber goods manufacturing industry and the deficit is made good by imports. Besides, the country was also traditionally used to the conventional grades of sheet and crepe and therefore a change was not felt necessary. Under scarcity conditions, no serious thought was given to bring about drastic changes in the field of processing until it became a necessity due to the pressure of circumstances.

At present there are ten crumb rubber factories in the country of which four are in the estate sector, three in the co-operative sector and three in the private sector. Besides, there is also a pilot crumb rubber factory owned and operated by the Rubber Board which can not be strictly classified as a commercial factory. It procures latex and scrap mainly from the Board's own experiment stations. This factory is also geared for undertaking extensive research on various aspects of crumb rubber production, such as raw material procurement, improvement in plant and machinery, quality control, development of special rubbers, effluent treatment and discharge and market promotion.

Eventhough there are eleven factories with an annual installed capacity of 14250 M. tonnes production of crumb rubber has been much below the desirable level. Production of crumb rubber in the country has been showing erratic trends right from the beginning. Variations in market demand, labour unrest other problems faced by the existing units etc are reasons attributed to this. In 1974-75 crumb rubber production was only 670 tonnes which had shot up to 3467 tonnes by 1976-'77. Since then, there has been ups and downs in the total production of crumb rubber. In 1980-81 production reached the level of 2416 tonnes from which it has declined to 1853 tonnes by 1981-82 Since then, an increasing trend is observed. Production has reached 2919 tonnes by 1983-'84 from 2240 tonnes in 1982-'83.

The infant crumb rubber industry in the country received an impetus and face lift with the implementation of the Kerala Agricultural Development Project.

The Rubber Processing Component of this project interalia includes the setting up of nine new 10 tonnes per day crumb rubber factories in a phased manner in the predominant small holder areas to convert their crop into technically specified block rubber and the expansion of the existing co-operative factory at Palai to 10 tonne per day capacity. It was envisaged that when the project factories are fully operational, they alone will be contributing 25,000 tonnes of crumb rubber to the total availability. The expansion of the Palai factory and the setting up of one factory each at Calicut and Kanjirappally have already been accomplished. These factories are now under commercial production. One factory each at Palghat Moovattupuzha and Thodupuzha and the expansion of the Kanjirappally factory to 20 tonnes per day capacity are now in an advanced stage of implementation. The present indications are that World Bank assistance may not be forthcoming for the remaining four factories originally planned under the project. Besides, there are also proposals to set up crumb rubber factories by public sector plantations and certain private estates. Therefore, assuming only seven factories under the World Bank Project, the total block rubber production in the country is expected to reach around 22,000 tonnes by 1986, which may go up further to 38,000 tonnes by 1990.

Production of crumb rubber

Production of crumb rubber involves a series of unit operations such as pre cleaning, blending, final size reduction, drying and packing. The raw rubber in the form of latex and of scrap is converted into crumbs after precleaning operations to remove foreign matter, washed, dried at a temperature not exceeding 110°c compacted into blocks of standard size and shape and wrapped in low density polythene film. Grading is done by taking samples from bales representing each lot and testing for dirt, ash, volatile matter, nitrogen content, initial plasticity and plasticity retention index. It is then packed in high density polythene bags marked with the grade and net weight. Each bag contains two blocks of 25 Kgs each.

Grades of crumb rubber

In India, crumb rubber is to be graded and marketed adopting ISI specifications and therefore it is called Indian Standard Natural Rubber (ISNR). The grades of ISNR laid down by the ISI can be broadly classified into two, viz latex based crumb rubber and scrap based crumb rubber based on the starting materials used for production. There are two grades under the latex based crumb rubber namely ISNR 5 (special) and ISNR 5. Similarly there are three grades under scrap based crumb rubber which are ISNR 10, 20 and 50. Efforts are now in progress to include some new grades such as ISNR 3 CV and ISNR 3 L into the ISI framework and deletion of the existing grade of ISNR 5 (special) in order to make it much more broad based and realistic.

Advantages of crumb rubber

Crumb rubber possesses certain specific advantages over conventional grades of ribbed smoked sheets and crepes.

They are:-

(1) being available in five well defined grades. correct choice of the grade to suit the requirements of the consumers is easy

(2) being processed in bulk quantities adopting latest technology, variation in technological properties within the same grade is minimum facilitating better quality control of the raw material and processing

(3) being possible to assess the actual content of foreign and volatile matter, realistic assessment of the worth of the material is possible

(4) being marketed in compact polythene wrapped bales, contamination of the rubber on storage, handling and transportation can be prevented

Cost benefits by using crumb rubber

It is well recognised that price is the most important factor influencing the selection of rubber grades by the consumers. However, market price alone is not sufficient for selecting rubber grades. In fact, the overall cost of production and the quantity and quality of the saleable products are also important factors to be considered. The following benefits in cost and quality by using crumb rubber regularly are worth mentioning:-

(1) Crumb rubber can be efficiently handled at all stages of external and internal transportation in view of the optimum bale size and compact nature of bales. This will reduce handling and transportation cost

(2) Crumb rubber being in standard size and compact shape, can be conveniently stored one above the other and the floor area required will be much less compared to that for conventional grades. This will result in savings on storage cost

(3) Crumb rubber does not require removal of bale cover, precleaning, bale cutting and straining. Besides, being processed from crumbs, it requires comparatively less pre-mastication. It can be fed directly into the mill (depending upon its initial plasticity and mill size) or banbury. The extent of cost reduction in this respect can be quite significant in terms of labour, power, and machinery output. Besides, use of block rubber can minimise certain production problems wastage and variability in product properties

(4) raw material testing as well as in process testing can be minimised by using crumb rubber with guaranteed specifications. Factories where facilities are not available for quality control testing can therefore avail of this advantage

(5) Since dirt, volatile matter and ash content are controlled and regulated and there is no bale coating, consumers can obtain a more realistic pricing advantage in terms of the actual worth of the material

Is crumb rubber an absolute necessity in India ?

After having glanced through the growth and development of crumb rubber industry in India and assessing the specific advantages accruing to rubber consumers by using it, let us now come to the most vital issue. Should India go in a big way into crumb rubber production? Opinions differed considerably on this issue. People who are familiar with the problems of rubber plantation industry and those who are farsighted enough to forsee some of the changes in the structure of this industry welcomed this proposition without any reservation or hesitation. However, some sections of the rubber community held divergent views on this issue. Some people argued that since India is still not self sufficient in this strategic raw material, maximum priority should be given to maximise production so that imports of rubber can be minimised and thereby drainage of valuable foreign exchange prevented. As such, diversion of scarce capital for building up crumb rubber factories, could wait till we achieve self sufficiency in rubber. However, they agree that, if India is exporting natural rubber there would have been a definite case for starting crumb rubber factories so as to remain competitive in the international markets. Another line of thinking is that since the rubber consumers in the country are happy and contended with conventional grades why should crumb rubber be imposed on them? To substantiate this argument further, it is pointed out that a request for crumb rubber, should have come from the consumers because afterall they are the section to clamour for improvement in quality. The consumers never asked for it. Yet another group thinks that the Rubber Board is trying to transplant the SMR concept in India just for the sake of technological improvement in processing and presentation of natural rubber, without assessing its absolute necessity under Indian conditions. While the above arguments against crumb rubber can be conceded as containing some stuff, some sections went further ahead and cast aspersions even on the viability of crumb rubber production in India. Serious doubts were also raised in these quarters on the market prospects of crumb rubber in the country. A careful analysis of their arguments will reveal that their antagonistic attitude to crumb rubber is not based on valid grounds, instead, it is a frantic attempt to protect and safeguard their own interests. The crepe mill industry have a genuine fear that crumb rubber will pose a potential threat to its very existence. Their fear is some what well founded also. In Malaysia, crepe mills made a gradual exit from the rubber scene with the advent of the SMR age. It is quite natural that rubber dealers will not be happy about any standardisation in quality which may tell upon their profits. They were very sceptical about the whole idea and there were even attempts to play down the demand for ISNR grades. Their anxiety to retain the system of conventional processing and visual grading system connected thereto is therefore quite understandable. However, the most surprising was the lack of enough patronage to crumb rubber from the tyre manufacturers. It is indeed dismaying to watch their subdued interest and enthusiasm because they are the people to reap the maximum benefits by using it. Their limited interest in this rubber is all the more significant considering the fact that almost all the technical collaborators of these companies are convinced about the advantages of crumb rubber and most of them are using it on a regular basis. It therefore becomes obvious that there are quite a lot of misconceptions about crumb rubber even now among the various sections of the rubber community. Probably this may be due to the lack of a realistic assessment to evaluate the pros and cons of introducing crumb rubber into the country. Let us now proceed to analyse the circumstances which necessitated introduction of crumb rubber in a big way in India. It is expected that this will dispel the misgivings and doubts, if any, still remaining in the minds of the critics.

Crumb rubber and the consumer

The resistence to crumb rubber is much more in evidence in the consumers camp. Therefore, the first task is to establish how crumb rubber will benefit rubber consumers more than any other section. Higher prices of crumb rubber vis-a-vis the prices of conventional grades are often reported as the reason for their resistance to crumb rubber. However, this is due to the lack of an assessment of the net benefits accruing to them by using it. It is, widely accepted that price is not the only consideration guiding purchase decisions. The overall cost of production, the net worth of the material, quality of finished products etc. are also equally important aspects to be considered. In fact due to a short sighted approach in which the price of rubber at a point of time is only considered in isolation the importance of availability of rubber of consistent quality at relatively stable prices throughout the year is often lost sight of. If a realistic assessment is made, it will become obvious that the consumers will stand to gain by switching over to such a polymer rather than depending exclusively on grades which are inconsistent in properties and erratic in supply. Consumers are the most benefited by crumb rubber as would become evident from the following analysis.

Availability of graded sheets

Complaints are often voiced by consumers on the non-availability of graded sheet rubber of prescribed quality at reasonable prices. Many people think that this is only a temporary imbalance in supply which will get corrected over a period of time. But the fact is that this is the cumulative result of many factors including the structural changes taking place in the rubber plantation industry and as such it will continue to be a regular feature in the years to come. The reasons for this are not far to seek. Bulk of the graded sheets available in the country are produced by large estates. Cost of production of sheet rubber has been going up in the recent past without a corresponding increase in the premiums of such grades. This has made many estates to think of alternative sources to dispose of their crop. Coinciding with this development is the sudden spurt in the demand for field latex consequent on the boom for latex concentrates. Field latex which was at one time sold at a price less than lot, price started commanding premiums extending even up to Re. 1 per Kg. By selling the crop as latex, the estate could also dispense with processing and marketing cost. It is therefore natural that estates find it a lucrative proposition which guarantees a better return and at the same time save the trouble and responsibilities of processing and marketing. However, the net result of this development is that a sizeable quantity of latex is siphoned off from the quantum of latex going into the production of graded sheet rubber. This in turn paves the way for frequent imbalances in the availability of graded sheets, wide fluctuations in their prices and down grading in quality.

Quality of small holders rubber

While this is the case with estates, there has also been a consistent deterioration in the quality of sheet rubber produced by small holders. It is common knowledge that the sheets produced by small holders significantly petty small holders are inferior in quality mainly due to the crude method of sun drying and kitchen smoking followed by them. Only a percentage of the small holders own the essential facilities for producing good sheets. Lack of cleanliness in collection, coagulation etc. is also found to be common. The spiralling cost of firewood has rendered operation of smoke houses for the production of quality sheets quite an unattractive proposition. The old practice of using a fallen rubber tree, or for that matter any tree, to cite an example, for the operation of smoke houses is not at all profitable due to the very high prices of timber and firewood. Yet another important reason is the lack of sufficient incentive to small holders to improve the quality of sheet rubber produced by them. The contributing factor is found to be the conventional system of processing and the visual grading system connected thereto. The small holders are fully aware that even if better sheets are produced by using improved methods of processing, they will not be compensated for their efforts as the existing marketing system allows the purchase of their rubber only as 'lot' without grading. As such the need of an average small holder is just to produce a sheet with the least minimum processing operations. It is therefore quite natural that such sheets suffer from lack of sufficient smoking, over smoking undried patches impurities and so on.

Future outlook

The circumstances leading to the gradual deterioration in quality of sheet rubber produced in the country have been explained. This tendency is not a healthy development. In this context it becomes necessary to examine whether this is going to be a regular feature and if so the impact of it on the availability, quality and prices of graded sheet rubber in the long run. For this purpose it is necessary to examine the changes taking place in the rubber plantation industry as a whole.

Sheet rubber

The rubber plantation industry in India is passing through a structural change, which is brought about by the gradual breaking up of large plantations new plantings by subsistence farmers and sub division and fragmentation of existing small holdings, due to various socio-economic factors. The net result is the emergence of the small holding sector as the dominant partner in the industry. In 1960-61 small holdings accounted only for 59% of the total area under rubber in the country which increased to 67% by 1970-71. It further increased to 74% by 1982-83. Similarly the share of small holdings to total production has increased from 25% in 1960-61 to 56% by 1970-71. It further increased to 71% by 1982-83. Yet another striking feature of this change is the fastly increasing number of petty small holdings which has now gone upto 23% of the total number of holdings. This change is truly reflected in the average size of the holding. The average size of the holding was 1.34 hect. in 1960-61 which has come down to 1.23 hect. by 1970-71. It has declined further to 1.02 hect. by 1982-83. Past trends unmistakably show that proliferation of small holdings will accelerate further in the years to come. Since the sheets produced by small holders significantly petty small holders are inferior in quality, it is but natural that the direct impact of the structural change on the industry is a gradual decline in the quality of sheet rubber. The impact of this is being increasingly felt now and many consumers are rather compelled to buy lower grades, accepting it reluctantly as higher grades at enhanced premiums. On the one hand there is deterioration in quality and on the other increase in premiums, that too for lower quality. In both ways the consumers stand to lose. If things continue at this rate the day is not far off when consumers have to knock from one source to another to procure enough raw rubber of prescribed quality, to meet their requirements.

Crepe rubber

Deterioration in the quality of crepe rubber produced from scrap rubber is still more significant. The scrap rubber produced by small holders is allowed to deteriorate in quality because of its unscientific storing in the growers courtyard. By the time it reaches the commercial crepe mills after passing through one or two market intermediaries, the quality would have deteriorated further. In fact an attempt is made then in the commercial crepe mills to upgrade the quality of such deteriorated scrap, without much success. Since estate brown crepe produced in the country is not subjected to any specifications, adulteration of the scrap with inferior quality skim rubber, bark particles etc is quite rampant. It is interesting to note here that bulk of the estate brown crepe produced in the private crepe mills cannot even be called as crepe as per the standards laid down in the Green Book. Quality problems of the crepe produced in private crepe mills are increasingly felt by major consumers, significantly tyre companies who consume almost 75% of it. They are, therefore, the worst sufferers in this regard.

Crumb rubber and the small holders

The decision to go in a big way for organised processing of small holders crop was also taken to ensure a better return to the small holders. In order to understand and appreciate this aspect it is necessary to examine the present system of marketing of small holder's rubber.

There is a marketing net work for small holders rubber involving a chain of agencies which has been evolved through the past many years. It consists of primary dealers, middle dealers and big dealers. Primary marketing co-operatives are also an integral part of this chain. However, their share of the market is considerably low. Their system of operation is more or less like middle dealers. Primary dealers operate at the village level and serve as the first outlet for small holders rubber into the market. Middle dealers operate at towns and buy rubber mostly from primary dealers and medium and big estates. From the middle dealers the rubber passes to the big dealers operating at important rubber markets in the country. At the level of the big dealers, proper grading and packing are done before the rubber is despatched to the ultimate consumer. Under the visual grading system followed in the country, grades are decided on visual inspection without relevance to the technical properties despite the broad guidelines and norms laid down. The main drawback of this system is that it paves the way for upgrading and down grading according to demand and supply forces. The visual grading system revolves around the 'lot' price. It is interesting to note that there is no specified grade as 'lot'. It just denotes a mixture of RMA 3, 4 and 5. Under the present system, small holders rubber is purchased at a discount to the 'lot' price by primary dealers. The rubber thus collected by the primary dealers is sold to middle dealers as 'lot' itself for a small margin of profit. The discount made from the market rate represents the profit margin of primary dealers. At the level of the middle dealers, sorting and grading is done to some extent. But actual grading takes place only at the level of the big dealers. It is worthwhile to note here that the sheet rubber produced by small holders does not undergo any change when it passes from one market intermediary to another before it reaches the final consumer ultimately. However, grading, packing and transportation etc. are services provided by dealers significantly big dealers.

Grade differentials for small holders sheet rubber

Due to the regular reporting of 'lot' prices in local dailies, the farm gate price received by small holders is comparatively high in the case of rubber. But the difference between the farm gate price and the price ultimately received by big dealers represents the marketing margin. Even after giving due allowance for the services provided by dealers in grading, packing, transportation etc,, the marketing margin is found to be still high. The point stressed here is that grade differentials which ought to have gone to the producer, have in fact accrued to the intermediaries because of the present system of marketing characterised by visual grading which is again a by product of the conventional system of processing.

Price of small holders scrap rubber

The loss sustained by small holders in the sale of their scrap rubber is still more pronounced. Unlike the price of sheet rubber, the prices of scrap rubber are not reported in local dailies. As such the competitive status enjoyed by small holders in the sale of sheet rubber is totally absent in the case of scrap rubber Bulk of small holders scrap is purchased by unlicensed dealers who visit the holdings periodically. The common practice is to negotiate a price for the whole lot rather than sorting out good quality scrap and paying a good price for it. Since the small holders are not keeping abreast with the latest price trends due to its non availability, they are not in a position to ascertain whether the price received is reasonable. Besides, faulty weighments are also methods used by unlicensed dealers to exploit the small holders A peculiar feature of this system is that many growers do not even realise the actual extent of loss sustained by them in selling scrap rubber to these petty traders.

The entry of crumb rubber factories into the scrap market has totally changed the situation in favour of the small holders. The system of purchase of scrap rubber at a fixed price formula by the KADP factories, rendered enough stability to the scrap prices. This becomes evident if the increase in the price of scrap rubber since the establishment of the KADP factories is closely examined. Prior to the setting up of the world bank aided KADP factories, the difference between 'lot' price and scrap rubber was well over Rs. 4 per Kg. This has narrowed down to Rs. 2.50 to 3 per Kg. by now.

Prospects of special rubbers

Many people still consider crumb rubber only as an improvement in the presentation of natural rubber with technical specifications. In fact it is much more than that. It symbolises the starting of a new era in the field of natural rubber processing in the country. Lot of work is now in progress throughout the world for the development of various customer oriented polymers. The rationale behind these efforts is to develop certain special grades which would cater to the specific requirements of the consumers. With the increasing mechanisation and sophistication of the plant and machinery of the rubber goods manufacturing industry, lot of emphasis is laid on techniques which would enable to dispense with certain initial stages in product compounding in the face of mounting cost of production significantly labour wages. It is therefore logical to expect an increasingly important role for special rubbers in the future set up. Operations like pre-mastication, to cite an example, which is at present done in the factory could be totally dispensed with if a viscocity stabilised rubber is used.

A glowing example of this shift towards special rubbers from ordinary grades is visible in Malaysia. Crumb rubber factories there were producing only ordinary grades to start with. Since then Malaysia has come a long way in the development of special rubbers. When crumb rubber was introduced into the world market for the first time, arrangements were also made simultaneonsly to monitor the views and attitudes of customers to this rubber on a regular basis. The market feedback thus received gave valuable information on the choices and preferences of consumers. Based on this, regular and continuous research ensued which culminated in the development of special rubbers such as constant viscocity rubber, low viscocity rubber, general purpose rubber, tyre rubber and so on. Most of these rubbers are well received in the market.

India being a developing country, it is very essential that our limited polymers are utilised in an optimum way. We cannot afford to waste any of the available rubbers. Development of special rubbers has therefore much more relevance in India under the present situation. Efforts may have to be made to develop special rubbers to cater to the needs of various industry groups by judicious deployment and diversion of the available latex and scrap so that wastage of rubber can be brought down to the minimum. Special rubbers like viscocity stablised rubber possesses promising prospects in our country due to the constraints on power. The role of crumb rubber in this regard needs no emphasis as it is the starting point for development of special rubbers.

Organised processing

To sum up the points already

discussed, there is a consistent decline in the availability of graded sheets from the estate sector, gradual erosion in the quality of small holders sheet rubber and deterioration in the quality of crepe rubber produced from small holders scrap rubber. The consumers feel to a greater extent. The producers, significantly the petty producers are also equally affected by the existing conventional system of processing and visual grading system connected thereto as it deprives them of grade differentials for their sheet rubber and a fair return for their scrap rubber. Moreover, with the increasing sophistication in the technology, plant and machinery of our rubber manufacturing industry and the deep impact of constraints like power shortage on its growth the need for special rubbers will be very keenly felt in the country in future.

After having identified the problems and the requirements let us examine the most ideal method to set things right. Here it is to be emphasised that an individual approach to improve the quality of rubber is rendered difficult because there are nearly 1.75 lakh growers who can not be practically reached, individually. The objectives of maintaining regular availability of higher grades of rubber with consistent quality at relatively stable prices, ensuring a better return to small producers and prevention of degradation of small holders scrap rubber can be achieved by collecting the crop from the growers before deterioration and converting it into high quality rubber through improved processing techniques in central factories. Collection of latex and scrap can be effectively done through a net work of collection centres in the predominant small holder pockets. The collection centres thus set up can, in course of time, be converted into small holder development centres which can serve as the nucleus around which the entire process of modernisation of small holdings can be taken up. In addition to collection of crop these centres could arrange the required inputs and appropriate technology to the growers for scientific cultivation of rubber. Another advantage of this system is that the central factories can sell their products directly to the consumers and thereby secure a better sales realisation by minimising marketing margins A portion of the profits thus made, can be channelled back to the growers as differential payments in the form of purchase bonus. This is precisely the programme envisaged under the Rubber processing Component of the Kerala Agricultural Development Project financed by the World Bank.

Conclusion

It has already been established beyond doubt that the decision taken to set up a chain of crumb rubber factories is a step in the right direction. It is beneficial to the consumers and producers alike. The consumers are benefited by regular availability of specified grades of rubber of consistent quality at relatively stable prices. Similarly the producers significantly the petty producers are assured of a better return for their crop. From the national point of view, the gradual erosion in the quality of sheet and crepe rubber has been arrested and a technical orientation brought into the field of processing and marketing of rubber. Moreover, with the setting up of crumb rubber factories, the required infrastructure has already been laid down in the country for the development of special rubbers, which is the need of the day. A beginning is only made and we have yet to go a long way in this field. Concerted efforts are therefore called for to develop special grades to suit the specific needs and requirements of our rubber manufacturing industry. It can be confidently said that with the passage of time crumb rubber will be better understood and appreciated in the country. □

ALL-SR TYRES A REALITY

The Soviet Union's rubber industry has developed all-synthetic-rubber radial and aircraft tyres, according to top industry officials there. The innovations are part of a major effort in the USSR to automate plants, cut costs and reduce the industry's already meagre dependence on imported natural rubber. The tyre developments were mentioned in speeches given during September's KP '84 International Rubber Conference in Moscow. No details were given on specific achievements, although Soviet officials spoke at length-and in broad terms-about their efforts to upgrade rubber product manufacturing. Dr PF. Badenkov, Director of the Scientific Research Institute of the Tyre Industry, mentioned the development of an all-SR aircraft tyre-which would be a significant innovation, according to Western aircraft tyre industry sources. Badenkov said the USSR has been mass producing all-SR car, truck and agricultural tyres for 10 years, and maintained that they are "in no way inferior to NR based tyres." Now, he added, "aircraft tyre manufacture from SR has also been established." Elsewhere in the world, NR is considered a vital ingredient in aircraft tyres because of its impact strength.

