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Rubber Board Bulletin

Rubber Board Kottayam 9 Kerala India

Rubber Board, Kottayam-9, Kerala State

Chairman	:	T. V. Swaminathan
Rubber Production Commissioner	:	K. C. Ananth
Director of Research	:	V. K. Bhaskaran Nair
Secretary	:	T. V. Joseph

Th... ...r Board is a statutory body constituted under the ...47.

...ons of the Board as defined under the Act are:- ... by such measures as it thinks fit the development ...dustry so far as the production and marketing of ...ithout prejudice to the generality of the foregoing ...easures referred to therein may provide for:- (a) ...isting or encouraging scientific, technological or ...ch; (b) training students in improved methods ...vation, manuring and spraying; (c) the supply of ... to rubber growers; (d) improving the marketing ...he collection of statistics from owners of estates, ...facturers; (f) securing better working conditions ...n and improvement of amenities and incentives ... (g) carrying out any other duties which may be ...rd under rules made under this Act.

... be the duty of the Board:- (a) to advise the ...nt on all matters relating to the development of ...ry, including the import and export of rubber; ... Central Government with regard to participation ...national conference or scheme relating to rubber; (c) to submit to the Central Government and such other authorities as may be prescribed, half-yearly reports on its activities and the working of this Act; and (d) to prepare and furnish such other reports relating to the rubber industry as may be required by the Central Government from time to time.

The Board has a full-time Chairman, appointed by the Central Government and 24 other members representing various interests.

The Rubber Research Institute of India, functioning under the Rubber Board, has been established under a scheme approved by the Government of India in 1954 for the benefit of the rubber plantation industry in India. The Institute has four research divisions, viz., Agronomy, Botany, Plant Pathology and Chemistry & Rubber Technology.

The headquarters of the Board and the Rubber Research Institute stand in the Experiment Station located at Kothapara near Puthupally, about eight km east of Kottayam town in Kerala State. The research farm where various field experiments are conducted is situated at Chethakkal (Ranni), about 70 km away from the Institute.

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Natural Damages to Rubber Plantations in India

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Introduction

Fire, wind and flood are the major natural calamities causing damages to rubber plantations. Fire is of frequent occurrence in rubber plantations. Every year large areas planted with rubber are destroyed by fire. In rubber plantations, wind also is a serious hazard. The extent of damage due to flood is comparatively insignificant. So far no study has been made in India to assess the extent of damage due to these natural calamities to rubber plantations. In this paper, an attempt is made to assess the damages due to fire, wind and flood to rubber plantations in India.

In Malaysia, Ceylon and India, the vulnerability of certain varieties of rubber planting materials to wind has been studied from the point of view of selecting them for propagation. These studies are different from the study undertaken by us now, since the intention of our study is to examine the damage in terms of money sustained by the plantations already set up, whereas the studies referred to above were initiated with a view to ascertaining the best variety of planting materials for future planting.

Reasons for Vulnerability

Rubber tree is a quick growing one found in the tropics. A warm, humid, equable climate and a fairly distributed annual rainfall of not less than 200 cm are necessary for its optimum growth. The tree takes about 5 to 7 years to yield after planting. The economic life of a rubber tree is about 30 years from the date of planting. The tree sheds its leaves during winter. As a good agronomical practice, leguminous cover crops are grown in many plantations. During summer, the dry leaves of the tree and cover crops will accumulate in the plantations making rubber plantations an easy target for fire. The location of many of the plantations prevents remedial measures being taken in case of occurrence of fire. Majority of rubber plantations are far away from towns, where fire brigades are stationed and facilities for fire fighting are available. The plantations are also mostly located on hill slopes which are not easily accessible. As stated above, fire generally occurs during summer months during which period scarcity of water is felt in hilly areas. For want of water and manpower, sometimes the fire is not put out easily. A number of rubber plantations are in the vicinity of forests and the hazard of forest fire spreading to the rubber area accentuates the vulnerability. The fact that the wood of the rubber tree easily catches fire makes it more prone to fire damages.

Wind damage is also found to be high in rubber plantations. In the first place, rubber plantations are raised generally on hillocks and they are thus exposed to damage by wind. Secondly, mature rubber trees have heavy canopy during the major part of the year. An exception is only during the months of January to March, when the tree sheds its leaves. As strong winds blow during the rainy months of July to September and as the canopy will be wet and heavy during the period, the susceptibility to wind damage is also more during

TABLE 3

Classification of Estates Affected by Fire According to Main Causes for Fire (Area in Hectares)

Causes for fire	Area of the estates affected by fire	Area affected by fire as a percentage to total area affected by fire	Estimated loss (Rs./lakhs)
1	2	3	4
1. Spread from the neighbouring land	274.42	49.22	5.83
2. Stubs of cigarettes, beedies, matches, country torches etc.	8.90	1.58	0.14
3. Reason not known	274.23	49.20	3.56
Total :	557.55	100.00	9.53

Out of 156 estates who co-operated in the survey, 109 estates are maintaining fire belts for preventing spread of fire from neighbouring areas. Some of the estates have been maintaining fire belts since the establishment of the plantations. In the case of certain others, they started maintaining fire belts either as a result of an occurrence of fire or at a later stage of development of plantations. Out of 156 estates, 93 estates are also taking other precautions against fire such as appointment of night watchmen, appointment of special watchmen during summers, removing grass and undergrowth in the plantations, clearing dry leaves etc. from roads and footpaths. However, 34 estates were affected by fire during the period even after establishing fire belts and 25 estates were affected by fire even after appointing night watchmen.

The estates have been asked whether they have insured their estates against fire damage. Only in 5 cases insurance has been effected. These estates belonged to one company The rate of premium is mentioned as 0.5 per cent of the total cost of the insured plantations. Two other estates have insured their smoke houses against fire. Out of the 156 estates covered by the survey, 68 estates have stated that they would like to cover their estates against fire by taking up insurance, and 12 estates would like to take up insurance against damage due to strike, riot and civil commotion only. Out of the 68 estates mentioned above, 33 estates would like to cover their entire area for insurance and 26 estates would like to divide their area according to mature area, immature area, nursery etc for separately covering for insurance. Nine estates have not made any comments as to the nature of coverage.

It was found that the loss of tree due to wind was on the increase in the last three years. In 1964, 7,823 trees were lost due to wind in the reported estates. The number of trees lost in 1968 was 20,321. The estimated loss due to wind has been worked out in table 4. It varied from Rs. 1.22 lakhs to Rs. 3.15 lakhs during the five year period.

In the same table, the number of estates affected by wind is also given. In 1964, there were only 29 estates affected by wind. In 1968, the occurrence increased to 45. In working out the percentage of the number of trees lost by storm, it is assumed that the average stand per hectare in estates which have replied to the questionnaire is 300. The percentage number of trees lost by wind per year varied between 0.10 and 0.21,

TABLE 4

Year	No. of estates which replied to the questionnaire	Estimated No. of trees in the estates which replied to the questionnaire (lakhs)	No. of estates affected by wind	No. of trees lost by wind	Percentage No. of trees lost by wind	Estimated loss (Rs./lakhs)
1	2	3	4	5	6	7
1964	154	78.30	29	7823	0.10	1.22
1965	155	81.56	28	7941	0.10	1.63
1966	156	82.67	30	14584	0.18	2.81
1967	156	85.65	40	14810	0.17	2.69
1968	156	98.59	45	20321	0.21	3.15
Total :				65479	—	11.50

Flood is not a serious threat to the rubber plantation industry. The reason might be that rubber tree is not generally raised in low lying areas and, therefore, is not easily affected by flood. Waterlogged areas are found unsuitable for rubber cultivation. However, it is seen that seven estates have been affected by flood during the period. The estimated damage was Rs. 31,700/-. In addition to flood, it is seen that one estate was affected by land slide and 1600 trees were damaged by it. The estimated loss reported by the owner of the estate is 50,000 rupees.

In the questionnaire circulated to the estates, we had asked whether they had insured against wind and flood. From the replies received, it is seen that none of the estates has insured so far. We had also asked the estates whether they would like to cover the plantations by insurance against wind and flood. It is seen that only 42 estates would like to cover their estates by insurance.

A combined table showing the estimated loss due to fire, wind and flood is given in table 5.

TABLE 5

Estimated Damage due to Fire, Wind and Flood in the Reported Estates

Year	Estimated value of the rubber estates which replied to the questionnaire (Rs./lakhs)	Estimated damage due to				Column 6 as % to column 2
		Fire (Rs./lakhs)	Wind (Rs./lakhs)	Flood (Rs./lakhs)	Total (Rs./lakhs)	
1	2	3	4	5	6	7
1964	1618	2.38	1.22	0.08	3.68	0.23
1965	1686	1.14	1.63	0.01	2.78	0.16
1966	1708	2.09	2.81	0.02	4.92	0.29
1967	1770	3.18	2.69	0 01	5.88	0.35
1968	2038	0.74	3.15	0.20	4.09	0.20
Total :	—	9.53	11.50	0.32	21.35	—

TABLE 6

Frequency of Occurrence of Fire, Wind and Flood
(During the period 1964—68)

Frequency of occurrence	No. of estates affected by fire	No. of estates affected by wind	No. of estates affected by flood
1	2	3	4
5 times	1	16	1
4 ,,	4	6	0
3 ,,	3	6	0
2 ,,	4	14	2
1 ,,	30	22	4
Nil	114	92	149
Total :	156	156	156

In table 6, the frequency of occurrence of fire, wind and flood has been worked out. The table shows that out of 156 estates reported, 42 estates were affected by fire during the five year period. The number of estates affected by wind was 64 and the number of estates affected by flood was only 7. The table shows that there are certain estates repeatedly affected by fire, wind and flood. It may particularly be noted that there were 16 estates affected by wind 5 times during the period.

Need for Crop Insurance

The study shows that the total loss to these estates during the five years has been about Rs. 21.35 lakhs due to fire, wind and flood. In terms of percentage, the average loss is found to be about 0.25 % per year of the total investment. This is not a mean loss to the industry when we consider the fact that the life span of a rubber tree is about 30 years. In other words, during the period of 30 years, natural calamities can cause loss amounting to 7½% of the total investment. Now the question is how to prevent such losses. The planters are taking precautionary measures like appointing watchmen, clearing of refuse and old leaves from footpaths and boundaries, raising fire belts etc. to prevent the occurrence of fire. With all precautions, estates are found to be still affected by fire. It is true that the planter's ability to prevent damage due to wind and flood is limited. Naturally the planter has to be protected against monetary loss resulting from the occurrence of these natural hazards. In this connection, the scope for introducing crop insurance is worth considering. The purpose of crop insurance in plantations is to ensure that the money and effort of the planter in raising the plantations are not entirely wiped out by natural hazards beyond his control.

The most important feature of insurance is that it is a contract whereby insurance company agrees that a lump sum or instalment will be paid to the insured by the company against the loss arising during the period of coverage in return for regular payment of insurance premium. The insured must have an insurable interest in the plantations and he must be in a position to ascertain that the damage to the property which he stands to suffer will lead to pecuniary loss.

Crop insurance is gradually gaining ground in this industry also. But the measure of success so far achieved by the insurance companies in this field does not ensure confidence in those interested in the welfare of the industry. As has been pointed out, only 5 estates have been covered by fire insurance, out of the 156 estates studied. The reason for the meagre coverage might be the paucity of information regarding the extent of damage due to fire, wind and flood to the industry. In the first place, any insurance company would require details regarding the incidence of fire, wind etc. The company would also like to know the factors influencing the occurrence of fire, accentuating the incidence and increasing the damage. It is hoped that the statistics collected in the survey would be useful to the insurance companies.

Crop Insurance in other Countries

It would be interesting to examine the details of insurance available to plantation crops in other countries in the context of this study.

Insurance against fire and hailstorm is the most common form of crop insurance in other countries. However, insurance protection is available against losses resulting from drought, break down of irrigation system, losses due to fall in price, hurricane, storm etc. So far as plantations are concerned, coverage against fire and lightning is "usually available from underwriters at Llyods' and certain specialist insurance companies for plantations almost anywhere in the world." ‡ Generally, rubber plantations are "fairly freely insured against the risks of fire and because of the damage which can be caused by the occasional storm in certain areas, it is often possible to obtain this additional protection against financial loss." ‡

It would also be of interest to examine in this connection the salient features of a crop insurance scheme existing for paddy in Ceylon. In 1958, a pilot crop insurance scheme was inaugurated in Ceylon. The scheme covered about 26,000 acres (about 10,500 hectares) of paddy land. In 1961 the Crop Insurance Act was enacted in Ceylon and the scheme was brought under it. Crop insurance is compulsory in the areas covered by the scheme. It is an 'all risk' rather than a 'specific risk' insurance scheme. Damage to crops caused by drought, lack of water, excessive water, flood, plant diseases, insect infestations etc. are indemnified. The scheme was envisaged as a partially subsidised venture rather than an actuarially based self-financing, self-liquidating one. The scheme operates on a uniform premium rate of Rs. 6/- per acre (Rs. 14.83 per hectare).

‡ 'Crop insurance' by J. Gaslee, 'World Crops,' June 1967, P. 34.

Conclusion

This study has been conducted with a view to fill in the vacuum existing in a vulnerable field of activity of the planters, namely, the protection of their most valuable asset—the rubber tree. It is hoped that the factual details enumerated by us will make them realise the need for obtaining some form of insurance. Individual instances have come to our notice where men of small means who invested their entire fortune in rubber plantations later on met with the most tragic experience of fire wiping out the entire plantations. To prevent such unfortunate occurrence in future, it is hoped that the conclusions of this study may be of some use. The insurance companies who generally hesitate to tread the path in the unknown jungle of rubber plantations to protect it, may well do good, if they can rely upon some facts regarding the incidence of fire, wind and flood, the percentage loss per annum etc., which are required for preparing actuarial tables for their operations.

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budding and the final success ten days thereafter. The data on the final success of budding was analysed statistically, after suitable transformation of the data.

Results

The percentage of final budding success of each day is furnished in table 1. The analysis of the data has indicated that spraying of budwood has significantly affected the budding success in four out of eighteen budding days, viz., 11-8-'69, 18-8-'69, 22-8-'69 and 13-9-'69. There was no significant difference on the budding success on 28-8-'69 and 4-9-'69 eventhough difference was noticed on 13-9-1969. However, after 13-9-1969, there was no significant effect of Bordeaux mixture spray of budwood on bud-take. The analysis of the data has also indicated that the interactions between the treatments were not significant except in one case between budwood spray and seedling spray and that too for only one budding day. Budwood washing has had no effect on the success of budding.