PROSPECTS OF PUNCTURE TAPPING IN SPECIFIC AREAS

Puncture tapping as a method of exploitation has been extensively evaluated on a wide variety of *Hevea* cultivars of various age groups. The results obtained from these studies suggest that it may not be a suitable method of exploitation for use throughout the economic life of the *Hevea* tree for two reasons. One is the poor yields which are inferior to those obtained from conventional tapping systems after two years of tapping. The other is the adverse bark reactions in certain wound-susceptible cultivars. In view of these constraints puncture tapping was found to be unattractive for large-scale adoption as a routine method of exploitation.

However, puncture tapping was considered to have potential for areas with acute shortage of skilled tappers or in situations where there is a prevalence of bad conventional tapping. There has also been further evidence recently in support of the suggestion that it could be used as a method to exploit immature rubber for a limited duration of one or one-and-half years prior to the trees attaining the desired girth sizes necessary for conventional tapping. Further confirmation in support of this suggestion has, however, been lacking due to the hesitation on the part of the industry to provide areas for commercial-scale evaluation.

This hesitation partly stems from the apprehension that early stimulation may be injurious to long-term yield response and since at some stage these puncture-tapped trees have to be converted to conventional tapping there are doubts about the subsequent long-term yield performance of the panel.

As implicit in the method, the bark treated with ethephon is not removed by tapping; thus the residual stimulant or its breakdown products remain on the panel for prolonged periods. The cumulative effects of residual stimulant on the bark tissues and in particular the latex vessels are yet unknown factors.

However, there has been evidence that good yields can still be obtained from these panels when tapped on conventional system after varying periods of micro-tapping. The markedly higher yields than those obtained during micro-tapping suggest that non-removal of treated bark does not adversely affect the yielding capacity of the panel.

To further determine that the presence of stimulant on the panel for prolonged periods has had no deleterious consequences, it was considered useful to study if the previously micro-tapped and stimulated panels had the capacity to respond to restimulation on conventional tapping. This study was also of interest since it could establish if an ethephon-stimulated panel would preclude obtaining positive responses to re-application of ethephon in situations where the first round of applications did not result in marked increases in yield normally associated with ethephon stimulation. This article discusses results obtained from several trials comparing yields obtained from conventional tapping with and without stimulation of previously puncture-tapped panels.

Discussion

The yield responses obtained from conventional tapping of previously puncture-tapped panels, subjected to three levels of ethephon stimulation, show that the yields obtained on conversion to conventional tapping without stimulation were very marked *(Table 1)*. This is evident from the high percentage yields obtained relative to ½S d/2 tapped unstimulated control trees. The preceding levels of stimulation had no influence on yields obtained as apparent from a comparison between trees previously treated with 2.5%, 5.0% and 10% ethephon.

All trees which were restimulated conventional tapping gave yields which were in excess of those obtained from trees which were not restimulated. This suggests that there were positive yield responses to restimulation. In contrast to trees that were not restimulated, the magnitude of yield responses obtained from trees which were restimulated was influenced by the preceding levels of stimulation during puncture tapping. Thus, trees which were stimulated with a low concentration (2.5%) of ethephon during period of puncture tapping gave the highest yield responses when restimulated on conventional tapping. Trees which were previously stimulated with higher concentrations (5% and 10%) of ethephon generally gave lower order of responses to restimulation

Puncture tapping may not be a suitable method of exploitation for use. But it is considered potential for areas with acute shortage of skilled tappers or where there is a prevalence of bad conventional tapping. Following is a detailed account of the prospects of puncture tapping reproduced from RRIM Planters' Bulletin.

Table 1.

Response of panels previously treated with different concentrations of ethephon to restimulation on conventional tapping

(Clone RRIM 600 (BO-2)—Twelve months)

Previous stimulation (1.5g. monthly)	Response to restimulation (%) Nil stimulation	Stimulated with 10%E	Additional response (%)
2.5%E			
Rep 1	181	235	54
Rep 2	173	223	50
5.0%E			
Rep 1	184	200	16
Rep 2	208	222	14
10.0%E			
Rep 1	180	198	18
Rep 2	187	221	35

All trees were previously puncture-tapped for period of thirteen months and then changed to ½S d/2 tapping.

Figures given are responses expressed as percentage of ½S d/2 unstimulated control trees.

Ready-to-use commercial ethephon formulations were used.

Restimulation by application of ethephon (10%) at 0.5g per tree to groove monthly.

Mean base yield (½S d/2 control) was 56g per tree per tapping.

ranging from 14% to 34% above the corresponding non-stimulated trees.

Previously puncture-tapped panels treated with three concentrations of ethephon applied at three frequencies when tapped conventionally without stimulation gave yield increases of 18% to 36% relative to ½S d/2 control trees *(Table 2)*. Trees previously stimulated at weekly intervals gave higher yields than those stimulated at fortnightly or monthly intervals.

Trees which were previously stimulated with the higher concentrations (5 and 10%) of ethephon were those that were restimulated on conversion to conventional tapping.

Despite the preceding higher intensity of stimulation, these trees responded positively to restimulation as evident from the better yield responses obtained, in comparison with trees that were not restimulated. The previous history of stimulation did not affect the magnitude of yield responses obtained from restimulation on conventional tapping. Thus, trees which were stimulated with 10% ethephon at weekly intervals during puncture tapping gave yield responses to restimulation which were comparable to those obtained from trees previously stimulated with 10% ethephon at monthly intervals. Similarly, trees treated with 5% ethephon at monthly intervals had comparable yield responses to those obtained from trees treated with 10% ethephon at monthly intervals.

Trees which were stimulated during the period of puncture tapping with the same concentration and dosage of ethephon recorded marked increases in yield relative to ½S d/2 tapped unstimulated contol trees when converted to conventional tapping without stimulation *(Table 3)*.

There was positive yield response to restimulation for all five replicates, ranging from 34%

Table 2.

Responses of panels previously treated with different concentrations of ethephon at various frequencies to restimulation on conventional tapping

(Clone PR 107 (BI-2)—Twelve months)

Previous stimulation (1.5g, 18 monthly)	Frequency	Response to restimulation (%) Nil stimulation	Stimulated with 10%E
2.5%E	Weekly	136	—
	Fortnightly	120	—
	Monthly	118	—
5.0%E	Weekly	128	—
	Fortnightly	—	179
	Monthly	—	210
10.0%E	Weekly	—	206
	Fortnightly	—	220
	Monthly	—	213

All trees were previously puncture-tapped for period of eighteen months and then changed to ½S d/2 tapping.

Figures given are responses expressed as percentage of ½S d/2 unstimulated control trees.

Ready-to-use commercial ethephon formulations were used.

Restimulation by application of ethephon (10%) at 0.5g per tree to groove monthly.

105% above that of unstimulated trees.

Another group of trees which were stimulated with similar levels of ethephon during puncture tapping despite being treated with various formulations (which only differed in type of bark penetrant and detergent incorporated in the formulation) recorded increases in yields when tapping was changed to conventional system without stimulation *(Table 4)*.

The increase in yields was similar for the other three replicates with the exception of one replicate.

Trees which were restimulated on conventional tapping recorded marked increase in yields, in excess of the corresponding unstimulated trees. The positive responses to restimulation was obtained for all four replicates with yield increases ranging from 47% to 70% above those of unstimulated trees.

Table 4.

Responses to restimulation on conventional tapping

(Clone RRIM 600 (BO-2)—Twelve months

Replicate	Response to restimulation (%) Nil stimulation	10%E (1.5g) monthly	Additional response (%)
1	115	185	70
2	118	165	47
3	118	174	56
4	108	171	63
Mean	115	174	59

All trees were previously puncture-tapped for period of twelve months and then changed to ½S d/2 tapping.

Panels of all trees during puncture tapping subjected to same concentration/dosage of ethephon (5% at 0.5g) for period of twelve months.

Variation between treatment involved application of formulation incorporating different bark penetrant and detergent.

Ethephon formulated in palm oil was used.

Figures given are responses expressed as percentage of ½S d/2 unstimulated control trees.

Restimulation by applicant of ethephon (10%) at 0.5g per tree to groove monthly.

Table 3.

Responses to restimulation on conventional tapping

(Clone RRIM 600 (BO-2)—Ten months

Replicate	Response to restimulation (%) Nil stimulation	19%E (1.5g) monthly	Additional response (%)
1	169	248	79
2	190	224	34
3	134	239	105
4	182	248	66
5	188	241	53
Mean	173	240	67

All trees were previously puncture-tapped for period of twelve months and then changed to ½S d/2 tapping.

Panels of all trees during puncture tapping were subjected to same concentration/dosage of ethephon (5%) monthly for period of twelve months.

Variation between treatment involved advance application of stimulant to either dry or wet panel at different intervals prior to each stimulation.

Figures given are response expressed as percentage of ½S d/2 unstimulated control trees.

Ready-to-use commercial ethephon formulations were used.

Restimulation by application of ethephon (10%) at 0.5g per tree to groove monthly.

Data presented here confirm the earlier reports that previously puncture tapped and stimulated panels give very high yields when they are retapped conventionally. The good yields were obtained irrespective of the preceding intensity of stimulation. This could possibly be attributed to the very low levels of crop extraction during puncture tapping and the effects of residual ethephon. In addition, it is now evident that these panels maintain a capacity to respond positively to restimulation on conventional tapping. Although the magnitude of the response differed, the potential to respond was not diminished by the previous intensity of stimulation. The results suggest that positive responses to restimulation can be obtained provided the earlier cycle of stimulations does not result in excessive crop extraction. The presence of ethephon or its breakdown products on the panel for prolonged periods has not adversely affected the subsequent yield performance of the panel. In the light of this knowledge there is a need for the industry to evaluate this technique so that its effectiveness can be established on a wider scale. The information thus generated will determine if this method of exploitation can be used to reduce the uneconomic immature phase of the *Hevea* tree. In view of this the Institute would welcome offer of commercial areas for joint evaluation from the industry.

Conclusion

From the foregoing the following conclusion can be made:

* Previously puncture-tapped and stimulated panels when converted to conventional tapping give very high yields
* Positive responses to restimulation on conventional tapping can be obtained from previously puncture-tapped trees.
* Good yields and positive responses are obtained irrespective of the preceding intensity of stimulation during puncture tapping.
* Presence of ethephon or its breakdown products on the panel for prolonged periods does not adversely affect its subsequent yield performance
* The absence of deleterious consequences provides support for the suggestion that early exploitation of immature trees can be carried out by puncture tapping for a duration of one to two years prior to opening for conventional tapping □

SPLIT ON NR SPECIFICATIONS

Malaysia wants to change its technical specifications for Standard Malaysian Rubber some time next year, but rubber traders and consumers seem dubious as to the need for a change and divided as to what kind of new specifications they would want. Malaysia is looking to adopt "pragmatic" new specifications for SMR that will also be acceptable to NR consumers, said Tan Sri Dr BC Sekhar, Chairman of the Malaysian Rubber Research and Development Board, at a three-day SMR revision workshop held at the MRRDB's British headquarters at Brickendonbury. The workshop was attended by representatives from all major U, S., European and Japanese tyre makers, as well as rubber traders and representatives from European manufacturers of industrial rubber products. Attendees have been reticent about what was discussed at the meeting. "If anything is going to be said, it should be said by the Malaysians, not us," said one attendee. Inside reports, however, indicate that there was considerable dissent over what the new SMR specifications should be. Trade sources say that Malaysia would like to limit SMR specifications to three grades, with no latex grades at all. They add that SMR-20, as it exists today, will cease to be produced after next year. Malaysia gives reasons of changing technology for its desire to change SMR grades. "Natural rubber is now facing a situation very different from that when the SMR scheme was introduced almost 30 years ago," said Sekhar. With the upsurge in radial tyre production and increasing automation in manufacturing plants, the predictability and consistency of NR quality has become an even greater concern among NR consumers, he added. "Malaysia now wishes to consult consumers to find a scheme which will fit the demand of the new technologies," he said. Some observers, however, are cynical about the Malaysians' motives. "What would the Malaysians consider pragmatic?" said Robert B Baird, Rubber Trader and President of Robert B Baird & Co., Southampton N. Y. "That's simple-I think it's whatever makes the most bucks for Malaysia" NR specifications, he added are "a thing that is forever evolving. It evolves privately between consumers and dealers on one hand, and between producers and dealers on the other." Baird did not attend the workshop at Brickendonbury. Neither did Thomas Cole, Chairman of the Tire Division of the Rubber Manufacturers Association. When asked about the plans to change SMR specifications, Cole said, "I would assume they (the Malaysians) would seek some comment through out the industry before they take such a revolutionary step." None of the tyre makers has yet submitted any suggestions for changes, according to a Malaysian Rubber Bureau spokesman. He also could not say whether Malaysia's recently created SMR GP (generel purpose) grade, which has been gaining increasing acceptance among rubber consumers would be affected by specification changes.

RUBBER: AN ASSURED PLACE IN ASIA'S FUTURE

LLOYD CHILVERS

TERENCE BURLEY

The rubber tree, *hevea brasiliensis*, is indigenous to the Amazon basin, having been introduced to Malaysia and Sri Lanka in the latter part of the last century, and subsequently to other parts of Asia and to West Africa. Asian production of natural rubber quickly surpassed that of South America, and the rapid development of the industry in Malaysia, Indonesia and more recently Thailand, has resulted in the region becoming the centre of the world's natural rubber industry.

Today, Asia accounts for 90 per cent of global output and Malaysia, Indonesia and Thailand alone for almost 80 per cent. Together these three major South-East Asian countries also account for most rubber that is traded internationally-no less than 88 per cent in 1982.

Malaysia, by a sizeable margin is the most important producer, although at one time Indonesian output was some-what greater. In 1983, world production amounted to nearly 4 million tonnes, of which Malaysia contributed 1.6 million tonnes or 40 per cent (Table 1). Natural rubber was for many years Malaysia's leading agricultural export, being displaced from this position only in 1982 by palm oil and its products: earnings from rubber in that year amounted to M$2655 million, while those from palm oil reached M$2746 million.

Indonesia ranks second, with output of around 1 million tonnes, or one quarter of the world total. As in Malaysia, the bulk of output is exported and rubber is an important source of foreign exchange. In Thailand, where production has been moving up steadily in recent years, output now amounts to almost 600 000 tonnes, some 15 percent of the world total.

Although natural rubber can be extracted from numerous trees and shrubs, *hevea brasiliensis* is the only source now being commercially exploited. The rubber tree takes five to eight years before it is of commercial use and then has a productive life of 25 to 40 years. In about the tenth year of productive use, yields reach a maximum and some ten years later begin to decline rapidly.

Improved tapping methods and more effective application of stimulants offer other routes to higher yields. Stimulants whose purpose is to prolong the latex flow by retarding coagulation, have been in use for many years. Such techniques may eventually persist the gap or at least narrowed substantially. The following article is a commodity profile on rubber written by Lloyd Chilvers and Terence Burley in ASIAN AGRIBUSINESS (Vol. I No. 6). The article assures a place for rubber in Asia's future.

There are several other commercially significant producers in Asia. India's output amounts to 168 000 tonnes, all of which goes to meet the needs of the country's relatively well-developed rubber manufactures industry, while China produces an estimated 150 000 tonnes, this again being consumed domestically. In Sri Lanka, production has fallen slightly during the last few years but still amounts to 137 000 tonnes, nearly all of which is exported, and the Philippines now produces 75 000, most of which goes to meet local demand.

Rubber is produced on a modest scale in Burma, Vietnam and Kampuchea and, indeed, rubber is produced by every SE Asia nation with a suitable climate. Thus the list embraces even tiny Brunei. In some cases, for example Kampuchea, extensive, but neglected, plantations exist; in others, such as Laos, 'wild' rubber has an important role to play.

Where Indo-China is concerned the general easing of the various hostilities means that rehabilitation of the rubber industry can be undertaken. For example, Vietnam's rubber plantations are reported to have expanded by 20 000 ha in 1983. The plantations in the south now total 100 000 ha in area, of which half was planted after the liberation of the south in 1975. By the end of 1985, rubber trees are expected to be cultivated on 750 000 ha of land in the country.

this knowledge there is a need for the industry to evaluate this technique so that its effectiveness can be established on a wider scale. The information thus generated will determine if this method of exploitation can be used to reduce the uneconomic immature phase of the *Hevea* tree. In view of this the Institute would welcome offer of commercial areas for joint evaluation from the industry.

Conclusion

From the foregoing the following conclusion can be made:

* Previously puncture-tapped and stimulated panels when converted to conventional tapping give very high yields
* Positive responses to restimulation on conventional tapping can be obtained from previously puncture-tapped trees.
* Good yields and positive responses are obtained irrespective of the preceding intensity of stimulation during puncture tapping.
* Presence of ethephon or its breakdown products on the panel for prolonged periods does not adversely affect its subsequent yield performance
* The absence of deleterious consequences provides support for the suggestion that early exploitation of immature trees can be carried out by puncture tapping for a duration of one to two years prior to opening for conventional tapping. □

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Although natural rubber can be extracted from numerous trees and shrubs, *hevea brasiliensis* is the only source now being commercially exploited. The rubber tree takes five to eight years before it is of commercial use and then has a productive life of 25 to 40 years. In about the tenth year of productive use, yields reach a maximum and some ten years later begin to decline rapidly.

Improved tapping methods and more effective application of stimulants offer other routes to higher yields. Stimulants whose purpose is to prolong the latex flow by retarding coagulation, have been in use for many years. Such techniques may eventually persist the gap or at least narrowed substantially. The following article is a commodity profile on rubber written by Lloyd Chilvers and Terence Burley in ASIAN AGRIBUSINESS (Vol. I No. 6). The article assures a place for rubber in Asia's future.

Table 1

Production of Natural Rubber ('000 Tonnes)

	1977	1979	1981	1982	1983*
Malaysia	1588	1570	1510	1517	1562
Indonesia	835	905	868	880	1005
Thailand	431	531	504	552	580
Sri Lanka	146	153	124	125	137
Vietnam	42	50	40	40	45
Kampuchea	15	10	1	1	5
India	152	147	151	166	168
Burma	20	20	20	20	25
China	50	91	128	140	150
Philippines	56	63	75	74	75
Other Asia	5	5	5	3	2
Total Asia	3340	3551	3426	3513	3754
World total	3615	3860	3690	3755	3985

* Provisional or estimated for some countries.

Source: *Rubber Statistical Bulletin*.

Table 2

Forecasts of Global Natural Rubber Demand ('000 Tonnes)

	1985	1990	1995	2000
Grilli et al (1980)	5245	6135	—	—
World Bank (1982)	4585	5565	6670	—
Smit (1982)—low growth scenario	4123	4897	5135	6083
—medium growth scenario	4304	4876	5051	6216
—high growth scenario	4508	4780	5203	6349

Source: *see bibliography*.

The importance of natural rubber to the economies of several Asian nations stems primarily from its export potential, but it has other features which make it of interest. In particular, cultivation and tapping is labour-intensive and mostly not amenable to mechanisation, and thus is a major source of employment: some 1.5 million families are thought to be engaged in rubber cultivation in Indonesia alone. This has not been without its problems, however, since in Malaysia labour shortages have sometimes prejudiced rubber production. In Indonesia, though, establishment of rubber smallholder schemes is seen as an important element in the country's transmigration programme.

Rubber production has also provided a base upon which to develop a local rubber products manufacturing industry. Here, as in so many other matters concerning natural rubber, Malaysia has taken the lead and now has a small but thriving rubber goods industry catering to export as well as domestic markets. Singapore, which produces no rubber, has meanwhile carved itself a unique role in the rubber trade. Large volumes, principally from Malaysia, are imported for remilling and regrading and then exported to many parts of the world, including Western Europe and the USA, as well as consuming countries in the Far Eastern region.

Production and processing

Although natural rubber can be extracted from numerous trees and shrubs, *hevea brasiliensis* is the only source currently commercially exploited. (There has in recent years been renewed interest in the potential of *parthenium argentatum*, or guayule, particularly in the USA and Mexico). The rubber tree takes five to eight years before it is of commercial use, and then has a productive life of 25 to 40 years. In about the tenth year of productive use, yield reach a maximum and some ten years later begin to decline rapidly. Natural rubber is obtained by tapping (ie the controlled wounding) of the trunk of the tree, which yields liquid latex.

A variety of yield-enhancement techniques are employed with improvements constantly being made. However, the lags between planting and maturity, and the lengthy productive life of the rubber tree, mean that scientific and agronomic advances often take many years to be introduced on a significant scale, and even longer to have any substantial impact on output. Efforts have recently been made to improve yields by broadening the genetic base, but attention has for the most part focussed on other means.

Reduction of immaturity period is a particularly useful development since it improves returns in the early years, an important consideration for both estate and smallholder projects, and there is scope for changing the time-sequence of yields such that high yields are obtained in the earlier part of the tree's lifespan-the so-called precocious yield characteristic. Higher yields must of course go hand in hand with other favourable secondary characteristics such as resistance to disease and pests as well as wind damage. Some very high-yielding varieties are not recommended because of inferior secondary characteristics, while some with outstanding secondary characteristics have unacceptably poor yields.

This dilemma is being resolved by the use of increasingly sophisticated grafting techniques. It has for some years been the practice to propagate using budgrafting, in which a high-yielding trunk clone is grafted onto a vigorous seedling root stock. This has now been refined with a second graft, resulting in a three part tree with a good root system, a high-yielding trunk and an excellent canopy which is not susceptible to leaf disease. Such techniques are already in commercial use in Malaysia on a limited scale.

Improved tapping methods and more effective application of stimulants offer other routes to higher yields. Depth of incision, positioning of tapping points and frequency of the tapping operation all help to determine yield, and must be carried out in an optimal manner to maximise output. A new method, puncture tapping, may eventually replace traditional methods, its attraction lying in its lower labour requirement.

Stimulants, whose purpose is to prolong the latex flow by retarding coagulation, have been in use for many years. They are used only on older trees, and they have proved to be especially valuable on those due for replacing in 5-10 years, where yield increases of 130 per cent have been achieved. Stimulants may be used to improve yield, while maintaining tapping frequency and intensity, or to maintain yield but with appreciably reduced tapping, thus offering savings in labour costs. Increasingly effective stimulants are now entering use.