Discussion and Summary

Results of the present study also support the earlier findings that spraying the stock plants does not affect the bud-take. But spraying the budwood affected the bud-take adversely for the first few weeks after spraying. However, the effect of spraying the budwood, five weeks before budding does not affect the success of budding. No difference was noticed between washed and unwashed budwoods which demonstrated that washing does not remove the effect of Bordeaux mixture. Common notion which attributes physical contamination of Bordeaux for bud failures was proved false as a result of the present findings. The low budding success obtained when sprayed budwood was used may be due to the production of some toxic substance detrimental to the budding success from the Bordeaux mixture. Since the effect of spray does not manifest itself on the budding for five weeks after spray, it may be assumed that the toxic substance disappears from the budwood in course of time. It may be mentioned that the effect of Bordeaux mixture to control diseases will also last for 4–6 weeks only. The effect of immersion of budwood in two per cent and five per cent copper sulphate solutions for two minutes and five minutes, to disinfect them, was too severe [3] and even the weakest treatment, i. e. immersion of the budwood in two per cent copper sulphate solution for two minutes with subsequent washing, was deliterious (4). Even when no acute injury results from the application of copper fungicide, profound physiological effects may be exerted on the plant (1). However, the exact action of the Bordeaux mixture on the tissue system is not known.

It is of interest to note that spraying the stock seedlings does not affect the success of bud-take, whereas when the budwood is sprayed, the bud-take is affected. It appears that the cambium of the scion contributes predominantly to the success of bud union and the subsequent growth of the bud sprout. Therefore, the possible cause of bud failures is attributable to some action of Bordeaux on cambium.

However, spraying of budwood does not affect the bud-take after five weeks from spraying. So spraying of budwood plants with Bordeaux mixture five weeks before budgrafting can be done for protecting them from diseases or in other words budwoods sprayed with Bordeaux should not be used for budding at least for a period of 5 weeks.

Acknowledgement

The author is indebted to Shri V. K. Bhaskaran Nair, Deputy Director (Botany), for giving guidance and suggestions for the above study and is thankful to Shri G. Subbarayalu, Statistical Officer (Research), for analysing the data.

TABLE 1

Percentage of Final Budding Success

Sl. No.	Treatments	11-8	18-8	22-8	28-8	4-9	13-9	15-9	18-9	22-9	27-9	3-10	7-10	13-10	18-10	23-10	28-10	3-11	8-11
		Dates (1969)																	
		Days after spraying																	
		0	8	12	18	25	34	36	39	43	48	54	58	64	69	74	79	85	90
1.	001	93·33	86·67	93·33	86·67	93·33	100·0	93·33	86·67	100·0	100·0	93·33	93·33	93·33	73·33	66·67	86·67	80·00	93·33
2.	100	93·33	60·00	46·67	86·67	100·0	100·0	100.0	100·0	86·67	93·33	93·33	93·33	100·0	86·67	93·33	86·67	80·00	93·33
3.	010	40·00	40·00	60 00	86·67	93·33	73·33	93.33	93·33	93·33	93·33	86 67	100·0	100 0	86·67	66 67	93·33	80.00	100·0
4.	110	46·67	66·67	20·00	73·33	80·00	66·67	100·0	93·33	100·0	80 00	86·67	86 67	100·0	80.00	66·67	93·33	73·33	93·33
5.	111	13·33	73 33	46·67	86·67	93·33	100·0	93·33	100·0	86·67	86·67	86·67	93·33	100·0	86 67	73·33	73·33	73·33	86·67
6.	011	40·00	26·67	60·00	100·0	93·33	73·33	100·0	100·0	93·33	60 00	93 33	100 0	100·0	100·0	80·00	80·00	80·00	100·0
7.	101	93·33	86·67	93·33	73·33	100·0	100·0	100·0	100·0	86·67	60·00	100·0	93·33	100 0	80 00	66·67	93·33	80·00	73·33
8.	000	93·33	93·33	86·67	86·67	93·33	100·0	93·33	86·67	80·00	93·33	86·67	86·67	100·0	86 67	8667	86·67	80·00	86·67

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Correlation of Metrolac DRC with Actual DRC of Field Latex

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Introduction

The dry rubber content (drc) of natural rubber latex collected in the rubber plantations varies considerably, ranging from 25% to 45%. Variation in drc of field latex occurs from tree to tree (of the same clone), clone to clone, field to field, region to region and also from season to season.

In the latex processing factories water and coagulating agents are added to the field latex. To determine their correct quantities, it is essential to determine the drc of the field latex as accurately as possible.

Methods of drc Estimation

There are many methods that could be adopted for drc estimations, viz., direct method [12] (trial coagulation method), hydrometric method [1], nephelometric method [11] and viscosity method [8]. In normal estate practice only the first two methods are being followed. The direct method or the trial coagulation method is the accurate method but it takes a fairly long time for determination. Hence, it is mainly used as a confirmatory method. The hydrometric method gives only approximate values and in the case of abnormal latices, it gives even erroneous values. However, in view of the ease of manipulation and rapidity of determination this method is still being followed in the rubber plantation industry.

Development of Metrolac and its Limitations

The relationship between the specific gravity of the latex and its dry rubber content is considered for designing the various special types of hydrometers [1, 5] called latexometer, simplexometer, laticcometer or metrolac—for use in rubber plantations. The specific gravity of the field latex varies from 0.9915 to 0.9628 depending upon its original dry rubber content [2]. To facilitate easy computations of the dry rubber content of the latex samples, the scales in these special hydrometers are calibrated to denote directly the dry rubber content of the latex in which they are allowed to float. At present, in India, the metrolac is the only hydrometer that is being used in the rubber plantations and the other three are not in general use. Earlier workers [1, 10, 8] who designed, developed and worked with the metrolac, knew about its limitations—that it gives only a very approximate value in normal latex and erroneous values in non-average latex, obtained from certain clones or from young trees. Nevertheless, the metrolac was introduced in the plantation industry by Morgans and Stevens [5] in 1922 for its usefulness in the rapid estimation of drc.

Factors Influencing the Metrolac Readings

Generally the hydrometers used in the plantation industry are standardised to denote the drc of latex in the region of 35% at a specified temperature (85°F) more or less accurately. In view of this, it is observed that when the metrolac is floated in a latex having higher drc than the specified drc, the metrolac readings are always higher than the actual drc and in the latex of low drc, a lower value than the actual drc is observed. This may be due to the limitations in construction and calibration of the instrument.

Since the calibration of the metrolac is based on specific gravity values, variations in the readings due to changes in temperature must be expected. The variations observed have been reported by Whitby[12] and Fairfield Smith [9]. However, Fairfield Smith has reported that temperature corrections for hydrometer as distinguished from real changes in specific gravity are smaller; hence in practice the correction factor to be introduced is a very low value and often it is considered as negligible. Variations of the serum constituents of latex also affect the specific gravity of latex resulting in the variations of metrolac readings[9, 6]. How far this influences the drc measurement is still a matter of study.

Earlier Attempts to Improve drc Measurements based on Metrolac Readings and Scope of the Present Studies

Considering all these factors and limitations of the metrolac, RRIM[9] and RRIC[6] have attempted to correlate the specific gravity of latex with the actual drc. Since these correction factors are suitable for application only in a very limited range (especially for normal drc values) it was considered worthwhile to study this problem in greater detail and draw up some probable correlations with the metrolac values and actual drc values over a wide range of values collected in all the seasons of a year and under other varied conditions that are normally met with in the rubber plantation.

Experimental Findings

The latex used in the studies was collected in the usual manner from the various fields and blocks of the RRII Experiment Station (consisting of different types of planting materials). The latex after sieving (through 40 and 60 mesh sieves) was used for drc estimation both by metrolac and trial coagulation methods.

The metrolacs manufactured by Messrs Dring & Fage Company, England, were used in these studies.

Verification of Metrolac

The studies were conducted with the two glass metrolacs calibrated in gm/litre on 148 samples of latex. The results indicated that the difference between the readings of the two metrolacs was not statistically significant at 5 per cent level.

Effect of Dilution

To increase the mobility of the metrolac in latex and to get a consistent equilibrium point for the metrolac reading, the field latex is generally diluted in 1 : 1 or 1 : 2 proportion with water. The work[9, 6] conducted in other countries (Malaysia and Ceylon) indicated that both the types of dilutions are in vogue. Consistency in readings of the metrolac was taken as the index of mobility. The 1 : 1 dilution followed at the processing factory of the RRII and majority of estates gave satisfactory and consistent readings. Hence 1:1 dilution was adopted in the present experimentation to fall in conformity with local practices.

Correlation of Metrolac drc with Actual drc

In the studies conducted, an analysis of the distribution of the values of metrolac drc and actual drc (using trial coagulation method) in the various ranges was conducted and it was found that the actual drc is generally different from the observed metrolac drc. So attempts were made to correlate these two values.

The 322 pairs of values collected during the first four months', i.e. June to September, 1965, period of study was statistically analysed and the following cubic equation was derived :

$$Y = 2.385 + 1.650\ X - 0.02796x^2 + 0.0001917x^3$$

where Y = actual drc % and
X = metrolac drc %

Based on the equation, a ready reckoner was computed and it is presented in table 1.

Comparison of Ready Reckoner Values with Actual drc Values and the Limitations of the Ready Reckoner

To verify the usefulness of the ready reckoner, some more trials were conducted with latex samples noting the metrolac drc and actual drc (862 pairs of values). For each metrolac drc the corresponding drc

TABLE 1

Ready Reckoner Computed Using Cubic Equation with both the Values in wt/wt & Corresponding wt/vol Values for the Various Metrolac Readings.

Metrolac DRC %* (Metrolac reading in 1:1 dilution x 2)	Weight of rubber % by wt of latex	Weight of rubber gm/litre	Metrolac DRC %* (Metrolac reading in 1:1 dilution x 2)	Weight of rubber % by wt of latex	Weight of rubber gm/litre
24	28.53	281.6	43	36 88	360.5
25	29.16	287.8	44	37.18	363.4
26	29.75	293.2	45	37.48	366.4
27	30.33	298.8	46	37.78	368.8
28	30 87	303.9	47	38.07	371.7
29	31.40	309.1	48	38.37	374 6
30	31.90	313.9	49	38.66	377.0
31	32.68	321.0	50	38.95	379.8
32	32 84	322.5	51	39.24	382.7
33	33.28	326.8	52	39.54	385.1
34	33.70	330 6	53	39.84	388.0
35	34.10	334.5	54	40.19	391.5
36	34.49	338.3	55	40.45	394.0
37	34.87	341.7	56	40 79	396.8
38	35.23	345.2	57	41.10	399.9
39	35.58	348.2	58	41 43	403.1
40	35.92	351.5	60	42.14	409.5
41	36.25	354.7	66	44.60	431.9
42	36.57	357.5	71	47.20	456.0

(To be used during the period from June to December)

* Eg; The reading of metrolac in 1:1 diluted latex = 200, taken as 20; so the drc = 20×2=40%

as per ready reckoner (calculated drc) was noted and compared with actual drc.

The results showed that by using the ready reckoner, the range of difference between the actual drc and calculated drc was within ±2 for nearly 60% of the total determinations numbering 862.

However, it is found that this ready reckoner has some limitations. Generally, in rubber plantations, it is found that one or two months before wintering the drc of the latex is fairly high and after wintering the latex does not attain normalcy till May or June. Consequently, it is found that this ready reckoner does not hold good during this period; hence the value obtained had to be subjected to further statistical analysis.

Development of Linear Equation

The 358 pairs of values obtained from January to May 1966 were subjected to relevant regression analysis and the following linear equation was derived:

$$Y = 16.68 + 0.5024X$$

where Y is the actual drc (%) and

X is the metrolac drc (%)

The ready reckoner computed on the linear equation is given in table 2.

TABLE 2

Ready Reckoner Computed Using Linear Equation with both Values in wt/wt and Corresponding wt/vol Values for the Various Metrolac Readings.

Metrolac DRC %* (Metrolac reading in 1:1 dilution x 2)	Weight of rubber % by wt of latex	Weight of rubber gm/litre	Metrolac DRC %* (Metrolac reading in 1:1 dilution x 2)	Weight of rubber % by wt of latex	Weight of rubber gm/litre
28	30.75	302.7	47	40.29	392.4
29	31.25	307.7	48	40.80	397.0
30	31.75	312.3	49	41.30	401.9
31	32.25	317.2	50	41.80	406.2
32	32.76	321.7	51	42.30	411.1
33	33.25	326.4	52	42.80	415.5
34	33.76	331.2	53	43.31	420.5
35	34.26	336.1	54	43.81	424.7
36	34.77	340.7	55	44.31	429.5
37	35 27	345 6	56	44 81	434 0
38	35.77	350 1	57	45.32	438.9
39	36.27	354.9	58	45.82	443 2
40	36·78	359.6	59	46.32	448.0
41	37.28	364.3	60	46.82	452.1
42	37.78	368.7	61	47.33	457.3
43	38.28	373.7	62	47.83	461.5
44	38.79	378.3	63	48.33	466.3
45	39.29	383.2	64	48.83	470.7
46	39.79	387 7	65	49.34	475.5

(To be used for the period from January to May)

* Eg: The reading of metrolac in 1:1 diluted latex = 200 taken as 20; so the drc = 20×2 = 40%

TABLE 3

Application of Ready Reckoner Values to Factory Studies

Month	No. of trials	Metrolac d.r.c% Minimum	Metrolac d.r.c% Maximum	Total yield of latex in litres used in trials	Total yield of rubber as per Cubic ready reckoner kg	Total yield of rubber as per Linear ready reckoner kg	Total yield of rubber as per Metrolac d.r.c. kg	Actual yield of rubber (Weight of smoked sheets) kg	Difference: Cubic ready reckoner	% error	Difference: Linear ready reckoner	% error	Difference: Metrolac d. r. c.	% error
September 1966	12	30	48	1276.90	444.087	—	510.034	447.700	− 3.613	0.81	...	...	+62.334	13.92
October 1966	9	28	54	1155.65	397.378	—	431.525	397.955	− 0.577	0.14	...	...	+33.570	8.43
November 1966	18	28	50	1843.05	629.738	—	685.296	641.650	−11.912	1.87	...	...	+43.646	6.80
December 1966	22	28	54	2084.50	743.609	760.754	835.588	765.300	−21.691	2.83	− 4.546	0.61	+70.288	9.18
January 1967	18	28	54	2071.50	717.586	738.327	824.650	748.700	−31.114	4.15	−10.373	1.39	+75.950	10.14
February 1967 (till 10-2-'67)	6	30	54	442.00	158.503	160.366	180.750	165.500	− 6.997	4.23	3.134	1.89	+15.250	9 21
								Average		2.34		1.30		9.61

Difference between actual yield and yield as per ready reckoner values and metrolac d. r. c. and % error

Average % error for cubic ready reckoner till December only (four months) 1.41%

Average % error based on mrtrolac d. r. c. till December only (four months) 9.55%

Usefulness of Ready Reckoner Values in Factory Studies

Trials were conducted to employ these ready reckoner values on the yield of latex obtained in the processing factory of the Experiment Station. In table 3 the results of 85 trials from September, 1966 to February, 1967 are given. From the results it can be seen that the percentage error in the computation of yield data can be reduced to a considerable extent by selecting the corresponding ready reckoner values to the observed metrolac drc values.