Such techniques may eventually permit the gap between attainable and actual yields to be closed, or at least narrowed

Rubber latex in individual trays on a family rubber farm in Southern Thailand. Each tray holds enough latex to produce one sheet of natural rubber.

substantially. Annual yield of 6000 kg per hectare have been achieved experimentally but even in the most productive areas yields are presently only a fraction of this level, ranging from 1400 kg per hectare in the Philippines and 1200 kg in the estate sector in penninsular Malaysia, to only around 300 kg in the Indonesian smallholder sector.

Subsequent processing of the extracted latex takes several forms and, according to the method can be undertaken on the individual holding by the farmer, in group or estate processing centres or by private or Government-owned factories. Four major types of rubber are produced: sheets, crepes, latex concentrate and block rubbers. Rubber produced by individual smallholders is usually sheet which is air-dried (USS), while smoked sheet (RSS) comes mainly from estates. Such rubber is visually graded. Block rubbers, or technically specified rubber (TSR) as it is usually known, is typically factory-produced because of the more sophisticated techniques and machinery which are required. TSRs were introduced by Malaysia in 1965 as the SMR scheme. Rubber classified into each of the several grades thus conforms to certain specified technical characteristics, this uniformity enabling particular customer requirements to be met. Other countries subsequently introduced similar schemes-Indonesia (SIR), Thailand (TTR) and Sri Lanka (SLR)-and

TSRs today account for about 45 per cent of rubber exports from the region.

World market

Natural rubber's share of the elastomer (ie natural plus synthetic rubber) market declined progressively up to 1974, as supplies were unable to keep pace with demand and synthetics, which were relatively cheap, captured many of the outlets formerly the province of natural rubber. By 1974 its share had fallen to only 29 per cent and, although the oil shock prompted a modest switch back to natural rubber, taking its share to 32 per cent in 1975, it subsequently settled at around 30 per cent. In the last year or so, natural rubber's market share, however, again appears to have edged upwards.

While there is a part of the total rubber market that can for technical reasons be met only by synthetics, and a part which similarly can be met only by natural rubber, the residual component of the market, the size of which is surrounded by some controversy, is theoretically open to both types and usage is determined primarily by relative price levels. Thus, natural rubber's current share of around 30 per cent is not a technically determined maximum: if supplies were available at a competitive price, it could recapture at least some of the ground lost to synthetics. It has been suggested that, in fact, natural rubber could take more than 40 per cent of the elastomer market on technical grounds. With total elastomer demand last year in excess of 12 million tonnes, this would mean that well over 1 million tonnes additional natural rubber could be placed in the market.

End-uses for natural rubber may be numbered in the hundreds, but by far the largest use is in tyre manufacture which takes as much as three-quarters of total supplies, compared with only about 60 per cent ten years ago. This has resulted from the trend towards radial tyres, which require a higher proportion of natural rubber, and the increasing share of large-size tyres in total tyre production (large tyres also use a greater proportion of natural rubber). Demand for natural rubber in the tyre sector has outpaced the increase in supply, and its share of tyre rubber demand has risen. but consequently natural rubber's share of non-tyre usage has declined. Non-tyre uses include a variety of other automotive applications such as hoses, as well as belting, footwear, and sports, household and medical goods.

Rubber in Malaysia

Rubber cultivation in Malaysia is concentrated in the peninsula, which provides about 97 per cent of the country's total output. In peninsular Malaysia a total of 1.7 million hectares are planted to rubber, of which smallholder area accounts for about 72 per cent. There are some 500 000 rubber smallholdings which range in size up to 40 ha although most are below 4 ha and many are considerably smaller. Productivity on the estates is much above that of the smallholder sector: while accounting for 28 per cent of planted area, the estates contribute 40 per cent of output. Nevertheless, the estate sector has since the early 1970s diminished in importance as new smallholder schemes were established and estates were drawn by the attraction of other crops, such as oil palm.

Government has taken a close interest in the smallholder sector through the Rubber Industry Smallholder Development Authority (RISDA), set up in 1973 to oversee the development of smallholdings and co-ordinate activities of other agencies; through the Federal Land Development Authority (FELDA), which is responsible for developing new areas; and through the Malaysian Rubber Development Corporation (MARDEC), which was founded in 1971 to improve the marketing of smallholder rubber. These and other bodies have served to put Malaysia at the forefront of the development of rubber as a viable crop. Malaysia has been the instigator of many of the improvements which have been introduced in recent years to cultivating and processing practices and techniques, and it has done much to improve the status of natural rubber among end-users.

As part of a more general programme to add value to its agricultural exports, Malaysia also led in developing a rubber manufacturing industry among producers. Current domestic usage amounts for only about 65 000 tonnes, but a variety of goods for export such as rubber gloves and sports goods are already manufactured, and there is very considerable potential for the future.

In Indonesia

As in Malaysia, rubber is essentially a smallholder crop in Indonesia. Production is concentrated in Sumatra, which accounts for 72 per cent of the nation's total output, but rubber is also produced in Kalimantan (16 per cent), Java (10 per cent) and Sulawesi (2 per cent). A total of 2.5 million hectares were planted to rubber by 1980, a figure which has continued to rise since that time. About 80 per cent of the area is smallholder, the balance comprising both government-owned and private estates.

Overall, yields are only about half those of Malaysia, and smallholder yields are particularly low, at only 290 kg per ha. Among the contributory factors for this poor performance have been cited inadequate access to capital and technology, thus preventing replanting with high-yielding varieties, insufficient application of fertiliser, and poor standards of maintenance. Estate yields by contrast are, by and large, internationally competitive.

Over the last ten years, considerable efforts have been made to revitalise the smallholder sector, although to date with only limited success. Research stations have been established and, with assistance from the World Bank, nucleusestate schemes (NES), smallholders' rubber development projects (SRDP) and the project for rehabilitation and extension of export crops (PRPTC) have been set up. The NES scheme, for example, which is not limited to rubber, involves government estates functioning as nuclei, co-ordinating the development of surrounding smallholdings and providing processing facilities for smallholder output. Such schemes are still in their infancy but offer considerable opportunity for improvement in particular areas; the very wide and fragmented geographical spread of rubber smallholdings in Indonesia, however, makes the upgrading of the sector a formidable task indeed.

In Thailand

Production is concentrated in the south of the country, and Thailand relies more heavily on the smallholder than do either Malaysia or Indonesia. In 1979, a total of 1.5 million hectares were planted to rubber, of which smallholdings comprised more than 1.4 million hectares. Not only are yield low in Thailand, but the country has been very much less successfull than its competitors in moving towards production of TSRs. Indeed, their production has actually declined in recent years, to about 80 000 tonnes last year, only 14 per cent of total rubber production.

Nevertheless, production of rubber has expanded more rapidly in Thailand than in any other country. Output increased from 171 000 tonnes in 1960 to 290 000 tonnes by 1970 and 501 000 tonnes by 1980, and by last year had reached an estimated 585 000 tonnes. Most observers expect Thailand to occupy an increasingly important role as a rubber producer over the coming years, and there is indeed great scope for expansion. Much of the problem of low yields can, however, be traced to the very limited planting of high-yielding varieties: of the planted area in 1979, only 24 per cent comprised such varieties, whereas, for example, almost all Malaysian estate area is planted with high-yielding types.

Elsewhere

In contrast to most other countries, and all of the major producers, rubber cultivation in Philippines is conducted wholly on estates. Output continues to increase, albeit at a slower pace than in the 1970s and yields are most impressive. Limited further expansion is certain, but there are no plans for major investment in the rubber sector. In Sri Lanka, some 230 000 ha are devoted to rubber cultivation, split almost evenly between smallholdings and estates (although, in the Sri Lankan context, the definition of smallholding is such that it includes only those holdings of less than 4 ha, in contrast to the more usual cut-off point of 40 ha). Most of the area is given over to high-yielding varieties.

Rubber wood is becoming increasingly popular for furniture making.

India's rubber area comprises 290 000 ha, three-quarters of which is operated by smallholders, which number around 230 000. Average size of holding is therefore very small at only about 1 ha. Replanting, following recent initiations by the Rubber Board of India, is now proceeding at the rate of 15 000 ha a year. Production is likely to continue to increase, although any such output is expected to be absorbed by the country's maturing rubber products industry.

Future prospects

While it cannot be denied that there has been some diminution of interest in natural rubber in recent years, there is every indication that market prospects in the medium to long-term are quite favourable. A sustained increase in demand seems inevitable given the economic recovery in the industrialised nations; the likely absence of any return to cheap oil supplies (thereby changing the competitive relationship between natural and synthetic rubbers); the rapidly spreading preference for radial tyres, which rely more heavily on natural rubber than do cross-ply tyres; the growth of rubber-based industries (particularly tyre-manufacturing) and vehicle usage in the developing world; and the development of new, albeit lowvolume uses for natural rubber.

To be sure, long-term demand forecasts have continually been revised downwards in recent years, as less favourable scenarios have been envisaged, but then so too have forecasts of natural rubber availability. But even the least optimistic demand forecast anticipates a level of 4.9 million tonnes by 1990, compared with 3.95 million tonnes in 1983, and over 6 million tonnes by the turn of the century; suggesting that a 50 per cent increase in output will be required over thd next fifteen or so years (Table 2). And, even were a less optimistic view taken, there would still be very considerable potential for the absorption of higher output.

Meeting this increased demand will require not only heavy financial investment but an enduring commitment to improving yields from existing rubber areas through replanting with higher-yielding materials, improved tapping and stimulation practices and other agronomic techniques, enhanced recovery and collection, and the streamlining of marketing systems. New areas will also probably need to be given over to rubber although recent experimentation has shown that the massive improvement in yields which is now technically feasible could, if realised across-the-board, alone be able to meet the anticipated level of demand. And, to make the most of future opportunities, producing countries will need to change the grade and type composition of production to meet the evolving pattern of consumer demand as well as just expanding output: technically-specified rubber will continue to replace visually-graded, and demand will increasingly centre upon the main commercial grades, although at the same time certain speciality grades will need to be developed. These are relatively straight-forward adjustments: the main challenge is to steadily increase total output to satisfy demand. This is an opportunity not to be missed by the South-East Asia producer-exporters. □

TECHNOLOGY CAN DOUBLE RUBBER PRODUCTION: Dr. BC SEKHAR

In the context of an expanding economic and industrial base, production of rubber in India will continue to be short of the consumer requirement, and hence producers in Kerala must strive to produce more rubber. This was the opinion of Tan Sri Dr. BC Sekhar, former Controller of the Malaysian Rubber Research and Development Board while addressing a select gathering of rubber planters in Cochin recently.

In his opinion, the average yield of 890 kg/hectare/year could be increased to 2000 kg. with modern scientific and technological inputs. "Genetic upgradation" is the main path towards increasing productivity. Dr. Sekhar explained genetic engineering, the IRRDS-sponsored Germ Bank, yield stimulation methods, new tapping systems and inter-cropping, all aimed at improving natural rubber productivity. He said that intense efforts to increase production from 2000 kg. to 4000 kg. are already under way in Malayasia.

Citing the example of RRIM-600, Dr. Sekhar said that this alone could be planted anywhere in the rubber growing areas, and the yield could come up to as much as 1500 to 1600 kg. per hectare per annum. Nearly 70 per cent of the rubber cultivation all over the world (and India is not different) is in the hands of small holders.

Efficiency of the small holder

Compared to the estate sector, the small holder productivity is lower. Dr. Sekhar suggested that the estate sector should come forward to transfer appropriate technology to the small holder so that there could be overall enhancement of production. Moderately deep tapping with controlled stimulation is one of the prime factors for yield increase. The small holder in Kerala, given the proper technological guidance and price assurance, would have no problem in being able to produce 1500 to 1600 kg/hectare/year.

Talking about price stabilisation of natural rubber, Dr. Sekhar said that in a controlled economy such as in India, evolving and maintaining a price mechanism should be easier. India has the triple advantage of having producers, manufacturers and an expanding domestic consumer market. As it stands, natural rubber is now in a buyer's market, and hence the price is controlled by the consumers. It will be in the longterm healthy growth of both the producer and consumer sections in India to operate a price stabilisation mechanism. To arrive at a mutually acceptable formula, these sectors should come to a negotiated understanding.

With the limited land available for rubber planting and in the light of the global demand for natural rubber forecast to go up to 7.2 million MT by 2000 A.D., we have to rely more on technological innovations and modern planting practices. In the context of short supply and to meet the expanding demand for rubber, India should plan and establish more synthetic rubber plants.

ENVIRONMENTAL MUTAGENESIS AND GENETIC HAZARDS OF AGRICULTURAL CHEMICALS

CK SARASWATHY AMMA*

Animals including man and plants are exposed to a variety of chemicals in the environment, especially in recent years. Since industrial development and needs of the modern society are interlinked, pollution and ecological changes resultant of industrial advancement have their own mutagenic effects on plant and animal life. A broad spectrum of chemicals both naturally occurring and applied for different purposes of both simple and complex structure, occur around us and are present in the air we breathe, the water we drink and the food we eat. Since environmental mutagens pose a potential genetic hazard for man, both for the present and future generations, efforts must be made to detect them in our environment and eliminate or restrict their use. In other words, it will be essential to evaluate all chemicals applied to the environment for their mutagenicity.

There are manifold problems in evaluating the mutagenicity of chemicals. It is also necessary to know the types of genetic changes induced by a chemical and how persistant they are in biological systems.

The genetic changes induced by chemicals which have significance in human health. can broadly be grouped into the following categories.

1. *Point mutations:* These could be base-pair substitutions and frame shift mutations. The number of abnormalities in man, associated with monogenic inheritance has increased to over 1000 in the past fifteen years with an additional 1000 suggested, for which proof is incomplete.

2. *Reciprocal translocation:* Next is reciprocal translocations which involve breakage and exchange of segments between two non-homologous chromosomes and are transmitted in a regular manner through mitosis. Such translocations are transmitted as dominants, may be maintained in the population for many generations, and as heterozygotes produce unbalanced chromosome sets at meiosis. Viable mosaic aneuploids may arise following loss of a small translocation element at mitosis-earlier the loss, more severe the abnormality. Karyotype survey of 31,000 new born children has shown that almost 0.2% of them are translocation carriers.

3. *Non disjunction:* The third one is non-disjunction. Aneuploid individuals (monosomics and trisomics) arise due to meitic non-disjunction and non-disjunctional mosaics arise when homologues fail to separate at mitotic division. Fortunately, in man most of the monosomic and trisomic conditions lead to dominant lethals (abortion, still births, etc.) and most of them go undetected.

4. *Chromosome losses:* The fourth is the chromosome losses which may occur when a broken piece of a chromosome does not get incorporated in the daughter cells. This is detected as monosome. Almost all conditions of monosomy are uterine lethal except Turnors' syndrome (XO) which has a high frequency of survival. Also the monosomic mosaics are quite high and these are associated with mild to severe congenetial malformation Hence, even those environmental chemicals which produce chromosome breakage without any rearrangements (eg. phenols and caffeine) could constitute potential risk for future generations.

Test systems for detecting environmental mutagens

Man and other organisms are exposed continuously to the chemicals in the environment, which occur at very low concentrations. It is therefore necessary to assess properly the small mutational effects of the active ingredients of these chemicals at low concentrations. It is also necessary to detect simultaneously many types of changes which may ultimately lead to genetic hazards. Various systems are employed according to their ability and sensitivity to detect different kinds of genetic hazards. There are problems of extrapolating the genetic hazards of a chemical to human beings, once it has been shown to be mutagenic in other sub mammalian systems. Mammals and man, due to their unique mechanisms of metabolic conversion and detoxification, alter a chemical after it enters the body. Thus

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a mutagenic chemical may be converted into a non-mutagenic one or *vice-versa*, inside the body. Various test systems and their suitability for detecting different forms of mutagenic action are briefly described in the following paragraphs.

Tests to detect direct acting compounds

These employ micro-organisms and mammalian *in vitro* cell culture systems and are very useful for rapid screening of large number of chemicals. Micro-organisms used are *Neurospora*, various strains of yeast and bacteria. Tester strains of *Salmonella typhimurium* have been extensively used to detect frame-shift mutations and base-pair substitutions.

In vitro microsomal enzyme activation: To overcome the problem that some chemicals show mutagenic effects only after microsoma enzyme metabolism, bacterial indicator organisms have been coupled with liver homogenate from mammals. Alfatoxins and polycyclic hydrocarbons are some such compounds which can be detected by this system. This however, cannot test the metabolities produced inside a mammal, by routes other than liver microsomal enzymes.

Screening for mutagenic compounds produced within the Animals

Host-mediated assay: In this test the animal (a mammal) during and after treatment with a potential chemical mutagen is injected with an indicator organism in which mutation frequency can be measured. After sometime the indicator organism is withdrawn and tested for mutations induced. Blood, urine and other body fluids from animals treated with a chemical, can be tested for its mutagenic activity on indicator organisms. Mutagenicity tests using *Drosophila* offer greater advantage because one can simultaneously detect a wide spectrum of genetic changes ranging from chromosome loss to non-disjunction. There are large number of tester strains available in *Drosophila* and it is possible to run host-mediated assays by feeding *Drosophila* on plasma from mice treated with different chemicals. Moreover, microsomal enzyme activation has also been demonstrated in *Drosophila*. Hence, mutagenicity tests on environmental chemicals using *Drosophila* can give relevant and useful information.

Chemicals with mutagenic activity

Eventhough only relatively limited studies have been conducted to test the wide array of chemicals, sufficient information is available to indicate that at least some of the well known and widely used chemicals are mutagenic. Captan, a well known fungicide, is known to cause about 41% increase in chromatid break at a concentration of 10 ppm, congenital mal-formation in chicken embryo and an increase in mitotic gene conversion. Due to its hazard it was suggested by the EPA that the use of this chemical should be banned/ restricted. Among other fungicides commonly used, Benlate (Benomyl) has been tested. While no detectable increase in sex-linked recessive lethals in *Drosophila* was observed, mild chromosome breaking effects of Benlate in cultured human lymphocytes have been reported. Some of the mercurial fungicides were found to increase the frequency of sex linked recessive lethals in *Drosophila*.

Dichlorvos (DDVP) is an insecticide which has been shown to be mutagenic in different *in virto* experiments as well as lower organisms Both positive and negative mutagenicity of DDVP has been reported in *Drosophila*. This compound has also been known to increase sister chromatid exchanges in *in virto* tests. In mice and other mammalian systems, no significant increase in mutation has been induced by DDVP. It appears that DDVP which is a strong mutagen in the lower organisms is converted into non-mutagenic forms within the mammalian systems. Several other organo-phosphate pesticides which have been tested are found to be mutagenic in different systems However, malathion and metasystox have been found to be non-mutagenic in different test systems ranging from bacteria to mammals. However, malathion induced significant decrease in the content of RNA and DNA and also reduced survival of cultured human lymphocytes Tests with methylparathion have given varying results and from the available reports so far this pesticide cannot be considered free from genetic hazards. 2, 4-D and Diquat showed genetic activity. Another herbicide 2, 4, 5-T also induced chromosomal disturbances in *Drosophila*.

Sodium bisulfite, a commonly used food preservative, is known to cause ceamination of cytosine and is found to be mutagenic in *E. coli*. Widespread use of this compound in the animal systems and its continued use is not considered free from genetic hazards. According to Doll and Peto (1981) there are five possible ways or means whereby diet may affect the incidence of cancer (Table 1). More than 20% commercially available tranquilizer based on phenothiazines, have been studied for their mutagenic effects. Chlorpromazine is known to cause genetic damage. Therefore these products are believed to be posing a potential mutagenic hazard. Many products such as 'Flaggyl' which are based on related compounds have been banned in the USA and other countries.

The artificial sweetner saccharine has also been suspected to be mutagenic in action. Tests on rats have suggested an increase in the incidence of lymphosarcoma as well as blood cancer. An increase in the incidence of chromosomal aberrations in onion root tip has been shown after treatment with saccharine.

The available data on this artificial sweetner indicate that this chemical is not free from genetic hazards. There are quite a lot of industrial chemicals comprising of halogenated hydrocarbons and alkylating agents and dietary factors which are chemical carcinogens and mutagens causing mutations in many organisms.

Thus, chemicals found in the environment must be assessed for their mutagenic effects, because they can cause gene mutations and chromosome damage. Observations made on non-mammalian system provide positive indications for thorough tests in mammalian systems which are very essential. Man's genes constitute his most previous heritage, that a deterioration in gene quality can result in a corresponding decrease in the quality of life. Steady progress in the control of infectious diseases, lengthening human life span and improved procedure for identifying genetic disorders have revealed an important residue of genetic disease in human populations. We must, therefore, detect chemicals which are mutagenic in our environment, assess their risk-benefit ratio and eliminate them from our environment, or at least minimise their use when they are absolutely essential.

Further Reading:

1. Anonymous, 1975. Environmental mutagenic hazards *Science, 187:* 503-514.
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TABLE 1. WAYS OR MEANS WHEREBY DIET MAY AFFECT THE INCIDENCE OF CANCER

Possible Ways or Means	Example
1. Ingestion of powerful, direct acting carcinogens or their precursors.	a. Carcinogens in natural foodstuffs (Plant products) b. Carcinogens products in stored food by micro-organisms (bacterial and fungal) c. Carcinogens products in stored food by micro-organisms.
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3. Affecting transport, activation or deactivation of carcinogens	a. Altering concentration in, or duration of contact with feces (fiber) b. Altering transport of carcinogens to stem cells (alcohol?) c. Induction or inhibition of enzymes (which affect carcinogen metabolism or catabolism) d. Deactivation or prevention of short-lived intracellular species (eg. use of selenium vitamin E, trapping free radicals, use of beta-carotene or otherwise quenching singlet oxygen; use of other antioxidants)
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GUAYULE: AN OVERVIEW

Dr. M. A. NAZEER *

Introduction

Natural rubber is commercially obtained from the para rubber tree (*Hevea brasiliensis* Muell Arg). Guayule (*Parthenium argentatum* Gray) has been considered a viable natural rubber source in U.S.A, and Mexico since the beginning of the century. It is reported that guayule rubber contributed 10-20 per cent of the total rubber consumption in the U.S.A. during the early part of the century (Naqvi, 1983). In 1910 it provided 10 per cent of the world's natural rubber (George *et al.* 1980). It is estimated that from 1905, when the first successful guayule processing factory was established in Mexico, till 1945, when commercial production from guayule ended, a total of 125 million kilograms of guayule rubber was produced (Anonymous, 1981). However, interest in guayule dwindled after world war II, when natural rubber from *Hevea* and elastomers of synthetic origin were available in plenty (Anonymous, 1977).

Following the oil embargo and price squeeze on petroleum feedstocks by OPEC during 1973, there had been a revival of interest in guayule as a source of elastomers. Due attention was also given to R & D efforts, especially in USA and Mexico where several institutions are currently working on different aspects to develop guayule as a commercial crop. The significance attached to this species is evident from the expenditure on R & D efforts, the outlay for which was 4 million $ in the United States during 1981 (Baird, 1981). The studies mainly pertain to domestication, cultural practices, plant improvement, extraction procedures and many other related basic problems.

History

The history of guayule dates back to 1500 AD. Conquering Spaniards were the first to discover Aztec youths in Mexico, playing with bouncing balls. The natives obtained rubber from guayule by chewing of the stems (Anonymous, 1977).