Discussion

Reported Correction Factors

Though the earlier workers [1, 5, 10, 3] knew about the limitations of the metrolac, in view of its usefulness it is being used in the rubber plantation industry with certain modifications in calibration (to read gm/litre instead of lb/gallon). O'Brien (1926)[7] has suggested a simple plan of using the errors of one month's reading of metrolac drc and actual drc as the correction factor for the subsequent month's reading. Fairfield Smith (1947)[9], after a detailed study has suggested the use of a new type of instrument preferably recording densities and interpreting the data by means of a table adopted to the special circumstances.

Nadarajah and Muthukuda (1963)[6] have brought out a ready reckoner based on the correction factor they determined from the values on drc using both trial coagulation and metrolac methods on 138 samples of latex which had a drc range from 20 to 41%.

The earlier formulations of correction factors and ready reckoners were drawn up from a limited number of observations. However, if a correction factor or ready reckoner is derived from a large number of observations, the chances of it being successfully used to plantation industry may be much better.

Use of Hydrometer in Other Allied Fields and Present Studies

In the dairy industry where a hydrometer called the lactometer is used for the determination of total solids in milk from its density measurements, Richmond's formula[4] is used for calculation. Similarly in the present studies for getting the true value of drc certain formulae have been developed.

The readings observed over a long period were subjected to statistical analysis and equations derived from such an analysis have been utilised to compute the two ready reckoners for the different seasons of the year. The usefulness of these ready reckoners for application to the factory scale of operations is given in table 3. The average error in the estimate of yield has been reduced from 9.61% to 1.30% in the case of ready reckoner based on linear equation (applicable to abnormal period) and 9.61% to 2.34% in the case of the ready reckoner based on cubic equation throughout the period of study. If the use of the same (ready reckoner based on cubic equation) is restricted to the short period of four months for which it was developed (i. e. September to December), the average error is reduced from 9.55% to 1.41%. Thus from this study the usefulness of such ready reckoners in the factory for a fairly correct estimation of the crop has been established.

However, it is to be noted that these results are based on conditions prevailing in a small area (50 acres). Therefore, it is to

Note :— The ready reckoners given in this paper are based on the results obtained from the latex collected at the RRII Experiment Station. The planters are requested to use these ready reckoners in their estates and to intimate their experience to the Director of Research, RRII, Kottayam 9, Kerala State, to evaluate its applicability for general adoption.

DIRECTOR OF RESEARCH

be examined whether these ready reckoners will hold good in other regions having different climatic conditions as well as other variable factors such as a clonal characteristics, age of the trees, nature of the planting material, etc.

Suggestion for the Design and Fabrication of a New Hydrometer

In the present hydrometer—metrolac—the calibrations are from 50 to 450. When 1:1 dilution is resorted to, the various readings for the latex of different drc values fall within the range of 120—330. Even if we accommodate some more variations due to abnormal conditions the limits could be fixed between 100 and 350 instead of the existing scale 50—450. In addition to the new scale if the sensitivity is also increased, then a new hydrometer with an improved sensitivity for use in the plantation could be fabricated.

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Studies on the Pollen of *Hevea**

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Palynological studies in agricultural crops are of considerable value in crop improvement and its importance in breeding has been stressed by several workers. In *Hevea*, information regarding detailed palynological study is limited. Attempts on the germination of *Hevea* pollen were made by Heusser [2], Ramaer [6], Dijkman [1] and Majumder [4]. Pollen longivity and viability were studied by Dijkman. Heusser's attempt [2] to germinate pollen in distilled water was not successful. Ramaer reported that no germination occurred in aqueous solutions of sucrose and glucose without agar. However, Majumder reported a small percentage of germination in rain water and distilled water. He obtained very high percentage of germination (86%) in 15% sucrose with 0.01% boric acid at 25°C, for clone RRIM 501.

Hevea produces a large number of flowers during the blooming season., Fruit set, however, is found to be very limited. Even in hand pollination programmes fruit set of 5–7% is considered to be quite high. The factors which limit fruit set in *Hevea*, remain to be fully understood. Flowering in *Hevea*, occurs during February to March in South India. The flowers are unisexual and are borne on the same inflorescence. The pistillate flowers are few and terminal to the central axis and major branches of the inflorescence, but the staminate flowers are numerous. The present study relates to the morphology, sterility and germination of pollen of a few species of *Hevea* carried out at RRII.

Materials and Methods

Observations were carried out on the following materials :

1. PB 86 ⎫
2. Gl 1 ⎬ Primary clones of *H. brasiliensis*
3. AVROS 255 ⎭
4. FX 516 — *H. benthamiana* (F 4542 × AVROS 363)
5. IAN 45–717 — *H. brasiliensis* (PB 86 × F 4542)
6. *H. spruciana*

H. benthamiana and *H. spruciana* are wild species and are of limited commercial importance. The clone F 4542 is, however, a selection made from *H. benthamiana*.

Fully matured male flowers which are expected to dehisce on the same day were collected for the study. The methods and terminology used for the morphological studies of pollen grains were those followed by Nair [5]. The pollen grains were examined and measurements were taken for 50 acetolysed grains using a visopan. The fertility of pollen grains was tested with acetocarmine. Germination of pollen grains was studied in different concentrations of sucrose solution with and without boric acid at room temperature. Brink's hanging drop method was employed. Observations

* Paper presented at the Symposium on Crop Palynology held at Tiruchirapally in September, 1969.

were recorded on two days during the season. Two slides were observed on each day from each treatment. Final count was made 24 hours after dusting the pollen on the media.

Results and Discussion

Pollen grains of *Hevea* are yellow and powdery. All the types studied are 3-zonicolporate. The shape varies from oblate spheroidal to prolate spheroidal. Amb is triangular with convex sides. The apertures are tenuimarginate. The colpi are flush with the grain outline or slightly depressed. The outer surface of the colpi is having the exine covering. The exine is uniformly thick (1.3μ) with endine and ectine in almost equal thickness. Columella slightly swollen at the ends and reticulate LO pattern. The size, shape, aperture size and apocolpium diameter of the grains are given in table 1. The size of grain and apocolpium diameter differ among the materials. In few acetolysed grains the three apertures are united to form para-syncolopate type. (Pollen morphology of AVROS 255, however, was not under-taken).

The fertility and germination were studied during the peak period of flowering. The percentage of morphologically sterile grains are given in table 2. It was found that the fertility was above 80% in all the materials studied.