Public attention to the commercial use of guayule rubber in the U.S.A. was apparently directed for the first time in 1876 (Llyod, 1911; Hammond and Polhamus, 1965; Hanson *et al.* 1979a) which lead to the establishment of many factories later. However, by 1912 many of the guayule processing mills were closed down due to depletion of the raw material, as the wild stand was continuously exploited and there had been no attempt for fresh cultivation or replanting. Subsequently, the Mexican revolution also put the mills out of business.

Restriction of rubber supply from the plantations in Malaysia by the British government in 1920s gave a boost to guayule rubber. At that time 3,240 ha of guayule was planted in California which produced 1.4 million kg of rubber. In 1942 a massive "Emergency Rubber Project" (ERP) was launched, when Japanese invaded South East Asia and blocked 90 per cent of the rubber supply to U.S.A. During this time 13,000 ha of guavule was planted and 1.4 million kg of resinuous rubber was produced. However, in 1943 production of synthetic rubber commenced and by the end of the war, when *Hevea* rubber from South East Asia re-entered the market, guayule production began to dwindle. In 1946 11,000 ha of guayule was burnt in U.S.A. However, during this time the U. S Department of Agriculture continued the investigation on guayule, though in a limited scale. This resulted in the development of deresination techniques and experimental production of heavy truck tyres which were road tested in 1953 (Anonymous, 1977).

Besides the U. S. efforts, attempts to cultivate guayule were made in Australia, Argentina, Spain, Turkey, Soviet Union and Israel. At present there are no commercial plantations in the world, except experimental plots raised in Israel, Arizona and California. An estimated 4 million ha with 2.6 million tonnes of guayule shrub stand are available in various states of Mexico. This is estimated to yield 30,000 tonnes of deresinated guayule rubber. A pilot plant for extraction of rubber was established in 1976 and tyres were manufactured which are now undergoing road tests (Anonymous, 1977). Recently, Good year company has produced 16 aircraft tyres exclusively from guayule rubber and U. S. Navy has successfully tested it in F4J Phantom II jet fighters and found that the guayule tyre performed well, compared to those made from *Hevea* rubber (Anonymous, 1983).

Systematic Position and Distribution

Guayule (*Parthenium argentatum* Gray) belongs to the tribe Heliantheae of the family Asteraceae. The genus name *parthenium* originated with Linnaeus in Species Plantarum and was based on two species, *P. hysterophorus* and *P. integrifolium* (Rollins, 1950;

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Polhamus, 1962). Guayule entered the formal literature of botany in 1852 when the famous physician and botanical explorer John Milton Beglow found it growing near Escondido Creek in Texas. Asa Gray, the distinguished Harvard botanist, gave the latin botanical name *P. argentatum* to this species, signifying the silvery sheen on the grey green leaves (Hanson *et al.* 1979 a). There are 16 species in the genus and *P. argentatum* is the only known species producing rubber. Several species cross freely with guayule and a few are employed in interspecific hybridization research.

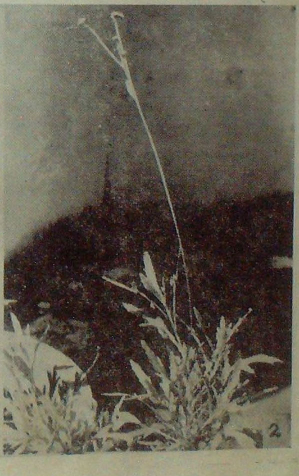
According to Muller (1946) guayule is not a typical desert plant, but rather semi desert species. It is native to North Central Mexico and Southern Texas and is scattered through out 33,700 sq km of Chihuhuan desert In the United States, the shrub is found wild in Transpecos area of Southwestern Texas at altitudes between 1,200 to 2,100 meters. The natural distribution of guayule is sporadic and patchy, generally restricted to calcareous slopes (Hanson *et al.* 1979 b; Naqvi and Hanson, 1980 a). The native habitat of guayule is classified as high desert (Hanson *et al.* 1979 b). However, the plant grows best in well drained soils and is adapted to a wide variety of shallow, stony, calcareous and friable soils (Anonymous, 1977).

Morphology

Guayule is a bushy perennial shrub, with narrow alternate leaves (Figs. 1 & 2). It attains a height of 30 to 90 cm, is hardy in nature and survives for 30 to 40 years under desert conditions where annual rainfall is less than 250 mm. (Anonymous, 1977). The plant develops a deep tap root, that may penetrate soil more than six metres, supplemented by extensive fibrous roots that may spread laterally upto three metres. This root net work allows guayule to absorb moisture from a large volume of desert soil and thus withstand periodic drought (Anonymous, 1977).

Morphological studies were initiated at Los Angeles County Arboretum with the aim of identifying morphological characters which could be used as indicators of high rubber content of plants in native populations (Naqvi and Hanson, 1981). Mehta *et al.* (1979) studied over 75 native guayule plants and grouped them into three classes based on leaf trichome morphology. Rubber content in each group was also analysed. Group I plants have leaf margins entire to two-toothed. T-shaped trichomes were found with centrally attached stalk and cap cell with two blunt ends. Plants in this group contain 17 percent rubber. Group II plants have leaf margins entire to

1



2

four-toothed and T-shaped trichomes have an acentrally attached stalk and a cap cell with short end blunt, long end pointed and straight. Rubber content in these plants was 10 percent. Group III plants have leaf margins four to eight toothed. T-trichomes have an acentrally attached stalk and a cap cell with short end blunt, long end pointed end wavy or curved. These plants contain nearly six per cent rubber. Morphological as well as biochemical data indicated the presence of mariola genes in the last two groups of plants, which might had resulted in an increase in trichome length and a decrease in rubber content.

Anatomy

Anatomical criterion that has proved valuable for selecting plants with comparatively high rubber content is bark-to-wood ratio. Since most of the rubber is stored in phloem, selection for plants which have a high phloem-to wood ratio have yielded good results (Naqvi and Hanson, 1981). Most of the rubber in guayule is located in the vascular rays of the secondary phloem. In comparing the stem anatomy of the high and low rubber guayule plants many differences were observed. In high rubber guayule plants the ratio of secondary phloem produced in relation to that of the secondary xylem is higher, the vascular rays are entirely parenchymatous and the number of vascular rays is higher. It appears that plants with high rubber content have more parenchymatous tissues available for the storage of rubber as compared to those with low rubber (Naqvi and Hanson, 1981).

Mehta (1982) conducted a detailed study of stem anatomy of *P. argentutum* and *P. incanum* (mariola) and significant differences in structural details were found in these two species. As a result of introgression of mariola genes into guayule, three different forms of the latter exist in nature. The stem anatomy of these three groups of plants differ significantly. Group I plants have taller rays with cells of pith region and vascular rays parenchymatous. In group III plants a few to many cells of vascular rays and pith have lignified secondary walls and the rays are shorter. However, in group II plants the anatomical characters were intermediate between those in groups I and III. From this study, it was concluded that group I are the least introgressed by mariola, group III plants highly introgressed and Group II intermediate.

Ultrastructure

Gilliland and Van Staden (1983) observed one year old stem tissues of guayule under electron microscope and the rubber particles appeared electron opaque and membrane bound· They were abundant in the meristematic cells of bud and shoot primordia and in the epithelial cells of resin canals. Smaller vesicles filled with rubber was apparent in the parenchyma cells ot cortex, pith and vascular rays. Chloroplasts were sparse in the stem tissue where most of the rubber occur. Backhaus and Walsh (1983) studied the ontogeny of rubber formation in guayule and found that rubber formation in stem first occurred in the cytoplasm of the epithelial cells surrounding the resin ducts and eventually in the cytoplasm of adjacent parenchyma cells. With age, rubber droplets appeared in the vacuole of both cell types. At maturity, rubber droplets increased in frequency and size, and most of the droplets occurred in each compartment-irregular or globoid in the cytoplasm and spherical in the vacuoles.

Rubber Content

Unlike in *Hevea*, rubber in guayule is contained in parehchymatous cells of the cortical tissues and medullary rays of stem and roots· There is no rubber present in the leaves. The rubber content is a measure of the total rubber present in a plant at any given time, being a measure of the amount of rubber that the plant has accumulated (Polhamus, 1962). Actively growing plants produce little rubber, but there is a gradual build up of rubber in the plant during the semi-dormant or apparently non-growing season. While all the factors which bring about this seasonal acceleration in rubber deposition are not known, it appears that the phenomenon is induced both by cool temperatures and high moisture stress (Hall, 1981). This is supported by Goss Rachel *et al.* (1984) who found that there was two fold increase in rubber formation to that of control, in guayule plants exposed to a night temperature of 7°C over a period of 6 months. The control plants were maintained at 21-24°C night temperature,

Due to considerable genetic variability, rubber content varies within the species. Various strains cultivated in USA and Mexico were reported to have a potential of only 20% rubber after 4 years of growth, whereas those grown during 1940's had 26% rubber content (Naqvi, 1978; Mehta *et al.* 1979). Naqvi (1978) collected guayule samples from 53 locations in Mexico which showed a variability in rubber content from 9 to 19 per cent. Tipton and Gregg (1982) analysed 158 plants from ten native populations and found that their rubber content varied from 5.5 to 20.0% with a mean of 14.9 $\pm$ 2.4.

Earlier workers related rubber content to morphology of the plants. Artschwagar (1943) had shown that the rubber content of the plant is determined at least in part by the amount of parenchymatous tissue available within which rubber is stored. Aizpurua (1958) found that highly branched shrub types had higher rubber than the less branched tree types.

The rubber percentage in guayule stem at any one time depends upon temperature, light intensity, water availability, nutrition and any other factors which influence the growth rate and metabolic activities of the plant (Hanson *et al.* 1979 b). Growth analysis over a period of three years had shown that the rate of increase in rubber content was high in fall and winter than in spring and summer. It was further noticed that the onset of flowering period for the second year was marked by a decline in the rubber percentage of the plant (Naqvi and Hanson, 1981). Yokoyama (1977) found that specific bio-regulators when sprayed on guayule plant cause a dramatic increase in the rubber percentages of the stem and root tissues. He showed that 2-(3, 4, dichlorophenoxy-triethylamine) when sprayed to the growing plants at a concentration of 500 ppm, caused 2.2-6 fold increase in the amount of rubber present.

Rubber analysis

Analysis of rubber content is a very important aspect in guayule research. A modified procedure based on Traub's photometric analysis is followed at Los Angeles County Arboretum (Naqvi and Hanson, 1981). Other popular methods are C-13 NMR analsyis, the soxhlet extraction methods, blender analysis etc. In gravimetric assay, retention of resin in "deresinated" guayule tissues can lead to false high rubber value. Verbisacr *et al.* (1982) developed a faster and more complete extraction procedure employing solvents of enhanced selectivity. This provides a higher purity for isolated rubber for quantitation. Lorriane and Downes (1983) found that low-resolution proton magnetic resonance could be used as a rapid procedure for determination of rubber content in guayule.

Cultivation

(i) Soil and climate

Though guayule is native to calcareous soils it grows well on a range of soil types, provided they are permeable, well-drained and reasonable moisture content is available. Guayule grows well in soil pH ranging from 6.0 to 8.5 but growth is stunted at pH 4.5 or 10.5. Guayule does not appear to be very salt tolerant and it can stand only up to 0.3 per cent salt (Srivastava and Subrahmanyam, 1983).

Warm dry summers are conducive to growing guayule with a high rubber content. Moisture is perhaps the most important factor affecting guayule growth and an annual rainfall of 280-640 mm is needed for commercial production. Highest yield is obtained when guayule is grown under irrigated conditions. However, to meet the particular stress requirements for good rubber synthesis, dry season also appears necessary (Anonymous, 1977).

(ii) Propagation

Guayule is propagated mainly through seeds, though propagation through cuttings is also possible. seeds, are spread in flat trays filled with a mixture of peatmoss and vermiculite The Seeds germinate in two days and are ready for transplanting into small containers in eight days. Although guayule seeds can be planted directly in the field, production of seedlings first and further transplanting is preferred.

(iii) Green house management

Under green house conditions the germinated seedlings are transplanted first in 5 cm pots. For optimum growth, the seedlings require well-drained soils, fortified with essential nutrients and lime Both liquid and slow-release fertilizers are used (Naqvi and Hanson, 1980 b). For liquid fertilization, the media should contain sand and peat and 500g of superphosphate per cum of the media. Best growth is obtained when a modified Hoagland's solution is added.

Under proper green house conditions, the seedlings will be ready for field transplanting in 6-8 weeks (Naqvi and Hanson, 1980 b).

(iv) Flowering and fruiting

The capitula are borne on long stalks (fig. 2) and each head contains five fertile ray florets. Flowers and seeds are produced as early as six months after germination. Vigorously growing plants bloom and set seed continuously, throughout summer. It is estimated that guayule under irrigated conditions yield 1.5 x 10^8 achenes/ha (Hammond and Polhamus, 1965).

(v) Harvesting and seed storage

Harvesting of seed can be done by hand as well as by mechanical means. A method of mechanised harvesting, cleaning and pre-treatment of guayule seeds was devised by Tipton *et al.* (1981). Achenes are harvested with a vacuum insect net and cleaned by a series of screening, threshing and forced air separation. Seeds are treated with 0.5% sodium hypochlorite (Naocl) solution in a semi automatic system and finally dried and stored. Whitworth (1983) recovered 90% seeds with a germination percentage of 70-95 by simple mechanical means. Achenes are then treated with 0.53% Naocl solution, washed, dried and stored. It is mentioned that good viability can be retained for one year in this way. If the seeds are stored carefully in sealed containers, viability could be retained for several years. The seeds collected during ERP in late 1940's were successfully germinated recently at Los Angeles County Arboretum (Anderson, 1983). In Israel, over 90 per cent germination was obtained from 20 year old seeds (Anonymous, 1977).

(vi) Seed dormancy and germination

A major problem in guayule propagation is seed dormancy.

The delayed germination is attributed to an embryo dormancy of two months and the longer lasting action of seed coat. The delayed germination was partially overcome by various earlier workers using Naocl containing 1.5% available chlorine (Mc Callum, (1929) or storing the seeds for six months or treating the seeds 2-6 months after collection, with a solution of Naocl containing 5% available chlorine (Benedict and Robinson,

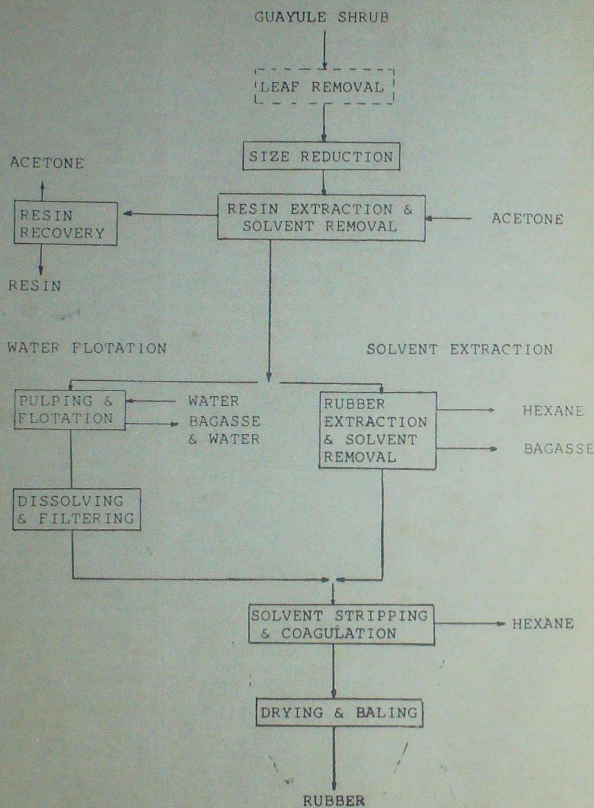


Fig. 3. The processing sequence, from shrub to the final product (from European Rubber Journal 1981).

1946). Federer (1946) reported that Naocl treatment sometimes retarded the emergence of guayule seedlings. Emparan and Tysdal (1957) and Hammond (1959) emphasised the importance of light as a factor in breaking the dormancy of freshly harvested seeds. Treatment with Nacol containing 0.75% available chlorine and Gibberelic acid (GA 3) acted as a substitute for light in breaking the dormancy (Hammond, 1959). Naqvi and Hanson (1979, 1980 c) obtained effective improvement in guayule seed germination by washing the seeds for at least eight hours in water and then soaking in a mixture of equal parts Naocl and GA3 for two hours. The optimum concentration of Naocl needed was higher for fresh seeds (1.0% for fresh seeds and 0.25% for older seeds). GA3 at 200 ppm served best for stored as well as fresh seeds. With this procedure, freshly harvested seeds germinated 100% under light and 75% in complete darkness.

Recent experiments had shown that guayule chaff present on seed, influenced seed germination. Bioassay of aqueous extracts of the chaff and seed coat showed at least seven phenolic acids. These phenolic acids were shown to be responsible for inhibition of germination and radicle growth (Naqvi and Hanson, 1982)

(vii) Disease and pests

Young guayule seedlings are susceptible to the attack of various damping off fungi during the initial stages of growth in the green house. The fungi commonly associated with damping off of guayule seedlings are species of *Pythium, Rhizoctonia, Fusarium* and *Phytophthora* (Naqvi and Hanson, 1980 b). Witch's broom disease was noted in three year old seedlings of guayule (Tipton *et al* 1982). The affected plants, though showed prolific blooming, had seeds which were small with low percent fill. The use of sterilized media, washing of pots with chlorox, treatment of seeds with Naocl and other precautions prevented the attack of fungi (Naqvi and Hanson, 1980 b). Various fungicides like Turban, in combination with Terrachlor may be used as a broad spectrum treatment for most of the damping off problems.

During warm, humid weather, the green house plants are attacked by various pests. The common one are aphids, moths, mealy bugs, white flies, thrips, mites etc. causing severe damage to the foliage and shoots. Chemical pesticides like 'Orthene' and 'Metasystox R' are effective against aphids, mealy bugs, thrips, and white flies. 'Comite' is effectively used against mites (Naqvi and Hanson, 1980 b)

Rubber Extraction

Guayule is harvested for extraction either by cutting the plant at about 5 cm above the ground, leaving the stem to regenerate or the entire plant is pulled out. Since guayule plant lacks an antioxidant, the processing may be done as early as possible. As rubber is restricted to individual cells of the plant, the whole shrub must be processed.

In conventional methods, extraction of rubber is done by various steps. Parboiling is done to coagulate rubber. Afterwards milling is done to release rubber from plant tissues and rubber is separated by flotation in large slurry tanks. Budiman *et el* (1981) reviewed various extraction procedures and deresination techniques, by which high quality rubber is obtained. Deresination may be done by subjecting fresh plants to microbial degradation or retting. In another method, freshly harvested plants are cut into pieces and then treated with acetone in a tubular extractor. By a still different method, guayule "worms" (agglomerated mass of rubber and resin) are deresinated using acetone. Recent researches at Firestone company has shown that 90% of the resins could be extracted as a by-product along with rubber (Anonymous, 1981). The various steps involved in the processing are shown in Fig. 3. In the first step, resin is recovered. Defoliated guayule is ground in hammer mills to about 3 mm particle size. Resin extraction is carried out in a continuous percolation extraction system similar to that used in oil industry. Following resin extraction the shrub is desolvenised. Acetone from desolvenisation and resin recovery is condensed and recycled. Recovery of rubber from the deresinated ground material can be done either by the flotation process or by solvent extraction method. The flotation process involves pulping and passing the pulped material through a series of mixing and flotation steps by which rubber agglomerates and floats, while bagasse or residue sinks. Rubber thus recovered is then dissolved in hexane and filtered to remove entrapped cork. Wet bagasse is recovered, dried and used as fuel. In the second method involving solvent extraction, continuous extraction of the deresinated material with hexane is done. The final rubber solution is filtered prior to rubber recovery. The rubber in hexane solution is steam stripped to remove the solvent. It is then coagulated, dried in tunnel driers and bailed. Bagasse is desolvenised, dried and used as fuel.

Rubber yield from both processes is about 90%. Rubber quality also does not appear to be affected.

Genetics and breeding

(i) Genetic system

P. argentatum is a genetically complex species, forming a polyaneuploid system comprising a wide range from diploid ($2n=36$) to octoploid ($2n=144$) (Khoshoo, 1982; Khoshoo and Subrahmanyam, 1984). Guayule plants growing in India were found to vary cytologically from $2n=54(3x)$ to $2n=74(4x+2)$ with two to four B-chromosomes

(Srivastava and Subrahmanyam, 1983). Cytologically, they are classified into three groups viz. diploids (2n = 36), triploids (2n = 54) and tetraploids (2n = 72) based on x = 18 (Bergner, 1946; Stebbins and Kodani, 1944). While the diploids are sexual, all the polyploids are pseudogamous facultative apomicts (Powers, 1945; Esau, 1946). The species is self-incompatible with a sporophytic control (Gerstel, 1950). The evolution of apomixis in guayule could probably be due to failure of chromosome reduction, failure of fertilization and development of non-reduced egg cells without fertilization. It is reported that apomixis and polyploidy evolved together in guayule with hybridization playing an important role (Powers, 1945). The genetic system has potentialities to conserve and preserve heterozygosity through agamospermy, provided the genotype has adaptive value (Khoshoo and Subrahmanyam, 1984).

(ii) Genetic markers

In guayule, plants with purple flower colour were identified among polyploid and diploid strains (Estilai and Tysdal, 1981). Purple flower colour was used as a genetic marker in hybridization studies. Diploid guayules with purple and white flower colour were crossed in all possible combinations. Crosses among white parents produced only white progenies. Reciprocal crosses between two purple parents produce fifty purple and one white. Crosses between purple and white parents produced either all white or white and purple progenies in 1:1 ratio. It was suggested that purple flower colour is a recessive trait, controlled by one pair of genes (Estilai, 1984).

The isozyme variation in guayule and allied *Parthenium* species like *P. incanum*, *P. tomentosum*, *P. fruticosm* and *P. confertum* were investigated by Radin *et al.* (1980) to help identifying genetic markers. The enzymes chiefly studied were peroxidases and esterases. Inter and intraspecific variations were observed in the case of peroxidase isozyme. Based on banding patterns, three groups of peroxidases were recognizable. The upper group-I, showed considerable variations and were subdivided into Ia and Ib. In *P. argentatum* Ia bands were present. *P. incanum* contained a different banding pattern and was classified as group II. However in *P.confertum*, a third type of banding (group III) appeared. Esterase isozyme patterns were found to be simple, and not much variable as that of the peroxidase. No esterase isozyme was located in *P. confertum*. Inheritance studies of peroxidase and esterase isozymes in F1 hybrid and back cross progenies showed extensive recombination patterns. Segregation data revealed the presence of three genetic loci corresponding to peroxidase, and two for esterase.

(iii) Germplasm

In 1910 W. B. Mc clung, a botanist, started domestication and cultural experiments on guayule in Torreon, by gathering seeds from native plants in many parts of Mexico and continued the work until 1942. As a result a number of superior lines were produced of which the strain N 593 was the standard variety during the ERP (Rubis, 1978). In 1948 B. L. Hammond made extensive collection of guayule seeds and was successful in obtaining lines with high rubber yield. Hewit Tysdal, who started systematic breeding work during 1949, developed a superior strain 11605. In 1959 seeds of 23 of the highest rubber yielding lines was sent to National Seed Storage Laboratory at Fort Collins (Rubis, 1978). Later, in 1976 guayule breeding programme was started at Arizona and 25 lines were obtained from National Seed Storage Laboratory. Reed Rollins and co-workers made an extensive germplasm collection (114 collections from 45 localities) in September 1976 (Rubis, 1978). George Hanson and associates at the Los Angeles County Arboretum selected a superior variety N 575, while Davis Rubis at University of Arizona obtained a top yielding strain 11591 (Baird, 1981).

An extensive germplasm bank has been established in the University of California, Riverside which includes the 26 U.S.D.A lines and selection from new accessions collected in Mexico; selections from Los Angeles County Arboretum and collections of North and Central American species. Besides, a number of hybrids between guayule and several other species are also maintained (Youngner, 1982). Recently four guayule genotypes were developed jointly by California Department of Agriculture and University of California, Davis and released in 1982 (Estilai, 1983; Tysdal *et al.* 1983). They are: Cal-1 and 2- developed from open pollinated seeds collected from F2 and BC1 plants of interspecific crosses between guayule and *P. tomentosum* and *P. fruticosum* respectively. Both strains showed good vigour and increased biomass production. Cal-3 resulted from intercrossing 12 diploid plants with high rubber content. This variety is a source of diploid genotypes. Cal-4 was developed as a composite of open-pollinated seeds from disease resistant diploid plants. It is a source of resistance to *Verticillum* wilt. The rubber content of these varieties varied from 1.49 to 3.5 per cent (Tysdal *et al.* 1983)

(iv) Hybridization

Guayule is very compatible with its related species. It often crosses naturally, offering opportunities to the plant breeder to add desirable features without losing rubber producing capacity (Me Ginnies, 1978). Mariola (*Parthenium incanum* HBK) is the closest relative and normally guayule and mariola are found in the same habitat. Natural interspecific hybrids between these species are often found in wild stands and there is tremendous introgression of mariola genes (Rollins, 1975). Mariola has winter hardiness, which could be transferred to guayule. A new population of diploid maniola was located by Behl *et al.* (1982), trichome studies of which showed no introgression from guayule.

Desirable qualities from related *Parthenium* species could be incorporated into guayule through interspecific hybridization. Increased vigour and biomass, cold and disease resistance and increased adaptability to diverse horticultural practices and agronomic conditions are some of the traits with potential for improvement. Successful interspecific crosses have been obtained with *P. incanum*, *P. tomentosum* and *P. fruiticosum* and the F1 hybrids were found to produce rubber. Other species that are being crossed include *P. confertum*, *P. hysterophorus*, *P. bipinnatifidum*, *P. schottii* and *P. integrifolium*. Back crossing with high rubber guayule is also being attempted to increase rubber yields (Naqvi and Hanson, 1981).

Tissue culture

Radin *et al.* (1982) initiated callus cultures in leaf and inflorescence from mature guayule plants. Initial cultures were morphologically heterogeneous and contained leaf and shoot primordia. These structures were substantially eliminated by serially culturing only the least organized callus like tissues. The selected calli from inflorescence have exhibited stable morphogenetic properties and growth rates for over one year. These cultures produced chlorophyll when grown under illumination and chemical analysis of both light and dark grown calli showed the presence of cis, 1-4 polyisoprene, besides various other compounds like alleanes sesquiterpenoids, guayulin etc. Staba and Nygaard (1983) established nine different guayule strains in tissue culture using shoot and root meristems, on static or liquid medium containing various growth regulators. Culture medium containing 6-benzyl aminopurine was best suited for callus growth and development. Smith (1983) devised a rapid invitro propagation method using excised buds, on a medium containing benzyl adenine (BA). Shoot proliferation was achieved with a concentration of 1.0 mg l^{-1}BA and root initiation, with 0.5 mg l^{-1} BA. Plantlets could be developed and grown in green house, by this way.

Research in India

Work on guayule has been taken up at the National Botanical Research Institute, Lucknow since 1978. The plant has been successfully grown from seed to seed for three generations. Standardization of propagation and cultivation techniques, cytogenetic studies and improvement by selection and breeding are being attempted (Srivastava and Subrahmanyam, 1983). Other centres involved in guayule research are Biocentre, Ahemadabad, Central Salt and Marine Chemicals Research Institute, Bhavanagar and Central Arid Zone Research Institute, Jodhpur. The Rubber Research Institute of India is also a member of the co-ordinating group for guayule research in India.

Future Research Needs

Considerable research and development efforts must be put in to place guayule among plants of commercial importance. Sizeable extend of land is available in the arid and semi-arid regions which could be considered for guayule cultivation. Studies on the adaptability of different strains to various agroclimatic regions and soil types will be of prime importance. Economic feasibility of commercial cultivation remains to be investigated. Another major problem with regard to commercial production of guayule is the low rubber productivity of the strains available in India. It is necessary to introduce improved strains and test its performance. Further improvement through breeding and selection is also necessary. It will be interesting to investigate the use of bio-regulators for increasing rubber production. Development of a quick and efficient method for estimation of rubber content or identifying certain morphological markers related with productivity are also essential.

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TRAINING PROGRAMME INAUGURATION

The various branches of Canara Bank in Kerala had disbursed an amount of Rs. 188.64 lakhs as loan during 1984 under the rubber plantation development scheme for newplanting and replanting of rubber. Though the achievement is only 50% of the target, the Bank's performance is outstanding among all other Commercial Banks in Kerala State. This was disclosed by Shri. TR Subramoniam, Deputy General Manager of the Bank at the inaugural session of a training programme organised by the Rubber Board for a group of Branch Managers at the Rubber Research Institute of India. He attributed several reasons for the poor off take of credit. He said that farmers are not willing to mortgage their property for fifteen years.

In most of the cases where replanting is undertaken the planters do not need bank finance since the income from slaughter tapping/sale of trees along with the subsidy from the Board would be adequate to meet the replanting expenses.

The subsidy is not linked to institutional finance. Shri. Subramoniam also claimed that the Canara Bank had conducted a series of extension programmes in different parts of the state to promote the scheme.

Shri PJ Thomas, Chairman, Rubber Board inaugurated the programme. Shri. P Mukundan Menon, Rubber Production Commissioner, Dr. MR Sethuraj, Director, Rubber Research Institute of India and Shri. George, Project Officer spoke on the occasion.

NEWS IN PICTURES

A SEMINAR FOR WOMEN

An exclusive seminar on rubber for women was organised at Kidangoor under the auspices of the Kidangoor unit of the Kottayam Social welfare Society at the Sreemurugan Theatre on 12th February 1985. Shri. PJ Thomas, Chairman Rubber Board inaugurated the seminar which was presided over by Rev. Fr. Thomas Kurisummoottil. Shri CI Sukumaran delivered the felicitation address.

It was for the first time that the Rubber Board organised such a seminar with the full participation of women only. About 300 women participated in the meeting. The Rubber Board Chairman promised to arrange training for women who intend to establish small scale rubber manufacturing units employing family labour and utilizing the rubber obtained from their estates.

KK Ramachandran Pillay conducted classes. SPIC Marketing Officer Mathew K Rajan conducted a class on 'Chemical Fertilizers and modern trends'. He also organised a quiz programme for the women participants. John Valayamthottam proposed a vote of thanks. The discussions were led by Sr. Jenova, Mathai Cherumanathu, Chacko Puthusserry and Sunny Valiyaparambil.

FARMERS FROM MEGHALAYA

A team of farmers from Meghalaya state visited Kerala from 20th March to 28th March 1985 to familiarise with the cultivation practices being followed in the rubber plantations here. The team consisting of 13 farmers led by Shri KC Momin, Planning Officer, Soil Conservation Department, Shillong visited rubber small holdings, estates and co-operative societies at Palai, Kuravilangad, Kanjirapally, Mundakayam, Punalur, Nagercoil and Kanyakumari. The visit to Kerala proved to be beneficial as it provided them an opportunity to learn more about rubber planting and processing aspects. They had also evinced keen interest in the activities of the Rubber Board, cooperative institutions dealing with rubber and voluntary organisations. They were much impressed with the performance of high yielding clones planted in many of the holdings in Kerala and they wanted to use the same planting materials such as RRII 105, GTI etc in their holdings in Meghalaya.

They also visited Malanadu Development Society at Kanjirapally, Estate and Factory of the Plantation Corporation of Kerala Ltd at Kodumon, plantation and polybag nursery of State Farming Corporation of Kerala at Chithelvetty, Estate at Ayiranaloor and Rehabilitation plantations and Board's nursery at Kadackamon. Also they had the opportunity to see the Velimala estate near Nagercoil and Hindustan Latex Factory at Trivandrum. They returned on 28th March 1985.

SATHEESAN AWARDED DOCTORATE

Shri KV Satheesan, a Research Officer of the Rubber Research Institute of India has been awarded Doctorate by the University of Calicut for the thesis submitted by him based on the research investigations conducted on the growth and productivity of turmeric when raised as an intercrop in coconut gardens. Dr. A Ramadas of the Central Plantation Crops Research Institute Kasargod was the principal guide of Shri Satheesan in his doctoral study.

news and notes

ADVANCED PLANNING REQUIRED FOR AERIAL SPRAYING

Shri PJ Thomas, Chairman, Rubber Board has stressed the importance of advanced planning and programming for aerial spraying operations. He said that the whole work has to be completed in a short period of 40-45 days covering an area of nearly 60,000 hectares. It involves an outlay of Rs. 4 crores. Shri PJ Thomas was presiding over the annual spray conference held on 25th February 1985 at the Council Hall of the Rubber Research Institute of India, Kottayam. Shri PN Radhakrishna Pillay, Joint Director of Research welcomed the participants. The Chairman identified the paucity of helicopters as the main constraint for the operation.

As a result of Rubber Board's constant appeal to the Government of India, the task force on Plant Protection for formulation of the 7th five year plan, took a special note of helicopter requirements of rubber plantations. The group appointed for working out the country's requirement of helicopters for agricultural purpose till 2000 AD assessed the requirement for 1985-'86 as 55 helicopters. The Chairman hoped that the recommendation of this group will be considered favourably. He mentioned the efforts being made by M/s Shaw Wallace in improving ground spraying equipments. Commenting on the increase in the cost of spraying year by year, the Chairman hoped that by introducing new innovations like Ultra low volume spraying, the cost could be reduced. He also expressed the need for more experiments in this sphere.

Spraying against abnormal leaf fall

Assessing the disease incidence and rubber Spraying during 1984, Dr. K. Jayarathnam, Deputy, Director, Pathology stated that during 1984 season, prophylactic spraying of rubber against Abnormal leaf fall disease commenced in the middle of April. But all the aerial spraying operators were fully active only by the beginning of 4th week of April, as in most of the estates the leaves did not mature due to the severe and repeated attack of Powdery mildew disease during January to March 1984.

A total area of 45,323 ha. were aerial sprayed in 1984 season. An estimated area of about 15,000 ha. were sprayed with Micron sprayers and about 75,000 ha by high volume spraying. Thus, a total area of 1,35,323 ha. were sprayed against Abnormal leaf fall disease in 1984 season. Eventhough, 12 helicopters were put into operation and there was no report of serious trouble for any of these helicopters, the total area covered by aerial spraying was found to be low. All the three major aerial spraying contractors could cover the targeted areas. But, M/s Plantation Corporation of Kerala could not spray 3000 ha. of their area due to labour problems.

Cost of chemicals

In 1984 season a total of 258.7 Metric tonnes of oil dispersible Copper oxychloride 56% powder, 29,680 litres of 40% oil based copper oxychloride and 19,575 litres of water based copper oxychloride were used for rubber spraying. In addition to these, it is estimated that about 900 Metric tonnes of Copper sulphate was also used. The total quantity of spray oil used was 6950 barrels. There was an increase of 6 to 10 per cent in the cost of spraying chemicals and spraying charges during 1984 season compared to 1983. There was no increase in the cost of spray oil.

Abnormal leaf fall disease incidence was rather mild due to the absence of pods. In unsprayed areas defoliation started only by the middle of July. In sprayed areas, mostly the leaf retention was satisfactory. No disease incidence was found in Kanyakumari district.

Helicopter availability

The action taken for improving Helicopter availability in the country was already explained by the Chairman. A commission under Dr. Kalkat, then Agricultural Commissioner recommended purchase of 8 helicopters by Department of Agricultural Aviation in 1977 itself. The group under task force of Planning Commission fixed the requirement for the year 1985-'86 as 55 number of helicopters. So far, no information could be obtained from the Directorate of Agricultural Aviation on the acquisition of new helicopters. Enquiries have been made about 'Microlight' aircraft and it was found unsuitable for aerial spraying in rubber. We have contacted the agents for Agri-Plane in India and could not get any reply from them on its suitability for rubber spraying. Field experiment to assess crop loss due to Abmormal leaf fall disease was initiated at the Central Experiment Station, Chethackal and Kumpazha Estate of M/s Harrisons Malayalam Ltd. New systemic fungicides, Delan 75 WP (Dithianon), Topsin M 70 WP and Oxadixyl were screened in the laboratory for activity against *Phytophthora*. Out of these, only Oxadyxyl was effective in high concentration. Copper oxychloride 56% powder supplied by M/s Venkateswara Agro Chemicals and Minerals Pvt. Ltd., was field tested and the leaf retention was found ot be satisfactory. This product is being recommended for use in rubber plantation. The Microspray Junior 300, a Micron Sprayer developed by M/s. Shaw Wallace & Co., for immature plantations from 3rd year upto 7th year was tested and recommended for use in rubber plantations. It was suggested that Electronic ignition may be introduced for the engine of ground power sprayers to avoid contact breakers which often create starting troubles. As in the previous year, in the crown budding experiment, the trees crown budded with RRII 33, F 4542, FX 516 had very good leaf retention without spraying. There was more yield in the crown budded areas of RRIM 600 and 628 and less in GT 1. A new replicated field experiment on crown budding with RRII 105 trunk will be initiated at Shaliacary Estate to evaluate the effects of crown budding on immaturity period, yield etc.

Shri. R. V. Narasimhan from M/s Peirce Leslie India Ltd., informed that they could spray 18,500 ha. using 5 helicopters during the 1984 season and that the results were satisfactory in all the sprayed areas. He said that helicopters would be available for rubber spraying this year.

Area sprayed

Shri PN Radhakrishna Pillai, informed that M/s Harrisons Malayalam Ltd., would arrange three helicopters for the next spraying season. Shri. TV Joseph from M/s Kerala State Co-operative Rubber Marketing Federation said that they had covered 6,000 ha during 1984 season and they have 2 helicopters ready for the current season. He requested the Chairman, Rubber Board to reconsider the issue of subsidising rubber spraying as the cost of spraying is too high for the small farmers to meet. Representing M/s Cochin Malabar Estates and Industries Ltd., Shri. Madhava Menon said that their estates were sprayed well in time and the results were satisfactory. He stressed the need for reducing the dosage required per hectare to surmount the increase in cost of spraying. He suspected that last years satisfactory results were partly due to severe Oidium attack. Shri NT Thomas, Scientific Officer of M/s Plantation Corporation of Kerala informed that they could complete spraying only in Kodumon and Perambra estates. The Kalady group could not be sprayed. The results in sprayed estates were satisfactory.

Dusting necessary

Shri. T Upendran from M/s AV Thomas & Co; stated that they could spray 3,800 ha. aerially with satisfactory results. He observed that Oidium had been severe during last year and expect the same this year as well. He requested the Rubber Board to initiate dusting programme against Powdery mildew, as this disease is on the increase. Shri. KR Nath of M/s Rehabilitation Plantation Ltd., informed that 1,600 ha. were aerially sprayed last season. This year they have to spray 2,000 ha. He suggested that the cost of aerial spraying can be considerably reduced if water based copper fungicides are used. Shri. BV Suresh from M/s Karnataka Forest Plantations Ltd., informed that 3,700 ha. were aerially sprayed during 1984 with satisfactory results.

Call for organised approach

Shri. MA Razzak, President, Venjaramood Co-operative Rubber Marketing Society complained that aerial spraying could not be carried out in his area as no helicopters turned up for spraying during the last two seasons. He expected that they might get the helicopters during the ensuing season. He also pointed out the necessity of more organised approach for the control of Powdery mildew disease and requested the manufacturers of duster cum sprayer to ensure better after sales service to their customers.

Regarding the availability and price of fungicides, Shri. R Ranganathan, of M/s Travancore Chemical and Manufacturihg Co., Ltd assured that there will not be any shortage for copper Oxychloride manufactured by them. However, there will be an increase in the price of Chlorocop to Rs. 48/- as against Rs 45/- last year and of Oleocop to Rs. 74/- against Rs. 68/- last year. He attributed the increase in price to increase in the cost of raw material in the international market. He also complained about the state Government's categorisation of Copper sulphate under chemicals liable to be taxed at about 9 % tax against 4.6% tax for fungicides. Shri. M. Indrasenan of M/s Rallis India Ltd., informed that they had supplied 136 tonnes of Fycop and 6000 litres of Fycol-8 during 1184. Shri. Suresh Sanghvi of M/s Karnataka Chemical Industries Corporation Ltd., announced that their oil based copper oxychloride which was approved by the Rubber Research Institute of India has been introduced into the market by M/s Shaw Wallace & Co., and the price would be around Rs. 47/- to Rs 48/- from 1985 season onwards.

Difficulties of manufacturing units

Representing M/s Coods Agrochemicals, Shri. Xavier Thomas Kondody raised certain difficulties being encountered by small scale manufacturing units producing Copper sulphate. He pointed out that the high rate of customs duty on copper sulphate compared to that of copper oxychloride, increase in sales tax and undue encouragement for the use of copper oxychloride by Rubber Board put the manufacturers of Copper sulphate in a difficult position. He announced that the price of Copper sulphate would be Rs. 14,300 plus ST per tonne.

Shri PN Radhakrishna Pillai, Joint Director clarified that the Rubber Board is not encouraging the use of copper oxychloride. Planters know the difficulties in high volume spraying as high labour requirement, shortage of water etc. They themselves have started using oil based formulations and one cannot now put the clock back.

Shri. B. Venkateswaraloo from M/s Indian Oil Corporation informed that they had supplied 7000 barrels of rubber spray oil during last spraying season and that in this season also there will not be any shortage for spray oil. Shri. MK Bhargava from M/s Chemoleum Pvt. Ltd., announced that their tentative price for rubber spray oil would be nearly Rs. 5,900/- kilo litre ex. Madras, subject to changes after the budget.

Shri. J. Devairakam of M/s Shaw Wallace & Co., announced that the new sprayer introduced by them during 1984 was received well by the planters. They could sell 120 units during last season. They had also improved upon the original machine and also introduced a dusting attachment to this Microspray power 400. Regarding the after sales service by Shaw Wallace, they informed that their mobile unit is touring the plantation areas and they could tackle any problem. Answering a question raised by Shri. PK Narayanan of the Rubber Board, he informed that the cost of dusting attachment is Rs. 1500/- and that the convertion of sprayer to duster is done by their mobile repair unit free of cost. Answering a query from the Rubber Production Commissioner, Shri. P Mukundan Menon, he expressed their inability to reduce the cost of Micro Spray Power 400 despite increase in production, due to the escalating price of raw materials. To the complaint of Shri. Vidyadharan on inadequate service to old models of sprayers, he promised to do the maximum service through the mobile unit. Answering a question on the use of water based fungicides raised by Shri. KC Thomas from Malankara Estate, the Joint Director of Research explained that the water based fungicides are not suitable for use in high rainfall areas. It is currently under use in either low rainfall areas like Kodumon or young plantations like that of Rehabilitation plantations.

Replying to another question on clonal susceptibility to abnormal leaf fall disease, Shri. Radhakrishna Pillai informed that different clones have shown varying susceptibility to disease depending on the rainfall pattern. RRII 105 and GT 1 could withstand the disease with moderate protection with fungicide.

The Chairman, Rubber Board in his concluding remarks thanked all the participants. He expressed that a scientific approach aimed at the reduction of cost of spraying is warranted. Subsidising every operation is not an answer. The Pathology department of RRII has a heavy responsibility in evolving ; cheaper alternatives.

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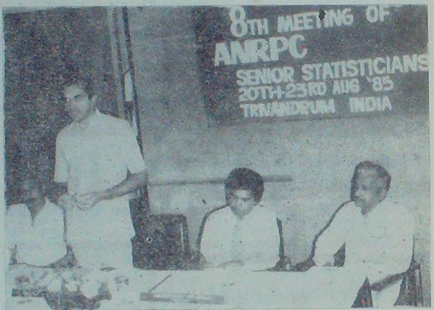
THE QUARTER

In view of its technical supremacy, natural rubber is regarded as the best all round elastomer. The shortage of this strategic material in India calls for urgency in increasing the overall rubber production in the country. Though the per hectare production has touched nearly 890 kg now, it does not give an impressive picture of the rubber scene prevailing in the country. More efforts are required for productive efficiency. The laxity or laziness to utilize the available resources would badly curtail the estimated targets.

Tapping and collection form a major chunk of the expenditure in estates and since it generates revenue, management has to keep a vigil on these aspects. Particular attention has to be paid to attain the maximum latex percentage from the existing holdings at minimum costs.

Following is a review of the proceedings of the Eighth Meeting of the ANRPC Senior Statisticians held in Trivandrum, Kerala from 20th to 23rd August 1985.

EIGHTH MEETING OF THE ANRPC SENIOR STATISTICIANS



The eighth meeting of the Senior Statisticians of the Association of Natural Rubber Producing Countries (ANRPC) was held in Luciya Hotel, Trivandrum from 20th to 23rd August 1985. Eighteen delegates including thirteen foreign participants from member countries, namely; Malaysia, Indonesia, Thailand, Sri Lanka and India attended the meeting.

The role of statistics

Shri. PC Cyriac IAS, Chairman of the Rubber Board of India, inaugurated the meeting on 20th August 1985. In his address, Shri. Cyriac emphasised the role of accurate, adequate and uptodate statistics in the orderly and systematic development of the rubber plantation industry. A common feature of the rubber growing countries is that they all belong to the category of developing economy. The rubber plantation sector in these countries is predominated by small holders and collection and compilation of statistics as such is a difficult task. Effective acquisition of statistical data in these countries could, therefore, be done with modern and sophisticated devices such as those involving remote sensing techniques. Shri Cyriac referred to the International Natural Rubber Agreement (INRA) on price stabilisation and drew the attention of the participants to the relevance and significance of quality statistics for ensuring fruitful outcome in the context of renegotiation of the Agreement. Unlike the position in other ANRPC member countries, the rubber produced in India is consumed by its own industry. In fact, the domestic production of rubber is not sufficient to meet the demand. Rubber industry in the Country heavily depends on natural rubber. As much as about 80% of the requirement is met by natural rubber as against the world average of around 32%. He added that India has gained substantially from its association with ANRPC.