TABLE 1

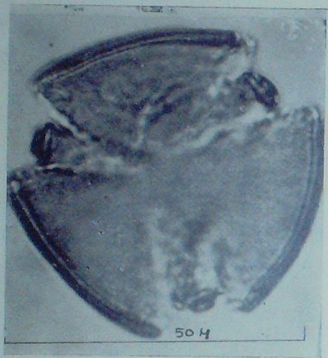
Description of Pollen Grains

Sl. No.	Clone	Size μ P	Size μ E	Shape	Aperture size μ	Apocolpium diameter μ	Remarks
1	Gl 1	45.8	47.4	Oblate Spheroidal	5.9	11.0	Measurement of 50 grains from the acetolysed sample
2	PB 86	41.8	43.4	,,	5.8	13.4	
3	FX 516	42.3	40.6	Prolate Spheroidal	5.5	14.0	
4	IAN 45-717	38.4	38.3	,,	7.2	13.2	
5	*H. spruciana*	39.9	38.6	,,	5.9	16.0	

TABLE 2

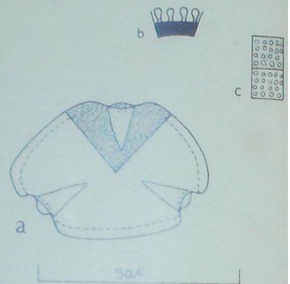
Pollen Sterility

Clone	Fertile grains	Sterile grains	Total	Percentage of sterility	Remarks
Gl 1	364	37	401	9.2	
PB 86	293	54	347	15.5	
AVROS 255	360	82	442	18.5	
FX 516	467	61	528	11.5	
IAN 45-717	73	5	78	6.4	Shy flowering
H. spruciana	208	17	225	7.5	



Microphotograph : Gl 1 —Polar view

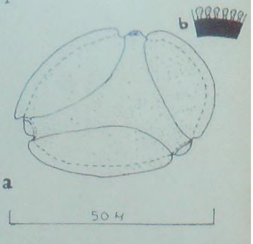
Fig. 2



Palynogram : Gl 1
(a) Main figure (b) Strata (c) LO patter

Microphotograph : *H. spruciana*—Polar view

FIG 4



Palynogram : *H. spruciana*
(a) Main figure showing syncolpate type
(b) Strata

TABLE 3

Germination of Pollen Grains

Clone	Percentage sucrose solution	Germination percentage without boric acid	Germination percentage with 0.01% boric acid	Remarks
Gl 1	0	—	1	
	10	0	13	
	15	14	31	
	20	33	37	
	25	9	25	
PB 86	0	0	1	
	10	3	13	
	15	7	22	
	20	26	34	
	25	9	12	
AVROS 255	0	—	—	
	10	1	11	
	15	7	10	
	20	7	17	
	25	15	24	
IAN 45-717	0	—	—	
	15	12	9	
	20	13	24	
FX 516	0	—	—	
	15	—	—	
	20	—	—	
H. spruciana	0	3	4	
	15	14	26	
	20	15	34	

The report of Majumder indicated that highest germination was in 15% sucrose solution with 0.01% boric acid. Hence, 0, 15 and 20 percent sucrose solutions with and without boric acid were tried with IAN 45–717, FX 516 and *H. spruciana* when these were in profuse flowering. However 0, 10, 15, 20 and 25 percent media were tried for Gl 1, PB 86 and AVROS 255.

The pollen grains germinated one hour after dusting on the media. The percentage of germination in different concentrations of media with and without boric acid are given in table 3. It is interesting to note that pollen of the different materials exhibited difference in their behaviour. The highest germination was observed in 20% sucrose solution with boric acid for all the materials except AVROS 255, which showed highest pollen germination in 25% sucrose with boric acid and FX 516 which showed no germination at all in 0, 15 and 20% media. In Gl 1 and PB 86, 20% sucrose solution with 0.01% boric acid at room temperature appears to be the ideal media, since concentration above and below showed lower pollen germination.

Gl 1 has shown highest germination closely followed by PB 86 and *H. spruciana*. The pollen of *H. spruciana* germinated in distilled water and 0.01% boric acid solution. About 1% pollen of PB 86 and Gl 1 germinated in 0.01% boric acid solution. Though pollen germinated in sucrose media, addition of boric acid markedly increased the percentage of germination. In water and lower concentrations of sucrose, the cytoplasmic material from the pollen grain was found to burst through the pores.

Though a high percentage of pollen fertility was shown by FX 516, none germinated in 0, 15 and 20% of sucrose solution with and without boric acid. The cause of non-germination may be some physiological factors. Further investigation is needed to find out the reason for non-germination in artificial media.

Summary

The pollen of *Hevea* are 3-zonicolporate, and amb triangular with convex sides. They are oblate to prolate spheroidal in shape. Exine measures 1.3μ with ectine and endine in almost equal thickness. Fertility was above 80% in all the materials. Highest germination was obtained in 20% sucrose solution with 0.01% boric acid media for Gl 1, PB 86 and *H. spruciana*, and 25% media for AVROS 255. The pollen of FX 516 did not germinate in any of the concentrations tested.

Acknowledgement

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Hevea Brasiliensis as a Source of Honey*

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Bee keeping (Apiculture) is one of the oldest cottage industries of India and it is a branch of agriculture, pertaining to the management and maintenance of honey bee colonies. The honey bees have a highly organised community life and some species were successfully domesticated since the second half of 18th century. The particular species of honey bees domesticated in India is, *Apis indica* or popularly known as Indian honey bee. The honey bees yield two valuable materials—the honey and the bee wax. The sweet honey is highly nutritious and has great medicinal value also. With the bee wax, many commercial products like high quality varnishes and candles are made. Further, the honey bees help greatly in the pollination of various crops of economic importance. Bee-keeping can be practised by any person without much effort, education or technical skill. In an economically underdeveloped country like ours, bee keeping may be a boon to the villagers for supplementing their income.

Hevea brasiliensis is a Euphorbiaceous plant, which yields one of the most important products required by the modern world—the natural rubber. The total area under rubber in India is 1,82,000 hectares and nearly 98% of the area is in Kerala and Tamil Nadu, with the rest scattered in the states of Mysore, Andaman and Nicobar Islands, Goa, Maharashtra, Tripura, Andhra, Orissa and Assam. Nearly 31% of the total rubber area is in 80,000 small holdings, of less than 2 hectares, which are not economically sound units.

Generally *Hevea* starts flowering three years after planting and in India the flowering season is spread over the months of January to March The flowers are produced in abundance and these are monoecious and diclinous, arranged in panicles. *Hevea* is a deciduous plant and during the wintering season the leaves are shed and fresh leaves formed in due course. The flowering season almost synchronises with the refoliation period after wintering.

During this season, in most of the rubber growing tracts of Kerala and also in the Kanyakumari district of Tamil Nadu, the bee keepers or apiculturists transport their bee-hives in large numbers to rubber estates. This is being done mainly because large quantity of honey is obtained from bee-hives kept in rubber estates during this season. By keeping a bee-hive in a garden usually 8 to 9 kg of honey is collected in a year and the extraction is done in monthly or bimonthly intervals. But by transporting the bee-hives to rubber estates during flowering season, 8 to 9 kg of honey could be collected from each hive in a short period of 1 to 1½ months with weekly extraction.