Improvement

The Acting Secretary-General of ANRPC, Shri GR Chandrasiri in his introductory address outlined the role of statistics in the production and marketing of natural rubber. He also explained the various subjects to be discussed during the course of the four day meeting. One of the important topics of discussion during the meeting was the review of progress and development on improvement of natural rubber statistics in member countries. The discussions revealed that a census of rubber area was started in Indonesia in 1983 and collection of data was completed in 1983. The processing of data collected is in progress. Indonesia also

(Continued on page 4)

PC CYRIAC
New Chairman

Shri PC Cyriac IAS (43) erstwhile Chairman of Small Industries Promotion Corporation of Tamil Nadu (SIPCOT) took over as Chairman, Rubber Board on 15th July, 1985. He belongs to the Tamil Nadu Cadre and is a native of Ettumanoor in Kerala.

Shri Cyriac who graduated in Civil Engineering from the Trivandrum Engineering College in 1964 started his career as a lecturer with his almamator. Later he was selected to the Indian Administrative Service in 1966 and allotted to the Tamil Nadu Cadre. He has held several prestigious assignments under the Govt of Tamil Nadu as Sub Collector of Tanjore, Collector of Madurai, Chairman of the combined Transport Corporations of Tamil Nadu and as Chairman of SIPCOT. Shri Cyriac has also presided over the Sugar and Engineering Industries in Tamil Nadu.

FAREWELL TO PJ THOMAS

Shri PC Cyriac IAS, the new Chairman of the Rubber Board has offered to contribute his mite to the development of the Rubber Plantation Industry in India for which he sought the co-operation of all concerned including the officers and staff of Rubber Board. He was speaking at a meeting organised to bid farewell to the outgoing Chairman, Shri PJ Thomas on the evening of 15th July 1985 at the Mamman Mappilai Hall, Kottayam.

Shri V Bhaskara Pillai who welcomed the distinguished guests, gave a brief account of the progress of activities of the Rubber Board during the Chairmanship of Shri PJ Thomas. The meeting also accorded a warm welcome to Shri PC Cyriac who had taken over charge as Chairman from Shri PJ Thomas earlier in the day.

Shri Thomas in his reply gratefully remembered the co-operation extended to him by the staff and said that he was fortunate enough to receive the support from all the quarters concerning the Rubber Plantation Industry in India. The speakers on the occasion included S/Shri Jiji Thompson, IAS, Managing Director, Rubber Marketing Federation, PS John, CM George, P Mukundan Menon and Dr. MR Sethuraj besides the representatives of the various staff organisations in the Rubber Board. Shri PK Narayanan, Deputy Director (Publicity and Public Relations) proposed a vote of thanks.

(Continued from page 4)

disclosed that they would be conducting an economic census in 1986, with a view to improving the statistics. In Thailand, the office of the Agricultural Economics and the Department of Agricultural and Extension Service would jointly undertake a large-scale sample survey mainly to ascertain rubber areas by age groups and holding size. A compilation of soil mapping survey indicating soil profile with special emphasis on rubber suitability, covering the whole Thailand was released in 1983 Thereafter the Rubber Research Institute of Thailand has been concentrating its effort on doing a detailed soil survey in the potential provinces. The work would continue for some more years. Sri Lanka delegation informed the meeting that a census of rubber land in Sri Lanka was completed in 1984. During the course of census, statistics on actual planted area, tapped area, composition of planting materials used, processing and marketing techniques adopted etc. were collected. Processing of the field reports is in progress. For the census work they had utilised the service of 2,600 enumerators and about 500 checking officers. An extensive test checking on 10% sample was also carried out. An annual survey on the cost of production of rubber covering plantations of over 50 acres (20.23ha,) in extent is in progress in the country. Sri Lanka would also be conducting a survey covering holdings less than 50 acres (20.23 ha.) on a sample basis to ascertain the cost of production in the sector.

Board's efforts

In India, in 1985, the Rubber Board has conducted a census of rubber area in one taluk on a pilot basis to ascertain the reliability of the registered area statistics. During the course of the census details like area under tapping, number of rubber trees and other trees in the rubber area, production, stock, labour employed, cultural practices followed and processing techniques adopted were collected. The field work is over and the reports received from the enumerators are under processing. A scheme for conducting a complete census of rubber area in the country has been drawn up and submitted to the Govt. The Cost Accounts Division of the Govt. of India in collaboration with the Rubber Board is undertaking periodical estimation of cost of production of rubber. The latest study in these series was undertaken in 1981. The Board is updating the figures every year taking into account the changes in the cost of each inputs. In 1984. a sample survey was carried out to estimate the cost of cultivation and upkeep upto the tapping stage. The field work of the survey was completed and the report is under preparation.

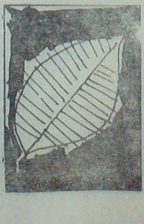
More Improvement

The meeting complimented India and other member countries for their efforts to improve the rubber statistics and urged the member countries to intensify their efforts to improve in particular the coverage timeliness and accuracy of rubber statistics in their respective countries. The meeting also considered a paper presented by the Secretariat on establishing a framework for the estimation of cost of production of natural rubber. The meeting also discussed the progress reports presented by Indonesia and Thailand, on the studies on estimating rubber areas using Remote Sensing Techniques. A good picture of these studies would be available only for the next meeting of the ANRPC Senior Statisticians.

One of the important decisions taken at the meeting was to establish a 'Work Group on Improvement of NR Statistics' to study the various recommendations arising from the various studies already conducted on improvement of NR statistics and to transalate these recommendations into appropriate measures, that could be implemented by the respective member countries. The report of the Working Group would be submitted to the next meeting of the ANRPC Senior Statisticians.

The meeting was presided over by Shri. P Mukundan Menon, Rubber Production Commissioner, Rubber Board of India who was elected to the position unanimously. The meeting complemented Shri Menon on the able manner in which he has guided the deliberations of the meeting. It is the first time that India is hosting a meeting of ANRPC Senior Statisticians. Previous meetings were held in Malaysia, Indonesia, Thailand, Sri Lanka and Singapore. The meeting has been very useful to ascertain the method followed in collection, compilation and publication of rubber statistics in member countries. It has also given an opportunity to the technical people in the field in India to exchange views with others in the field in other countries. The Indian delegation to the meeting consisted of S/Shri. RG Unny, Dy. Director (Statistics & Planning-leader) G Subbarayalu Statistician, KS Varma, Financial Adviser and Smt. E Lalitha Kumari Asst. Statistician, Rubber Board.

—RG Unni,
Dy. Director
(Statistics & Planning)



POTASSIUM REQUIREMENTS OF RUBBER

The Natural Rubber Industry has made tremendous advances in the past twenty years. These have made Natural Rubber more competitive. Over the same period, Potassium has also become the most prominent nutrient.

The eleventh Congress of the International Potash Institute held in Bern, Switzerland discussed different aspects of "Potassium Research Review and Trends". In his welcome address at the Congress, Dr. N. Celio, President of the Potash Institute declared that their aim was to arrive at a critical evaluation of past results and to assess the present state of knowledge in this particular field of science.

Potassium in the soil/plant root system, the role of Potassium in yield formation, Potassium requirements of crops etc were some of the specific items discussed by the Congress. Unless grown on very fertile soils, high yielding rubber has a fertilizer demand that far exceeds the amount of nutrients removed with the latex. Large quantities are immobilised in the trees and less than 10% of the nutrients are contained in the green branches and leaves and this explains why Potassium often becomes a critical factor on replanting.

Lack of Potassium during early growth limits the active leaf area and reduces the photosynthetic activity of the foliage. As a result girth increases slowly and it takes the tree much longer to reach tapping age.

Severe wind damage might be associated with Potassium deficiency.

To sum, up Potassium plays a dominant role in the life of the rubber tree. This has been clearly depicted in the proceedings of the eleventh Congress of the International Potash Institute. Following are the relevant paragraphs on rubber reproduced from the proceedings.

General

Latex is essentially a hydrocarbon compound containing only very small quantities of inorganic ingredients. The direct nutrient removal was therefore trifling in the early days of low-yielding seedling rubber. Early estimates put the nutrient removal at 3 kg/ha N, 0.5 kg and P and 1.8 kg K/ha (*De Vreis* (*1921*]).

As with most crops, potassium became a most important factor only when, as a result of a combination of breeding, agronomy (more intensive tapping) and crop physiology (stimulation), the potential and actual yields increased. They shot up from about 650kg/ha dry rubber in the 1920's to over 5000 kg/ha today. Early fertiliser trials showed little response to K and frequently even negative responses were reported (*Akhurst* and *Owen* [*1950*],*Owen et al*. [*1957*]).

On the basis of the low K removel in the latex and poor responses observed in the early experiments, it was concluded that.

a) rubber had a low K requirement (*Rhlnes et al*· [*1952*] and

b) most mineral soils(in Malaysia) were adequately supplied with K (*Bolton*]*1966*]).

Early practice was to apply phosphate in the planting hole (end to the cover crop) and small dressings of N (ammonium sulphate) up to the early mature stage

Modern recommandations give the main emphasis to K.

Many factors have contributed to the rapid change in thinking about the proper potassium nutrition of the crop. They fall into 3 different groups:

Group 1. Those that increase yield and nutrient requirements.

- a) Changes from seedling to clonal rubber.
- b) Better clones.
- c) Better and more complex buddings.
- d) Better upkeep.
- e) More intensive tapping systems.
- f) Yield stimulation.

Group 2. Those that decrease soil K availability.

- a) Replanting.
- b) Rock phosphate and ammonium sulphate only applied in the past.

Group 3, The correction of other nutrient deficiencies.

a) Mg deficiency.

b) B deficiency.

The combined effect of the above is that, especially for wind-prone clones and for intensive exploitation with Ethrel stimulation, potassium has become the most critical element (*Chan et al.* [*1972*] , *Puddy and Warrior* [*1960*], *Sivanadyam et al.* [*1972*] *Pushparajah et al* [*1971*])

The latest recommendations for smallholder's rubber in Malaysia range from 23-J7kg N, 0-57 k6 P_2O_5 and 25-59kg K_2O for wind-resistent clones and 15-21kg N, 0-56kg P_2O_5 and 30-70kg K_2O for wind-prone clones (*Chan et al 1972*]).

Sources of nutrient demand

Unless grown on very fertile soils (where normally more demanding crops like oil palm or cocoa are preferred), high-yielding rubber has a fertiliser demand that far exceeds the amount of nutrients removed with the latex. There are 4 reasons for this.

a. Nutrients immobilised in the trees

Very substantial quantities of nutrients are immobilised in the trunks and branches of rubber trees as shown below:

Nutrients immobilized in clone RRIM 600 (*Lim [1974]*)

Age of trees month	Number of trees per ha	Nutrients immobilized N	P	K	Mg
33	420	140	19	75	9
79	420	635	73	365	103
190	335	656	134	874	149

Large quantities are immobilised in the tree and less than 10% of the nutrients are contained in the green branches and leaves, *Shorrocks*[*1965*], and this explains why potassium often becomes a critical factor on replanting.

b. Nutrients leached from leaves

Frequent heavy rains in the tropics leach considerable quantities of nutrients from the leaves In Malaysia it has been found that with 2,540 mm of rain per annum, about 20kg of K/ha can be leached out of the foliage of mature rubber (*Lim* [*1974*]).

c. Nutrients drained with the latex

Under 'normal' conditions the nutrient drain in the latex is small. Even with the yields of 2000kg of dry rubber/ha, removal would be below 20 kg of K/ha,but nutrient removal increases steeply under yield stimulation. In extreme cases, where with stimulation of 5796 kg of dry rubber have been obtained in 10 months of tapping, removal in the latex reached 63 kg/ha (*Pushparajah et al.* [*1971*]). Stimulation decreases the D.R.C (Dry Rubber Content) in the latex, As practically all potassium is contained in the serum, any yield increase as a result of stimulation will cause a very large increase in the removal of K as shown below:

Nutrients drained on stimulation, clone RRIM 605, pannel B (*Pushparajah et al.[1971]*)

Treatment	Yield kg/ha	relative	Nutrients drained,kg ha and relative N		P		K		Mg	
No stimulation	1454	100	7.6	100	1.7	100	5.1	100	2.1	100
2,4,5T(1%)	1716	118	12.7	167	2.4	141	8.7	171	3·6	171
Ethrel*(10%)	2269	156	19.3	254	4.7	276	15.8	310	4.8	229

*2-chloro-ethylphosphoric acid

d. Inhibited feeder root proliferation as a result of exploitation (tapping)

Effect of tapping and fertiliser on girth increments (*Sivanadyan et al. [1975]*)

Treatment	Girth increment in cm (Oct.71-May J5) Tapped		Untapped	
Manured	1.2	100	2.0	100
Unmanured	1.8	150	2.4	120

Tapping interferes with the normal flow of assimilates to the roots and thus increases the nutrient drain and, at the same time, decreases the active absorbing root surface area. Feeder root proliferation is particularly inhibited by Ethrel stimulation (*Haridas et al*[*1975*]) To compensate for the poorer efficiency of the root system caused by intensive tapping, the K concentration in the soil solution must be increased.

Roles of pottasium

Effects on early growth

Lack of K during early growth limits the active leaf area and reduces the photosynthetic activity of the foliage. As a result girth increases slowly and it takes the tree much longer to reach tapping age. Good management and proper fertiliser use can reduce the time to come into tapping to less 3½ years (*Sivanadyan et al* [*1975*])

Properly fertilised trees can be opened up at a smaller diameter as they continue to put on girth even under tapping.

Effects on bark thickness and quality

As latex is produced in the bark, good bark 'quality' is most important for sustained high yield. Recent work by *Pushparajah* [*1969*]. *Pushparajah et al.* [*1974*] and *Samsidar Hamzah [1975]* have shown that K significantly improved bark thickness (bark regeneration), phloem thickness, cell size, latex vessel size and number of latex vessels per unit bark.

Effect of potassium on latex flow and latex stability (latex quality)

By improving bark quality K also increases the flow rate of latex on tapping. It has also been found that K helps to prevent pre-coagulation of latex in the cup or on the tapping cut. Improvements in latex stability could be a direct effect of K or might be caused by lower Ca^{++} and Mg^{++} levels and relatively higher P levels in the latex. High Ca^{++} and Mg^{++} values are closely associated with unstable latex. Where precoagulation of latex occurred due to excessive application of magnesium or due to high soil Mg content, application of potassium has been shown to overcome this and to increase the yield. Potassium together with phosphorus has also been shown to improve the stability of stored concentrated latex.

Potassium and wind damage

Rosenquist [1960] was the first to suggest that severe wind damage might be associated with K deficiency. He showed that:

a) Nitrogen increased losses and this effect was related to leaf N content.

b) Rock phosphate increased losses, but this effect was not correlated with leaf P content.

c) Low leaf K was co-related with heavy losses. This does not necessarily imply that low potash was the cause of the losses.

Middelton et al. [1965]. on the other hand, found that potassium reduced wood strength. Today, it is an accepted field practice to reduce nitrogen and increase potash for wind-prone clones.

Potassium and seed production

Watson et al [1965] found that, when K increased yield, less seed was produced. There was an indication that this was associated with widening of the N/K ratio in the leaves. Heavy fruiting is often triggered by a stress situation. Low K and high nitrogen could cause (temporarily) moisture stress or a stress in available carbohydrates; both might induce more profuse flowering and fruiting.

K-deficient trees tend to shed their leaves later and the 'wintering' period is longer than when K is adequate. Refoliation of trees with a good K-status is faster and more uniform and this could possibly affect flowering and fruiting.

Potassium and latex yield

As K has a pronounced positive effect on bark quality and latex stability, it follows that it also affects yield. Table below shows the effect of nitrogen and potash on girth and yield of young mature rubber grown on a Rengam series soil in Malaysia (*Pushparajah [1969]*)

Increasing the leaf nitrogen level from 3.19% to 3.46 at a K level of 1.35 increased the yield.

Increasing leaf N from 3.22 to 3.38 with a leaf K of 0.8% decreased yield.

Recent investigations of the nurient requirements of ethrel stimulated hevea have shown the need for adequate manuring under such intensive exploitation. Figure 1 shows the effect of supplementing the regular maintenance estate manuring with extra K on the response to ethrel stimulation.

N and K are the main requirments of mature rubber which receives normal (NPKMg) maintenance fertiliser during the immature period. The effectiveness of N depends largely on adequacy of K and *vise versa*.

Current recommended maintenance dressings for young mature rubber on average Rengam series soil are 130g 40g P, 160g K and 26g Mg/tree and year. With a stand of 280 tree/s ha, this would come to about

Girth and yield response of young rubber to N and K in West Malaysia Experiment Se 1/21)

Treatment	Girth increment (cm in 6 years)	%K in leaves	Mean yield/tree/tapping (g) 1st year	3rd year	6th year	6year average
N_0K_0	17.7	0.83	26.3	47.4	53.8	49.4
N_0K_2	20.4	1.48	26.0	49.2	55.1	52.2
N_2K_0	15.8	0.79	26 2	40.3	40.4	42.0
N_2K_2	20.7	1.25	23.2	50.5	66.0	57.3
S.E	1.22	0.006	1.51	4.48	5.32	
Min. sig diff. ($P<0.05$)	3 7	0.19	0.19	13.5	16.0	

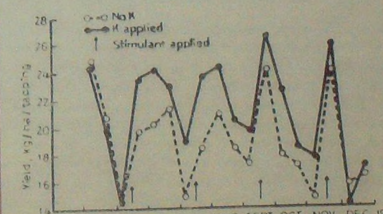


Fig. 1 Effect of potassium application on response to ethrel stimulation. (Expt. S. 484/2, clone tjir 1, seedl, panel B) *Sivanadyan et al. [1972]*.

35kg N, 11kg P, 46kg K and 7kg Mg/ha.

Critical leaf-K levels

Leaf anaylysis is widely used to assess the nutritional status and fertiliser requirements of rubber *(Beaufils[1955], Cocci[1960] Shorrocks [1965], Guha[1969], Pushparajah et al. [1972])*.

The *Rubber Research Institute of Malaya* [1963] suggested the following 'critical' values for the major nutrients (Table 14).

Later, the above levels were found to be unsatisfactory for certain newer clones. PB 5/51, RRIM 600, GTI responded to K even when leaf K ranged from 1.5-1.8% (Table 15).

On the basis of such findings, fresh criteria have been adopted (Table 16).

Conclusion

The natural rubber industry has made tremendous advances in past twenty years. These have made natural rubber more competitive. Over the same period, potassium has also become the most prominent major nutrient. Its importance will continue to grow as further progress is made in rubber breeding and agronomy.

'Critical' leaf nutrient contents of Hevea (expressed as percentage of oven-dry sample)

Nutrient	Nutrient level below which response likely		Nutrient level above which response unlikely	
	Leaves exposed to sunlight	Leaves in shade of canopy	Leaves exposed to sunlight	Leaves in shade of canopy
Nitrogen	3.20	3.30	3.60	3.70
Phosphorus	0 19	0 21	0.25	0 27
Pottassium	1.00	1.30	1.40	1.50
Magnesium	0 23	0.25		0.28

Response of clone PB5/51 to potassium in areas high in leaf potassium (*Pushparajah* and *Tan [1972]*)

K-level kg K_2O/ha/year	%K in low shade leaves 1967	1970	5 year cumulative yield, dry rubber,kg/ha
0	1.71	1.90	6585
54	1.70	1.97	5890
102	1.76	2.15	7290
156	1 62	2.14	7780

Range of K content in leaves at optimum age*in the shade of canopy (%K in dry matter)

Clone group**	Low	Medium	High	Very high
I	1.25	1.26-1.50	1.51-1.65	1 66
II	1.35	1.36-16 5	1.66-1 86	1.85

*About 100 days old

**Group I: 'Normal' clones
Group II: RRIM 600,PB 86 PB 5/51, GTI

MALAYSIA MOVES TO CENTRALISE RESEARCH

The Malaysian Rubber Research and Development Board has closed a number of its European bureaux in a move to centralise all its research activities at Brickendonbury, Herts. At the same time the MRRDB is calling for more of the cost of research to be borne by user countries rather than by Malaysia. Encik Ahmad Farouk bin Haji Ishak said that natural rubber research had now become more international. There is now more input from the producing countries which had previously benefited by the efforts of Malaysia. Farouk was speaking of the new international research programme set up by the International Rubber Research and Development Board, in which almost all the research institutes of producing countries are represented. In the new programme, costs would be shared by those countries likely to benefit. The MRRDB still maintain bureaux in a number of countries, including the US, Japan, South Korea and Australia.

ANTHER DERIVED HAPLOIDS

Dr. B. SASIKUMAR *

Haploids are organisms with a single set of genome (n number). Since last 50 years, production and utilization of anther derived hapioids have received much attention of scientists all over the world. Blakeslee in 1922 first reported haploidy in plants. India has done pioneering work in successful production of haploid embryoids. Guha and Maheswari of the Delhi University were the first to report successful production of haploid plantlets by *in vitro* culture of anthers. Nitsch (1969) was the first man to recognize the significance of haploids in crop improvement. Today, plant breeders and cytologists have realised the enormous potentialities of anther derived haploids in breeding programmes as well as in cytological and cytogenetical investigations.

Production of haploids from anther culture.

The first successful production of haploids was reported in *Datura*. Various species of *Nicotiana* has now become the most popular experimental material. Successful anther culture with haploid production has now been reported in several plant species.

Flower buds with anther containing young uninucleate or binucleate pollen are first surface sterilized Squash preparation of the anther could be done to ascertain the stage of the microspore. Individual anthers are then removed and incubated under aseptic condition for 3-6 weeks on a chemically defined media at temperature usually between 24-27° C to yield plantlets. Anthers containing uninucleate microspores have been found more receptive for the production of haploid callus and subsequent differenciation into plantlets. The development of the plantlets from the callus is influenced by the media. When a large number of plantlets are produced from one anther they can be separated and sub-cultured. After 3-6 weeks in the initial medium the plantlets are transferred to a secondary medium. The plantlets after proper development of root systems are transferred to pots.

Factors affecting the production of anther derived haploids

Various factors are associated with the successful production of haploids from anthers, such as genotype of the cultured plants, cultural media, technique, stage of microspore, conditions of anther donor plant, pretreatments adopted, cultural conditions and case of anthers during and after dissection.

Genotype of the cultured species:- The response of anthers placed in culture is influenced by the genotype of the plants. Successful production of haploids from different species is correlated with the genotype of the cultured species. Vyskot and Navak (1974) established significant genotypic effects haploid plantlet production in ten species of *Nicotiana*. It would appear that genotypes differ in the optimum level of concentration of the constitutents of the culture media and now several laboratories are investigating this aspect.

A plant breeder considering the use of anther derived haploids should be reasonably clear that gametic competition does not influence the production of haploid plants or their survival. Nataka and Kurihara (1972) however have reported that pollen competition may not influence genotype of the haploid plantlets.