While carrying out observations on the insect pollinators of *Hevea* in India [4], the author noted the Indian honey bees visiting rubber trees in hundreds. They were found

* Paper presented at the Symposium on Crop Palynology held at Tiruchirapally in September, 1969.

to visit the trees during all hours of the day, but their number increased significantly in the late evening. In these silent hours prominent hissing sound is heard due to the flight of thousands of honey bees in the rubber estate. The honey bees were not observed to visit the flowers of *Hevea*, but the extra floral nectary glands only, present at the distal end of petioles, and were noticed to actively collect the sugary secretion. The bees were found to fly towards such glands particularly and collect the drop of nectar present. Sometimes they were also found to sit on the short stalk of leaflets attached to the distal end of petioles and gather the nectar (Plate). Martius [5], Delpino [3], Daguillane and Coupin [2] and Bobilioff [1] observed the presence of extra floral nectary glands at the distal end of petioles. Parkin [8] and Thankamma and George [10] have described the presence of other extrafloral nectary glands on the bud scales and on the lower surface of leaves respectively. But the honey bees were found to visit only the glands at the tip of petioles. In very rare cases they were found to visit the flowers of *Hevea* and these visits were mostly accidental, since the bees stay on the inflorescence only for a few seconds. The author collected the honey bees visiting the rubber trees using specimen tubes of 1" × 6" size and killed them gently by introducing cotton wool soaked in chloroform. These bees were examined thoroughly for rubber pollen in the laboratory under microscope. No pollen grain of rubber was present on their body, in their mouth parts or in the pollen baskets of their third pair of legs. The dead honey bees were washed well with alcohol and the washing diluted with water centrifuged. The bottom fraction was examined under microscope and pollen grains of rubber were not obtained. The honey bees which accidentally hit the flowers during flight, were collected and examined. They were found to bear pollen grains of rubber on their head. But no pollen grains were noticed in the pollen baskets. In agreement with the observations made by the author, pollen grains of rubber were absent in the combs of bee-hives kept in rubber estates. The apiculturists, who take their bee-hives to rubber estates in the flowering season, also observed the bees to collect only the nectar secreted in the extrafloral nectary glands at the tip of petioles.

Plate
Honey bee feeding the nectar from the extra floral nectary gland present at the distal end of petioles

Even though flower of *Hevea* is produced in abundance, it is not a good source of honey for the bees as there are no nectary glands in flowers. And the pollen grains produced in the flowers are also seen to be unacceptable to the honey bees. The reasons for the same are not adequately known. Probably the sticky nature of the pollen and the small size of the flowers may be uninviting. Morris [7] stated that the more numerous and active bees may be responsible for pollination of *Hevea*. But from the observations made by the author [4] and Sripathi Rao [9] it is clear that the bees are not responsible for the pollination of *Hevea*. In large rubber estates generally no other plants except cover crops are allowed to grow among the rubber trees. Hence the honey bees do not have a good source of pollen. Because of the abundance of nectar, probably the honey bees tendered in rubber estates do not make any attempt to divert their attention from the collection of nectar to pollen by flying longer distances. So the bee-hives kept in rubber estates are mostly devoid of pollen. But pollen is an important ingredient in the food of honey bees, especially the larvae. The larvae of workers and drones are fed with a special kind of food known as 'bee bread' which is prepared by mixing honey and pollen. Further the pollen is the main source of protein in the food of honey bees. The honey bee colony cannot thrive without enough pollen. In a normal colony 60 to 125 lb of pollen and 150 to 300 lb of honey are procured in a year for survival [6]. So the bee-hives kept in rubber estates will die off, when these are retained in the rubber estates for more than 1½ month. Hence the bee-hives are transferred to other areas where there is a good source of pollen as well as nectar after keeping them in rubber estates during the refoliation period, for 1 to 1½ months. Moreover there may not be much secretion from the extra floral nectaries after the refoliation as the glands become functionless, with the tissues getting shrunk and discoloured, when the leaves mature.

The honey produced in the hives kept in rubber estates is mobile because of extraction before maturation. This honey is also stated to be slightly bitter in taste. But these bad qualities are negligible and can be eliminated by mixing this with the honey collected from other sources and also by adopting special curing methods.

Even though the Indian honey bees were not found to visit the flowers of *Hevea* either for nectar or pollen, another honey bee belonging to the species *Melipona* (Dammar bees) has been noticed to visit actively the the flowers of *Hevea*. And they were never observed to fly to the extra floral nectary glands. Thick mass of rubber pollen was present in the pollen baskets of their third pair of legs. This bee has not been domesticated so far. But its honey is reported to have much greater medicinal value than that of *Apis indica*.

Apiculture is a highly profitable cottage industry, since a kilogram of honey costs about Rs. 8/-. If a honey bee colony is successfully tendered throughout the year in a rubber estate, 15 to 18 kg of honey could be collected in a year. So to maintain a healthy colony in rubber estates during and after the refoliation period, it is necessary to provide good sources of pollen and nectar to the bees. Establishing plants like Antigonon and some fruit trees may help to achieve this end. Popularisation of this cottage industry may be of great help to the small growers for enhancing their income.

Acknowledgement

The author is thankful to Shri K. C. Ananth, Chairman/Director of Research, Rubber Board, for his keen interest in this work and to Shri P. N. Radhakrishna Pillay, Deputy Director (Pathology), for his valuable suggestions and critical review of the manuscript. He is also grateful to the Y. M. C. A., Rural Demonstration Centre, Martandam, for furnishing the necessary information.

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NEWS AND NOTES

Meetings of the Rubber Board

65th Meeting

The 65th meeting of the Rubber Board was held in the Council Hall of the Board on the 25th October, 1969. Shri T. V. Swaminathan, Chairman of the Board, presided.

At the outset, the Chairman expressed his grateful regards and most sincere thanks to members who had sent him messages congratulating him on his appointment as Chairman, Rubber Board.

The Chairman said that the four vacancies in the Rubber Board had since been filled up with the representatives of labour. The nominees were Sarvashri K. P. Raghavan Pillai, B. K. Nair, K. V. K. Panikkar, and G. Gopinadhan Nair, M. P. On his personal behalf and on behalf of the Board, the Chairman extended a hearty welcome to the incoming members. Proceeding, the Chairman said that he would be failing in his duties if he did not remember the precious service rendered by his predecessor in office, Shri P. S. Habeeb Mohammed, whom it was no easy task to succeed successfully.

The Chairman then sought the leave of the Board to take up the items on the agenda for discussion. The important decisions taken by the Board are detailed below.

Vice-Chairman

The Board elected Shri Joseph Mangara as Vice-Chairman of the Board for a period of one year commencing from 25th October, 1969, or till he ceased to be a member of the Board, whichever was earlier.

Committees

The following members were elected to the various committees as indicated.

Shri Michael A. Kallivayalil—Executive Committee

Shri Joseph Jacob—Smallholdings Development Committee

Sarvashri K. P. Raghavan Pillai and K. V. K. Panikkar—Planting Committee

Sarvashri B. K. Nair, K. P. Raghavan Pillai and K. V. K. Panikkar —Labour Welfare Committee

Budget

The Board approved the revised estimates for 1969—70 and the budget estimates for 1970—71 of the General Fund and Pool Fund of the Board.

It was also resolved to request the Government to permit continuation of the existing schemes of the Board without making the conditions stricter and to grant in time the full finance required. In the meanwhile, the Chairman was permitted to carry on the schemes as existing and honour the commitments already entered into.

Import Policy

After taking into account the estimates of production for the year and the current position of stock, the Board resolved to recommend to the Government of India that no further import of raw rubber should be allowed for the period ending 31st December, 1969.