Not all plantlets derived from anther culture exhibit the haploid chromosome number. Plantlets derived directly from pollen following a true embryo-genetic development are haploid individuals. This is the normal situation in species of *Nicotiana* and *Datura*. But plantlets regenerated from callus may not be true haploids. *Brassica. Oryza, Lycopersicon, Solanum nigrum Petunia, Lolium* etc. come under this category. This situation may be due to the occurence of endomitosis. It is well known that culture media also influence the level of ploidy. Some workers reported that a high concentration of IAA influences the process of endonitosis *Cultural media:-* The need for a proper culture medium for the successful production of plantlets cannot be overemphasized. Nutritional requirements for inducing cell proliferation in pollengrains vary greatly. Most species of tobacco can be cultured in the same type of medium. Sugar, iron and mineral salts are the necessary ingredients for the production of embryoids from pollengrains in tobacco. Coconut milk and plum fruit juice are also effective media in anther culture. Gbo-El-Nil and Hilderbrandt (1973) employed a method which includes a series of media. Their method consisted of an initial medium favouring callus formation, a second medium which favours shoot formation and a third one promoting root production. The culture of isolated pollen, rather than intact anther, is the recent approach.

Microspore stage: Introduction of anther containing microspore to the media at an optimum stage of development is an essential factor for the efficiency of haploid production. Anthers containing uninucleate microspores have been found most receptive for the production

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of haploid plantlets. In some cases anthers with two celled pollengrains also give rise to callus and haploid plantlets. A cytological squash preparation of the anther can be used for ascertaining the stage of the microspore.

Conditions of plant supplying anther:- Anthers selected from mother plants maintained in a vigorous and healthy condition provide the best source material. Sunderland (1971) correlated the age of the plant with the efficiency of the anther culture. Tomes and Collins (1976) observed significant effect of the number of days the plant had been in flowering on the haploid plantlet production. It has been observed that anthers from plants grown under high light intensity yielded high output.

Cultural condition:- Sufficient intensity of light is necessary to avoid etiolation of developing plantlets. An increase in the percentage of anthers responding to haploidy induction in culture is reported by Sopery and Maheswari (1976) when the culture was transferred from dark to light conditions. Temperature is also a major factor influencing anther culture experiments. Sunderland (1971) reported that temperature in the range of 25°C favours haploid androgenesis in *Nicotiana*. However, Irikura (1972) reported that a relatively cool temperature in the range of 20°C favours *Solanum* species. Most species can tolerate a medium with a pH value between 5 and 6.

Handling of anthers during and after dissection is a very critical step in the entire proceedings.

Most haploids produced by anther culture are sterile and hence maintenance of the haploid line for the production of seed and further genetic manipulation of the lines requires the establishment of diploid condition. Diploid condition can be achieved in three ways (1) as stated earlier a low percentage of haploid plants revert to diploid condition spontaneously (ii) doubling of chromosome can be easily done by colchicine treatment. [This can be done either by treating the leaf axils or by immersing of the plantlets in colchicine solution. (Nataka and Tanaka, 1961; Burk, 1972)] and (iii) by *in vitro* application of colchicine in hayloid callus cultures.

Economic utilization

The anther culture offers greater opportunity to plant breeders as a rapid method of producing fertile and completely homozygous lines which can be used directly in crop improvement programme. Collins and Legg (1975) compared the anther derived doubled haploid lines with conventionally derived lines and found the variation among haploid lines comparable in magnitude to that observed among conventionally derived lines.

Melchers and Habib (1970) enumerated the potential use of anther derived haploids in plant breeding. Their suggestions included induced mutagene*sis*, determination of genetic ratios and the development of breeding lines with specific characteristics such as combination of several dominant genes. Doubled haploid lines offers a definite advantage over the conventional backcross method of breeding which is mostly employed in transfer of genes for qualitative characters. With the use of doubled haploid lines the time required for a routine back cross programme can be drastically reduced. Moreover, it offers and increased probability of retaining the character under transfer and more rapid stabilization of the transferred genetic material in homozygous form at the end of the back cross programme. Another advantage of anther derived haploids is that with smaller population the breeder can determine phenotypic ratios. For example a monohybrid F_2 phenotypic ratio becomes a 1:1 ratio instead of a classical 3:1 ratio and the F_2 ratio for duplicate factor inheritance become 3:1 instead of 15:1. This is because the investigator is actually dealing with a gametic ratio (Collins and Legg 1975). Homozygous diploid plants for special characters can be produced from anther derived haploids by introducing the gene for the desired character and doubling the chromosome compliment of haploids. Recently this technique has been employed to study the phage mediated transfer of genes controlling galactose metabolism from the bacterium *Esherichia coli* in the haploid tissue obtained from anthers of tomato (Doy, 1973). This technique offers immense scope for transfering nitrogen fixing genes to higher plants.

Selection of induced and spontaneous mutants from anther culture are means to create useful and new genetic variability. Haploids can play a major role in the identification and selection of auxotropic mutants for elucidation of biochemical pathways, in researches to select resistance for antibiotics' base-analogues and herbicides, in selection for adaptation against environmental stress, and for selection for metabolic overproduction.

Thus anther culture offers a rapid and economic, as well as efficient, method for producing homozygous lines and developing novel varieties. The breeder can be reasonably certain that the lines he has selected are homozygous when obtained by doubling the chromosome compliment of haploid plants. Anther derived haploids can also be employed in induced mutagenesis, genetic transformation, development of specialised cytogenetic stock etc which all are important in broadening the genetic base and crop improvement.

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RIDLEY CENTENNIAL AWARD FOR Dr. B. C. SEKHAR

The third Ridley Centennial Award was presented to Tan Sri Dr BC Sekhar, for his outstanding contribution to the natural rubber industry over many years. The Award was established by the Malaysian Rubber Producers' Council in 1977. The presentation of the award to Tan Sri Dr. Sekhar came the day after his retirement as Controller of Rubber Research of the Malaysian Rubber Research and Development Board. His distinguished career in the natural rubber industry started in 1949, when, having graduated from New Delhi University and Michigan University, USA, he joined the Rubber Research Institute of Malaysia as an assistant chemist. In 1966 he was appointed Director of the Institute and in 1974 Controller of Rubber Research and Chairman of the Malaysian Rubber Research and Development Board. In the 1970s he was a leading proponent of technically specified rubber, resulting in the now well-established Standard Malaysian rubber scheme. Since then his enthusiasm has made its mark in many areas, including price stabilization through the International Natural Rubber Organisation, the Malaysian Government's Dynamic Production Policy, and the effective co-ordination of natural rubber research through the International Rubber Research and Development Board (IRRDB). In conferring the Ridley Centennial Award the Minister of Primary Industries, Dato' Paul Leong, said that Tan Sri Dr Sekhar was 'another man of rubber with similar pioneering spirit and vision worthy of Ridley's memory.'

TURBLOW TREE SPRAYER

PK NARAYANAN*

The Rubber Research Institute of India has accorded approval to TURBLOW TREE SPRAYER designed and developed by the Bombay based American spring and Pressing works, which is considered appropriate and effective as a power device to spray oil based copper fungicides on rubber trees against the attack of Abnormal leaf fall disease caused by the fungus *Phytophthora Palmivora*. The disease, if left unchecked, results in heavy shedding of leaves during monsoon, causing crop loss of alarming proportions.

Considerable headway has been made in the fabrication of this new sprayer as its weight has been brought down by replacing the metal parts of the blower mechanism has been modified to make it more efficient and lighter by using Aluminium sheets. Due to these major changes the total weight of this sprayer filled with 10 litres of fungicide solution, 2 litres of petrol and fitted with bamboo handles is only 63 Kgs. This is 14 Kg less than the lightest sprayer now in use.

The sprayer is powered by the Villiers MK 25 Petrol engine of 3.5 HP. The blower has a capacity to blow air to a velocity of over 200 Km per hour and cover a volume of 1,33,000 cubic foot per hour. This is rated to be the highest air velocity and air volume achieved by any Power sprayer developed for rubber. Thus the spray particles can reach up to a height of 75-80 feet under field conditions. Dozage of fungicide can be adjusted from 0.89 litre to 4.22 litres per minute by changing the delivery disc. As the sprayer is sturdy, operational vibration is reduced to the minimum. The mechanism to fix bamboo poles for carrying the machine is also very simple and convenient. Being lighter in weight, it can be carried easily by four persons even in difficult terrains.

The cost of the sprayer including sales tax is Rs. 12750/-. A Duster attachment also is available for this sprayer which would cost another Rs. 2000/-. The sprayer is marketed by Sujirkar's Trading Company, Cochin-2. As a promotional measure to popularise spraying of rubber trees against leaf fall disease, the Rubber Board is subsidising half of the cost of this sprayer bought by co-operatives of growers, farmesrs associations and voluntary agencies engaged in rural development, who in turn are supposed to rent out these sprayers to small holders within their gurisdiction for protecting rubber trees. □

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RUBBER GROWING THE MODERN WAY

This review of current technologies and future developments in the exploitation of the rubber tree is based on a paper by Wan Abdul Rahman, Ismail Hashim, Leong Sook Kwai, Aj Mohd Sidek Modh Din, Tan Ah Moy, and E. Pushparajah (the Rubber Research Institute of Malaysia), presented at a Malaysia-USSR joint symposium on Isoprene (Natural and Synthetic) Rubbers and Latices, in February 1984, at Kuala Lumpur.

Since the introduction of *Hevea brasiliensis* to Malaysia in 1877, there has been a rapid spread of the crop not only in Malaysia but also in South and South-East Asia. During this century or so, the technology of *Hevea* cultivation has experienced many changes, but the last 20 years in particular have seen the most dramatic innovations.

Breeding and selection have increased the *potential* annual yield of the rubber tree, from the 200 to 300 kg/ha of the original seedlings to over 2000kg/ha by the mid-1960s, and to over 3000kg/ha by the early 1980s. There is, nevertheless, always a gap between experimental yield and the actual yield obtained in commercial cultivation, caused by the interaction of environment (climate, soil, disease incidence), management (fertilizer use, covers, weed control, exploitation systems) and cultivars (clones, propagation systems *etc*).
With a better understanding of these interacting factors, yields realized in the field have risen considerably over recent years.

The average yield for both the smallholder and plantation sectors has increased by about 80 per cent during the 20 years covered by Table 1. the improvement in the estate sector (of 532kg/ha) being more than that in the smallholder sector (of 384kg/ha). The best average commercial yield obtained in the individual smallholder sector is now 1103kg/ha and in the estate sector is 1900kg/ha. Both improvements in clones (by breeding) and use of better agricultural techniques have had a significant effect in achieving these levels, although yields are still well below the potential of the tree.

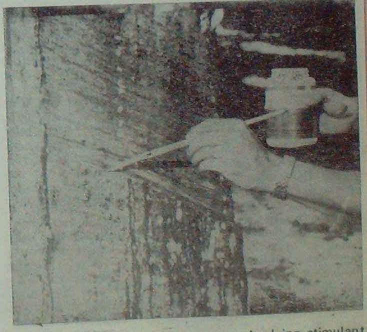
Breeding for newer clones has progressed relatively fast despite the fact that *Hevea* is a tree crop. Newer clones in testing and soon to be available for large-scale planting not only give higher yields but are precocious yielders (Table 2)[1]. Thus for example, the RRIM 900 series clones not only yield 50 per cent more than GT 1,

Table 1

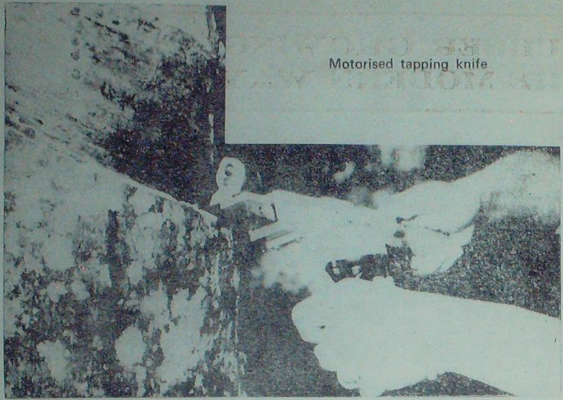
Improvement in yields in Peninsular Malaysia

	Year (kg/ha/y)[a]		
Year	Smallholdings	Estates	Mean: both sectors
1965	346	662	480 (552)
1970	515	960	705 (810)
1975	723	996	825 (950)
1980	728	1194	863 (992)

a. Over all planted area. Yields in tapped area are in brackets



Applying stimulant



Motorised tapping knife

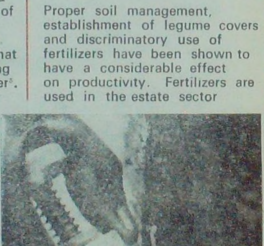
but the yield in the first year of tapping is high.

For propagating clones, budding with the selected scion is done on seedling rootstocks. Traditionally, unselected seedlings have been used as the rootstock. Recent published information shows that more selective choice of rootstock results in higher yields. In areas where moisture deficits are not large, rootstock PB 5/51 on RRIM 600 has given 14 per cent extra yield[2], while in areas where moisture deficits of 2 or 3 months are experienced, GT 1 rootstocks on PR 107 have led to 27 per cent higher yields[3].

For a long time the normal practice in establishing plants in the field was planting seed at stake followed by field budding. This was subsequently replaced by use of budded stumps, the seedlings being raised in nurseries, budded and then extracted and transplanted as bare root stumps. Developments have now shown that other methods of establishment give better performance (Table 3)[4]. The yield obtained by using 2-whorl buddings is 24 to 46 per cent higher than conventional field brown budding and the use of of 2-whorl buddings is becoming a common practice. More recent findings show that other, more advanced, planting materials improve yields further[5]. The use of such material, *ie* RRIM stumped buddings or 5 to 6-whorl plants, gives considerably higher yields than the 2-whorl buddings currently being used. The better performance of the 5- to 6-whorl buddings or stumped buddings has been ascribed to the good uniformity and vigour[6]: selection at seedling growth stage pre- and post-budding and of subsequent buddings on scion growth, produces plants of excellent quality.

Recent work has also included the use of budding on young stocks (8-10 weeks instead of the conventional 5-8 months). This enables plants to be raised to 5 to 6 whorl stage in smaller polybags (13kg soil instead of 23kg) making handling and transport easier.

Proper soil management, establishment of legume covers and discriminatory use of fertilizers have been shown to have a considerable effect on productivity. Fertilizers are used in the estate sector



Puncture tapping

Table 2

Precocious-yielding newer clones

Clone[a]	Yield (kg/ha)						
	1st y	2nd y	3rd y	4th y	5th y	Total 5y	Total as%
GT 1	700	1180	1410	1640	1570	6500	100
RRIM 600	720	1210	1600	1860	2310	7700	118.5
PB 280	1090	1500	1800	2180	2240	8900	136.9
RRIM 900	1040	1910	2280	2210	2300	9750	150.0

a. From clone trials[2], GT 1 and RRIM 600 being clones currently planted on a wide scale.

Table 3

Effect of type of establishment on immaturity (After Shepherd *et al*[4])

Planting material	Period of immaturity (mths)	Yield over 4y 3mths	
		kg/ha	as %
Brown budding-field	67	3946	100
Green budding-field	61	4575	115.9
Green budding in bags (2 whorl)	59	4872	123.5
Budded stumps in bags (2 whorl)	57	5757	145.9

fairly regularly but are seldom used in the individual smallholder sector from the time that tapping commences. The lack of both fertilizers and proper cover management in smallholdings is one of the major factors in the yield difference between the estate and smallholder sectors.

The advent of the yield stimulant *Ethephon* has opened up more avenues of increasing the productivity of the rubber tree. Firstly, it has enabled finer control of production; *eg* yields can be increased at times of high demand by intensifying the use of *Ethephon*. At the same time, the judicious use of *Ethephon* in low concentrations has enabled trees to be opened for tapping early, with consequent high and sustained yields, especially where adequate fertilizers are used (Table 4). Early opening with fertilizers and mild stimulation can lead to an additional yield of over 5000kg/ha over a period of 8 years when compared to conventional tapping.

Detailed studies [7,8] have shown the existence of clone-environment interaction, *ie* same clones are better adapted to a given environment than others. Thus in the last few years, the clones used have been chosen to suit the environment they are to be grown in.

Adoption of newer technologies such as proper fertilizer use, appropriate crop protection measures, or newer exploitation systems coupled with the use of yield stimulants, has been poor in the individual smallholder sector. This is generally due to lack of understanding and inadequate credit facilities. At the same time, the size of smallholdings does not allow any economies of scale. Currently, the agency responsible for extending aid and advice to smallholders, the Rubber Industry Smallholders Development Agency (RISDA) is introducing and implementing new technologies by grouping the small farms into composites of 40ha and above. Productivity

Table 4

Effect of early opening on yield of RRIM 600 (After Sivanadyan and Pushparajah[9])

Treatment	Cumulative yield (kg/ha) up to Dec 1982		
	Early opening[a]	Conventional opening[b]	Difference
No fertilizers	14850	13200	1650
Fertilizers	18780	13720	5060
Difference	3930	520	

a. Field budding opened at 57 mths in Oct. 1974 at a girth of 45cm and tapped on s/2 (2×3d/7) with *Ethephon* on groove.

b. Opened in May 1976 at a girth of 50cm and tapped on s/2. d/2.

in such organized areas is expected to approximate to that in the estate sector. Modernization through this system of management, in a sector which accounts for over 60 per cent of the area under rubber in Malaysia, is going to have a major impact.

With a view to reducing costs and overcoming the labour shortages currently affecting the Malaysian agricultural system, mechanization has become a pressing concern: innovations have enabled considerable progress to be made'. Some of the benefits of using machines for field operations are shown in Table 5. Mechanization not only overcomes labour shortage, but also allows faster operations, ensuring that fields are ready for planting on time.

Several diseases are found to affect rubber in Malaysia. Their occurrence is often localized to particular areas and some clones are more seriously affected than others. The most important diseases are *Oidium hevea*, *Phytophtohra botryosa*, and *Colletotrichum gloeosporioides*. The first two are known to affect not only growth but also yield [9-10]. The conventional method of control of *Oidium* was through sulphur dusting using a motorized duster (tractor or shoulder mounted) which could cover 20ha per day. The use of tridermorph-in-oil at 0.5kg/ha/round as a fog by mechanized fogging has enabled a coverage of 100-150ha per day. This is about 5 times faster than conventional sprayers or dusters and results in a 70 per cent saving.

Similarly, oil-based formulations have been developed for other diseases and pests. Weed control accounts for over 30 per cent of upkeep costs of young rubber. Conventional knapsack spraying is not only labour intensive but also expensive: it costs about M$40 in labour and about $150 to $170 in chemicals, per blanket hectare. The advent of motorized sprayers has enabled tractor-mounted treatment to reduce costs to about $30 for labour and $140 for chemicals.

More recently, ultra-low-volume (ULV) mechanized systems have been tested and found to be efficient. These require less volume to be handled and are very easy to use, even on hilly terrain. The cost is relatively low ($15 to $20 for labour and $90 to $100 for chemicals per hectare). Shortage of labour, especially of skilled tappers, can be a constraint to production. With a view to overcoming this problem, less labour intensive tapping systems have been developed [11-12]. The use of such a system, *ie* half-spiral tapping once in four or six days, but will *Ethephon* applied, has given at least similar yields to the current alternate-day tapping. At the same time, the newer system enables labour savings of up to 70 per cent (Table 6). Additionally bark consumption is low and if required the life of the trees can be extended.

Tissue culture plants

Table 5

Reduction in time and labour needed for field operations

Type of operation	Time required per ha: Manual (man days)	Time required per ha: Machine (hours)
Felling	5 (Using winch) 2 (Using chain saw)	3.0 (Bulldozer)
Holing	2	5.4
Terracing	6 to 10	10.0
Construction of drain	5[a]	1.0[a] (Back-hoe and rotary ditchers)

a. per 20 metres

In addition to a general shortage of labour, there is a concurrent shortage of skilled tappers. A combination of Puncture and excision tapping called Micro-X tapping reduces requirement for skilled tappers. In this system, a normal half spiral excision is made. For tapping, 3 to 5 punctures at equidistance are made on the half spiral cut: this can be done by any unskilled worker. After a few such tappings (usually not more than 10 or 11 on an alternate daily system) excision tapping is done for up to three tappings. Yields obtained are similar to conventional excision tapping.

In addition to the innovations discussed above which are currently being implemented in the field, the RRIM is involved in other developments, a number of which show considerable promise. As indicated earlier, tapping involves a considerable amount of skill particularly when the excision method is used. With a view to overcoming the need for skill, a motorized tapping knife has been evolved. The prototype, which is currently under intensive evaluation indicates that depth of tapping and thickness of the bark shaving can be easily controlled. This ensures a good quality tapping cut, so that optimum yield can be obtained even by unskilled tappers. Modifications have, however' been found desirable and this work is currently being given high priority.

One of the time-consuming operations in rubber production is collection of the latex, in which a tapper moves from tree to tree emptying collecting cups into a container. To overcome the need to collect latex daily after each tapping, a polybag collection method was evolved in which the yield could be collected once in 5 or 6 tappings. This however was found to have social problems and other investigations are currently in hand. One of these involves continuously dripping anti-coagulant on to the tapping cut to give longer flow times and thus enable latex to be collected through a system of conduits leading to a central point[13]. Further work is in hand to overcome the apparent cost prohibitiveness and other problems of this system.

Tissue culture is becoming increasingly important as a tool for mass propagation of desirable individual plants as well as in the production of somatic hybrids. Current investigations in tissue culture indicate that it is possible to regenerate *Hevea* plants from cells of tissues. Further refinements of this technique for *Hevea* might enable selected clones with their own root systems to be produced. This would eliminate the requirement for large field nurseries, selection of appropriate seedling stocks and the process of budding. As *Hevea* is a tree crop, genetic improvement by normal crossing and selection is a lengthy process. The use of tissue culture should enable iimprovements in *Hevea* plants to be made more readily through chemical mutation as well as through genetic manipulation of cells. Emphasis is currently being centred on such investigations.

Normal practice in producing latex is to allow the trees to grow for 4-6 years and attain a girth of 45 to 50cm before they are exploited. Investigations[14] have shown that if the plants were destructively harvested earlier and the rubber extracted from the shoots chemically, yields of up to 950kg/ha/annum could be obtained. Extraction rates could be higher than this if new clones were selected on the basis of percentage rubber hydrocarbon in tissues as opposed to the current system of selecting *Hevea* for maximum yield on exploitation.

Fogging in rubber plantations

Horticultural manipulation by crown budding or producing a three-part-tree has been found to be useful in modifying properties such as the Mooney viscosity of rubber. This has been done by grafting the crown of a clone with low Mooney viscosity on to a high-yielding trunk producing a high Mooney viscosity rubber[15]. It has thus been possible to lower the Mooney viscosity of the final rubber that is obtained from the trunk. Such manipulations therefore offer a route to obtaining rubber of specified characteristics.

At the same time, attention is now being focused on biomodification of natural rubber. The pathways for biomodification would include progressive secession of one or both ends of the polymer or the splitting of the polyisoprene chain into smaller fragments. If this were to be achieved, then modified rubber such as expoxidized rubber and deproteinized rubber could be produced more cheaply than by the present chemical modification. Biodegradation of natural rubber allows for another approach to biomodification. Current investigations indicate that both purified as well as raw natural rubber can be biodegraded by selected micro-organisms. The production of a low-molecular-weight rubber through such a process has potential for reducing production costs as well as being of practical benefit in applications in the liquid rubber and adhesive fields.

It can be seen that the natural rubber producing industry in Malaysia has transformed itself from a peasant agriculture to an organized one by adopting a variety of new technologies. Innovations, particularly in clone selection and breeding, in planting, tree maintenance and the extraction of yield, have resulted in considerable progress, not only in modernizing the industry but also in increasing productivity per unit area. Current research investigations clearly indicate that the potential for further improvements is great. Thus the natural rubber industry in Malaysia should be able to make rapid progress in the years to come.

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TWO PRODUCERS PLAN MAJOR NR PROJECTS

Malaysia and Sri Lanka have launched major projects to boost natural rubber production. Sri Lanka has begun a four-year, $244.7 million programme to reverse the decline of its agricultural exports - including Hevea rubber - by rehabilitating production and processing facilities. Malaysia, meanwhile, will spend $61.4 million during a five-year period to improve the productivity of small NR producers in northeast Peninsular Malaysia. The Asian Development Bank, which is partially funding both projects, said the Sri Lankan programme involves lands managed by two public sector corporations, the Sri Lankan State Plantations Corp. and the Janatha Estates Development Board. About one-third of the Island nation's NR output comes from lands under the two organizations' control, as well as 75 per cent of the tea and 10 percent of the coconut production. Funds for the project will come from the Asian Development Bank ($45 million); the International Development Association ($55 million); the Overseas Development Administration of the United Kingdom ($10 million); and the OPEC Fund for International Development ($5 million). Another $5 million will come from one of several interested agencies, the bank said, while the remainder of the costs will be met by the Sri Lankan government, the Bank of Ceylon and the two estates. In Malaysia, the Trengganu Smallholders Development project is aimed at improving the situation of traditional smallholder. NR growers who haven't benefited from the mainstream of economic development, and whose prospects are held back by the small size of their holdings and low productivity, the bank said. About 4,000 hectares (9,884 acres) will be replanted with high-yielding rubber, and another 10,000 hectares (24,700 acres) replanted with oil palm. About 70 percent of the land will be organized into units 40 or more hectares to form centrally managed mini-estates while 30 per cent of the land will be planted by the smallholders themselves. The government of Malaysia will provide about $36 million for the project.

RUBBER WOOD: A STUDY OF SUPPLY AND DEMAND IN INDIA

DR. V. HARIDASAN & K. G. SRINIVASAN

Introduction

The shrinking of the area under forests has been causing great concern and anxiety among the Indian planners and policy makers for a long time. The per capita forest area which was around 0.2 hectare in 1954-55 has declined to 0.11 hectare by 1982-83. The National Forest Policy Resolution of 1952 proposed to increase the area under forests to 33.3 per cent of the total land area. But the target has not been fulfilled as the percentage was only 22.8 in 1982-83.

With the increase in population, the demand for wood of every kind is bound to increase. Our people are traditionally depending on firewood for cooking. Wood is also required for a variety of uses in such industries as paper, plywood, match, furniture, building, packing case and a host of others. Naturally there must be increase in the availability of wood; but unfortunately there is a decline in the availability. The gravity of the situation has been recognised by the Sivaraman Committee on Backward areas. The Committee noted that by the turn of the present century rural India would need 250 to 300 million cubic metres of wood every year and to meet that requirement it would be necessary to plant fast growing trees over an area of four million hectares every year for the next 20 years*. In this connection an examination of the role of rubber plantation industry to alleviate the situation is relevant.

*Commerce, Bombay 8 September, 1984. p 384.

Findings of studies

To evaluate the demand and supply of rubber wood, the Rubber Board has been carrying out studies frequently. A study has been conducted recently to assess the availability of rubber wood in the next five years. The study covered around 10000 hectares under rubber. The information was collected from the estates by sending a questionnaire. A similar study was made in 1972-73. The present study collected information on the type of rubber trees felled in the estates, the number of trees per hectare at the time of felling, the quantity of wood obtained per tree, the cost of felling, the programme of felling during the next five years etc.

The present study has revealed that at the time of clear felling there were 227 trees per hectare. In the previous study (1972-73) the corresponding figure was 184 trees. The difference for the number of trees in the two studies is due to a number of factors. In 1972-73, the trees felled for replanting were mainly ordinary varieties, whereas the present study shows that they are more often clonal seedling trees. It is a common knowledge that high yielding clonal seedling trees are usually looked after well by the planter compared to ordinary varieties and as a result the stand per hectare at the time of clearfelling would be higher. Further the application of fertilizers and plant protection chemicals has been more in vogue during the last twenty years when these trees were in their prime of youth. These reasons coupled with the good maintenance, resulted in more number of trees available at the time of clear felling. The initial stand however is higher and according to the Rubber Board recommendation it is to be 420 to 445 trees per hectare for buddings.

Although there are more trees at the time of clear felling, the wood per tree is found to be lower in the present study compared to the previous one. According to the present one, the average wood available per tree is 31 cft (0.88 cmt) as against 37 cft (1.05 cmt) in the previous study. This decline is due to the fact that when there are more trees in a unit area, the size of each tree is bound to be lower, because of the competition for plant nutrients by the trees and the consequent lowering of the quantity of available plant food among them, resulting in lower girthing per tree. The increase in the number of trees at the time of clear felling has resulted in 3 per cent increase in the total wood available from a hectare.

It has been found in the present study as well as in the previous one that a certain percentage of wood is used in the estate itself, as firewood in the smoke house and by the workers. Around 10 per cent of the total wood is used in the estates and it is mainly of branch wood.

There has been increase in the price realised by the estate

found to

from the sale of wood. In the previous study the price per tree was around 18 rupees which has gone up to Rs. 122 in the present one. However such a price is generally available to estates accessible by road. Consequently there has been increase in the cost of clear felling which was Rs 2.50 per tree in 1972-73. The corresponding figure is Rs. 14/- per tree today.

The Rubber Board has been encouraging subsidised replanting since 1957. The progress of replanting over the last five years averaged around 4000 hectares per annum. On that basis and taking into account the findings of the above study, 28 million cft (0.79 million cubic metre) of rubber wood would be available in India per annum. It has been found from studies that on an average the rubber tree would give about 60 per cent of stem wood (round wood) and 40 per cent of branch wood. On that basis the stem wood and branch wood available per year are placed at 17 million cft (0.48) million cmt) and 11 million cft, (0.31 million cmt) respectively. Most of the branch wood is utilised as firewood in Kerala and a large part of it within the estates themselves.

Utilisation of rubber wood

Surveys have been conducted periodically to find out the number of saw mills exclusively or predominantly handling rubber wood in Kerala. The surveys conducted in Kottayam district a few years ago and Quilon district last year, have revealed that there were 163 saw mills handling rubber wood. Idukki, Ernakulam, and Trichur districts are the other three important districts producing rubber wood. In these districts the number of saw mills handling rubber wood is placed at 150. The main activity of these units is to saw the stem wood for manufacturing packing case materials. Two units are also located in Kottayam district of Kerala to produce furniture, window and door frames, shutters, T. V. cabinets etc., out of rubber wood and a number of plywood factories and veneers and splinter factories* also use rubber wood. Still packing case is the most important product of the industry.

Although rubber is produced mainly in Kerala, it is sold outside the State as packing case material. The main centres of consumption of packing case according to importance are Bombay, Madras, Poona, Bangalore, Hyderabad and Coimbatore. Studies have been made as to the quantity of rubber wood consumed in Bombay, Madras, Poona and Coimbatore and a reasonable estimate has been prepared for the remaining places.

Table II

Number of dealers (1984)

Centres	No. of principal dealers identified
Bombay	23
Madras	34
Poona	31
Coimbatore	10
Total	98

Railway wagons, trucks and ships are used to transport rubber wood from Kerala and Kanyakumari district. However shipping is confined to the transport of rubber wood from Calicut to Bombay. For the purpose, mechanised country craft known as *Uru* in Malayalam is used. It takes 5 to 6 days to reach Bombay by this mode of transport and the cost of transport per tonne comes to around Rs. 200/-. By road and rail it takes 4 to 5 days and 12 to 15 days respectively to reach Bombay from Kerala and amount to Rs. 370/- to Rs. 400/- per tonne as transport cost.

Table I shows the quantity of rubber wood cosumed at the important centres.

Table I

Packing case materials consumed (1984)

Bombay	—	3.7 million cft	(0.105 million cmt)
Madras	—	2.7 ,,	(0.076 ,,)
Poona	—	2.0 ,,	(0.057 ,,)
Bangalore	—	1.5 ,,	(0.042 ,,)
Hyderabad	—	1.0 ,,	(0.028 ,,)
Coimbatore	—	0.7 ,,	(0.020 ,,)
Other places in Tamil Nadu, Karnataka & Andhra	—	2.00 ,,	(0.057 ,,)
		13.6 ,,	(0.385 ,,)

In Bombay, Madras, Poona and Coimbatore there exist distinct markets for rubber wood packing case material and a number of dealers have been identified as the principal sales outlets in these places. In all these centres the trade is concentrated in the hands of a few dealers.

The packing cases are sold in different grades and the common grade is of the size ¾ to 1 inch (1.88 to 2.5 cm) X 5 to 8 inches (12.5 to 20 cm) X 5 ft (1.5 metre). The price per cft (or 0.028 cmt) of the common grade in different marketing centres in the beginning of 1984 is shown in table III.

* A separate study of rubber wood consumption in plywood factories and veneers and splinters factories is in progress.

Table III

Price per cft. of common grade of packing case material-1984

Bombay	Rs. 26 per cft (0.028 cmt)
Poona	26 ,,
Madras	25 ,,
Coimbatore	23 ,,

The future

There appears to be vast scope for converting rubber wood into quality wood with a view to making quality products. At present there is some awareness regarding the use of rubber wood for the purpose of manufacturing plywood. In a recent study by the Forest Research Institute of Kerala it has been observed: "In India at present rubber wood is mostly used for firewood, packing cases and match veneers and splinters. Its susceptibility to fungal and insect attack limits its wider utilisation, although studies elsewhere have established the suitability for rubber wood for furniture panel products etc. Rubber wood will continue to be utilised if it is not treated with preservative chemicals for protection against fungal and insect attack".*

From the studies undertaken in the Rubber Research Institutes in various countries it has been found that preservative chemicals can be applied to rubber wood by pressure methods or non-pressure methods. The KFRI has done research work on a non-pressure method of diffusion of preservative chemicals,§ and have come up with a recommendation. The report concluded: "Rubber wood is easy to work with hand tools. It does not split while nailing. Treated rubber wood will be highly suitable for making low-cost and medium quality furniture items, door and window frames etc.¶".

Rubber wood is being used for furniture manufacturing in other countries after treatment. The chemically treated rubber wood is a light hard wood with a pleasing colour and fair grains. There is no doubt that it would be possible for us too to undertake large scale use of this material for such products. What is required is to create an awareness of the vast potential of this raw material.

Acknowledgements

We are grateful to Shri P. Mukundan Menon, Rubber Production Commissioner for carefully examining the paper suggesting improvements. □

*KFRI Research Report No. 15, Kerala Forest Research Institute, Peechi, Dec. 1982- P. 1.

§ Ibid. P. 12.

¶ Ibid

MALAYSIA BUYS UNIROYAL ESTATES

Uniroyal, the US tyre company has announced the sale of its plantations in Malaysia, totalling nearly 11,000 hectares, for 199m ringgit ($84m) to Permodalan National, the Malaysian Government's investment agency. With the sale, there are now only two foreign groups still with substantial plantations in Malaysia. They are the French Socfin company, with 28,000 hectares and the British-Dutch Unilever group with 14,000 hectares. In the past decade, Malaysian companies, including government agencies, have been gobbling up foreign-owned plantations as part of the government's policy of buying back control of the country's natural resources. Estates bearing such famous foreign names as Dunlop, Guthrie, Harrisons and Barlow are now owned by Malaysian interests. Permodalan National is buying the Uniroyal plantations through its wholly-owned subsidiary, Kumpulan Guthrie, which was itself taken over in a celebrated dawn raid on the London Stock Exchange in September 1981, and which cost Permodalan nearly lbn ringgit. Apart from the Uniroyal estates, Kumpulan Guthrie is currently in the final stages of acquiring Highlands and Lowlands, a publicly listed plantation group with 28,000 hectares. It is offering to pay 2.7 ringgit cash for the 302m shares of High and Low, valueing the company at over 185m ringgit. With the latest acquisitions, the big four Malaysian plantation groups are Kumpulan Guthrie (121,000 hectares), Harrisons Malaysian Plantations (85,000 hectares), Sime Darby (77,000 hectares) and Kuala Lumpur Kepong (61,000 hectares).

R. THANKAPPAN PILLAI RETIRED

NEWS IN PICTURES

Shri R. Thankappan Pillai, Joint Rubber Production Commissioner has retired on 31st August 1985 after a distinguished career in the Rubber Board for over a period of 30 years. Shri Pillai joined the services of the Board as a Junior Field Officer in 1955. During his career he served in various capacities, as Field Officer, Assistant Development Officer and Deputy Rubber Production Commissioner under the Board. His services were also utilised in Andamans in 1972 and 1973 as Officer on Special duty at the Rubber Research and Development Station there. Later he was elevated as Joint Rubber Production Commissioner in 1981. He continued in this position till retirement.

Shri Pillai was given a warm and affectionate farewell on 5th September 1985 by his colleagues in the Board.

THONNACKAL HARIJAN COLONY

Distribution of Permits

180 Harijan families consisting of educated unemployed persons rehabilitated in 1972 at Thonnackal by the Govt of Kerala have made remarkable progress to find out a solution for their agricultural problems.

The Government have allotted each family an area of 2 acres along with another half acre with a newly constructed house. The colonists started cultivating coconut, cashew, rubber etc in the land allotted to them. But major portion of the land is left unutilized. Most of the colonists are labourers and a few are employed persons. It must be the main reason why their efforts in taking up different cultivation have failed. Having failed in other cultivations, possibilities have been explored for rubber cultivation in an area of 360 acres. The Rubber Production Commissioner Shri P Mukundan Menon along with other officials visited the area in 1982. Water scarcity was the main problem. Harijan Welfare, Public Works and Irrigation Departments of Government of Kerala agreed to supply water required for the rubber nursery there. On this promise Rubber Board decided to raise a poly bag nursery in 10 acres.

Lack of facilities for irrigation delayed the project and enough poly bag plants could not be produced in the nursery. But somehow or other poly bag plants for 73 acres were available with which planting was done on a scientific basis. Subsidy was also disbursed. Two instalments of subsidy were disbursed and permits distributed by the Jt. Rubber Production Commissioner Shri MG Jagadish Das in April last.

Inauguration

SEMINAR:

A one day rubber seminar under the joint auspices of Rubber Board, PPCL and Farm Information Exchange Club was held at Chapparapadavu. Shri KP Nooruddin, Minister inaugurated the seminar. Shri V Rajan and Fr. Jose Manimala spoke on the occasion. Shri Asayanar Kutty welcomed the gathering and Shri KP Devadas proposed a vote of thanks. The Officers of the Rubber Board took classes on various topics pertaining to rubber cultivation.

MD JOSEPH

Vice-Chairman

Shri MD Joseph, Mannipparambil has been elected as the new Vice Chairman of the Rubber Board. He represents the large growers.

A view of the participants

news and notes

RUBBER SUBSIDY CLEARANCE CAMPAIGN

On account of the unprecedented response from the farming community to take advantage of the benefits under the subsidy linked soft loan scheme implemented by the Rubber Board for promoting new planting and replanting of rubber, the Rubber Board has not been able to complete the inspections in full and issue permits and subsidy to the growers in time mainly due to the inadequacy of personnel to cope up with the resultant increase in volume of work. There are over 30,000 applications pending inspection filed up to 1984-85. With a view to clearing the huge back log and granting permits and subsidy before the close of 1985 in respect of all the pending cases, the Rubber Board intends to launch an intensive "Arrear Clearance Campaign" from September 1985 by deploying the entire Development Personnel at its command exclusively for this task on a priority basis.

Applicants in each region are proposed to be called in small groups, where the formalities to be completed by the growers to enable speedy inspections of their holdings will be explained and inspection schedules drawn up in consultation with each of them. The growers who have applied for planting subsidy are being invited to such meetings through a personal letter from the Chairman, Rubber Board. The success of a time-bound campaign of this nature, depends to a great extent on the support and patronage it enjoys from the participating growers. They are being advised by the Board to be available in their holdings at the appointed date and time of inspection and present relevant documents to prove ownership of the planted area, cash bills of planting materials and fertiizers and survey plan of the planted area in duplicate to the inspecting officer. They should also strictly abide by the stipulations in the rules in respect of retention of trees other than rubber in the planted area. Similarly crops chosen for intercropping in the first three years in the plantation, raising of cover crops and filling of vacancies also have to be consistent with the provision in the rules governing the scheme. Strict compliance with the terms and conditions laid down in the scheme would ensure expeditious inspections, issue of permits and grant of subsidy in all pending cases within the estimated time frame.

TRADE DEVELOPMENT AUTHORITY, NEW DELHI

The Trade Information Centre, run by the Trade Development Authority maintains information on all products, markets and functions without limitation in any of these areas. The Centre keeps latest available information on such aspects of trade information e.g. overseas and Indian trade directories, world wide trade statistics, customs regulations and duties in target markets, GSP, shipping, offers of joint ventures/licensing, status reports on overseas firms, country reports, commodity prices, overseas tenders, trade fairs and exhibitions, import-export policies, product/country profiles etc. etc.

A weekly Trade Intelligence Bulletin sent to all members contains news, articles, tender notices, Calender of trade fairs, trade enquiries etc. A Market Intelligence Bulletin containing detailed market reports is also brought out about once a month and sent to all members. Besides, hand-outs on important subjects are issued from time to time. TDA's publications are available to its members at 70% discount. Members are free to obtain information by post, telephone, telex or personally visit the Centre at Delhi or the Branch Offices at Bombay, Calcutta, Bangalore and Kanpur.

Associate Membership of TDA is available to companies, institutions, associations, Chambers of Commerce and individuals. The membership fee is Rs 500/- per year. For details, contact Mr. J K Bedam Deputy Chief, Trade Information and Statistics Division.

TDA's Regional Offices

1. Air India Bldg., 8th Floor, Nariman Point, Bombay 400 021.
2. Laxmi, 1/A Ulsoor Road, Bangalore-560 042.
3. Shantiniketan, Flat No. 9, 4th Floor, 8 Camac Street Calcutta
4. C-13, Sarvodya Nagar, Kanpur

POLYSAR TO BOOST BUTYL RUBBER SALES

Canada's Polysar hopes to double exports of elastomer to around $275m. a year following the start-up of its new butyl rubber plant at Sarnia, Ontario. The new plant was built at a cost of $300m over three years ago and was Polysar's largest investment in this period. The Sarnia plant can produce 70,000 ton/year of butyl rubber and can be expanded to 100,000 ton/year. Said to be one of the most advanced plants in the world, it employs 150 people. Officials at the opening of the Polysar plant said there was a continuing need for a revised federal policy on petrochemical feedstock prices.

MICHELIN PONDERS SAUDI SR PLANT

Saudi Arabia's National Industrialisation Co. has approached Michelin about the possibility of being its joint venture partner in a massive synthetic rubber plant project it is considering at the Red Sea port of Yanbu. Michelin's official spokesman in Paris confirmed that the privately-held Saudi company had been in contact with his firm, but would say nothing more than : "It's obvious that Michelin is interested in any kind of (rubber-related) project anywhere in the world." The project, thought to include plans for a $300m SR plant as well as to involve a third-probably Saudi-partner, is in a very early stage.

ANYONE FOR POWDER?

East German tyre maker Pneumant has developed a rubber recovery plant that makes powder from scrap tyres, and said it is seeking licensees for the process. The Furstenwalde-based firm explained that tyres are supplied to the installation in prepared form with maximum dimension being 20 cm-and are first passed along a conveyor system with a magnetic separator to remove any metal. The whole system is controlled from a central unit, Pneumant noted, and can be operated by three workers. The technology licence on offer is for a sixmill plant, with each mill capable of producing 500 tonnes of product per year, for a total yield of 3,000 tonnes of powder annually. A typical installation requires 225 m2 of floor space for the production plant, and another 125 m2 for the materials handling plant.

CONFUSION CLOUDS SMR'S FUTURE

A cloud of confusion is shrouding the future of Standard Malaysian Rubber. On the one hand, Malaysian authorities consider introducing to the Kuala Lumpur Commodities Exchange a second hedging grade based on SMR's current specifications. On the other hand, natural rubber officials there made clear their intentions to revise SMR's specifications this year-perhaps to such a degree that SMR as we know it now would cease to exist, informed sources say. In addition, the Singapore market intends to introduce by mid-year a new hedging contract based on technically specified rubber, according to a recent report in the Singapore Business Times. It is most puzzling, one trade source said, that two new contracts based on current SMR specifications are being proposed at the same time as those very specifications are undergoing radical revision.

MALAYSIA REJECTS WORLD BANK NR PLANTING SUPPORT

Malaysia, the world's biggest natural rubber supplier, has rejected World Bank offers of financial support for additional planting, saying that it prefers to concentrate on more profitable items such as palm oil and cocoa. According to reports from Kuala Lumpur, the Malaysian government, accepts that rubber production should be boosted-but believes that it can do this from existing acreage, rather than from extending cultivation. The World Bank initiative reflects the organisation's belief that without further planting, there will be a shortage of rubber developing before the end of the decade. The Bank recently granted significant loans to Indonesia to increase rubber output in line with the country's determination to reduce its dependence on oil and gas. But the Malaysian authorities-running an industry which holds more than one third of the world's rubber exports-believe that the time has come to aim for more lucrative crops.

MALAYSIA PLANS CONSORTIUM

Malaysia's rubber industry plans to set up a consortium involving a number of the country's producers to build a commercial plant for the manufacture of epoxidised rubber. The planned facility, which will have a capacity of 1000-1200 tonnes a year, forms part of Malaysia's drive to develop new, advanced uses for natural rubber. The potential market for modified natural rubber stands at around one million tonnes a year, but at present the sector is monopolised by synthetic material. However, thermoplastic natural rubber was almost ready for commercial scale production and potential had been identified in the automotive area. Development of other forms of modified rubber such as powdered NR and powdered carbon black masterbatches would continue. The consortium will be headed by the Malaysian Rubber Research and Development Board whose UK arm is also to play a part in the development of modified natural rubber.

MONSANTO STARTS UP TP PLANT

Monsanto has started up its new European Santoprene thermoplastics rubber plant at Newport, Gwent, the US group has announced. When a similar facility now being built in the US and due for completion later this year comes on-stream, Monsanto will have a three strong hand for manufacture of the fast growing TPR. It already operates a unit at Akron. Ohio. □