The Board decided that the balance quantity, if any, out of the imported rubber due to arrive against the licences already issued be made available to the manufacturers only after December, 1969.

The Board requested the Government of India to take expeditious decision on the recommendations of the Tariff Commission and to notify without any further delay the fair and firm minimum price for indigenous natural rubber.

It was also resolved to recommend to the Government of India to nominate, in addition to the Chairman, Rubber Board, a minimum of two members of the Rubber Board representing the producers, in the State Trading Corporation's advisory committee on import of rubber.

Regional Nursery

The Chairman informed the members that the Government of Kerala had allotted an additional area of 5 acres on lease at Neriamangalam for expansion of the regional nursery and the Board had formally taken over the land on 9th October, 1969.

Working Capital Loan

The Board resolved that the scheme for the grant of working capital loan to rubber marketing societies be continued during 1969–70.

Representation on ICAR

It was resolved to nominate Shri K. C. Ananth, Director of Research, to represent the Board on the Indian Council of Agricultural Research for a period of three years, in the place of Dr. K. T. Jacob.

After discussion on the agenda, the meeting came to a close with a vote of thanks to the chair.

66th Meeting

The 66th meeting (special) of the Board was held at Kottayam on the 7th February, 1970. Shri T. V. Swaminathan, Chairman, presided.

Initiating discussions, the Chairman recalled the decision taken at the 65th meeting of the Board that no import of rubber should be recommended till the end of December 1969, and that the balance quantity, if any, due to arrive against licences already issued should be made available to the manufacturers only after December, 1969. It was, therefore, necessary to examine the position again and advise the Government regarding import policy and programme for the quarter January to March, 1970, and for the year 1970–71.

The production of natural rubber from April to end of November, 1969, was 54,694 tonnes. The estimate of production for the period December, 1969 to March, 1970 was 26,600 tonnes. The production of natural rubber during 1969-1970 would, therefore, be 81,294 tonnes. The quantity of natural rubber physically imported during April to November, 1969 was 16,122 tonnes. The quantity of synthetic rubber produced during April to November was 15,542 tonnes. The estimate of production during December, 1969 was 3,506 tonnes. The estimate of production during January to March, 1970 was 9,000 tonnes at the rate of 3,000 tonnes per month. Therefore, final dependable figure of production for synthetic rubber would be 28,000 tonnes. The quantity of synthetic rubber physically imported during the period April to Novmber, 1969 was 2,342 tonnes. The dependable estimate of consumption for 1969-70 would be 1,20,000 tonnes. The actual consumption during April-November, 1969 had been 77,187 tonnes, comprising 57,230 tonnes of natural rubber and 19,957 tonnes of synthetic rubber. The estimate of consumption during December, 1969 to March, 1970 was 43,000 tonnes. The opening balance as on 1-4-1969 was 28,000 tonnes comprising natural and synthetic rubber. This lead to a surplus of 7,464 tonnes, the Chairman said.

The meeting had a detailed discussion of the supply and demand position of rubber and came to the conclusion that internal production coupled with the stock of rubber available with producers, manufacturers and dealers would be sufficient to meet the demand fully.

Members expressed their concern at the delay on the part of the Government of India in notifying the minimum price for indigenous natural rubber based on the recommendations of the Tariff Commission. They emphasised the need for expeditious decision on the recommendations of the Tariff Commission and the Smallholdings Economics Enquiry Committee. Many members expressed anxiety at the withdrawal of some major rubber goods manufacturers from the market and stoppage of purchases which had resulted in the accumulation of stocks and consequent fall in prices.

Summing up the position in the light of the critical comments, suggestions and advice of the members, the Chairman said that the consumption requirement could initially be placed at 1,35,000 tonnes. A cover of three months, might be provided for in consonance with earlier resolutions of the Board. The total requirement would, therefore, be 1,69,000 tonnes. Special purpose synthetic rubber which should in any way be imported would constitute 3,500 tonnes. The requirements of natural and synthetic rubber would, therefore, be 1,65,000 tonnes. The pattern of consumption was 75 to 25 as between natural rubber and SBR produced in India. Hence, the quantity of natural rubber required would be 1,24,000 tonnes. As the production of natural rubber would be 90,000 tonnes and the opening balance of natural rubber would be of the order of 30,000 tonnes, the deficit could only be of the maximum order of 4,000 tonnes. This would represent only half a months' consumption. Hence there was no need for any import during 1970.

The Board then adopted the following resolutions :

"Resolved that the Board, after taking into account the estimates of supply and demand for the years 1969-70 and 1970-71 and the current position of stock, recommends to the Government of India that no import of natural rubber should be allowed up to the end of September, 1970."

"Resolved that the balance quantity, if any, remaining to be imported out of the rubber licensed to be imported should, unless it be special purpose SR, be made available to the manufacturers only after further appraisal of the position by the Board after 1-4-1970 and before 30-9-1970."

67th Meeting

The 67th meeting of the Rubber Board was held on the 30th June, 1970, at the office of the Board at Kottayam, Shri T. V. Swaminathan, Chairman, presiding.

Reviewing the rubber situation in the country, the Chairman said that the stock position could be considered to have improved very much as a result of decline in consumption and increase in production during the previous months. Consumption of rubber in April, 1970 was less than in March and consumption in May was less than in April. He hoped that production of natural rubber during 1970-71 would exceed the target fixed.

The Chairman said that actual consumption of rubber during 1969-70 was 1,16,869 tonnes. Production of natural rubber had exceeded the target by about 1000 tonnes. As on 1st April, 1970, the stock of rubber had increased to 44,236 tonnes. The Chairman declared that there was no need for any import of rubber into the country during the current year as internal production was sufficent to meet the demand.

The meeting constituted a sub-committee with Shri T. V. Swaminathan as Chairman to review the situation created by the glut in the rubber market and the consequent decline in prices and to suggest remedial measures.

It was decided to hold the next meeting of the Board at New Delhi during the third week of August, 1970.

Third Conference of Rubber Growers' Co-operatives

The third conference of rubber growers' co-operative societies was held on the 8th and 9th November, 1969, at Palghat under the joint auspices of the Palghat District Co-operative Rubber Marketing Society and the Rubber Board. About 250 delegates representing the societies in Kerala and Tamil Nadu attended the conference.

The conference was inaugurated by Shri M. K. K. Nair, Managing Director, FACT. Shri E. P. Gopalan, Chairman of the Kerala Agro-Industries Corporation, presided. Shri T. V. Swaminathan, Chairman, Rubber Board and Sri G. Gopalakrishna Pillai, District Collector, Palghat, spoke on the occasion. Shri O. M. S. Namboodiripad, President of the Palghat District Co-operative Rubber Marketing Society, welcomed the gathering and Shri M. Krishna Menon, President of the conference committee, proposed a vote of thanks.

Six papers were presented for discussion at six sessions held on two days.

Shri K. Krishnan Nambiar, Registrar of Co-operative Societies, Kerala, was the chief guest at the concluding session held on the second day of the conference.

Rubber Crepe Mill

The first rubber crepe mill in the co-operative sector was inaugurated at Karur near Palai in Kottayam district on the 21st March, 1970, by Shri T. V. Swaminathan, Chairman, Rubber Board. The mill has been established by the Meenachil Taluk Rubber Growers' Marketing Co-operative Society with the aid of the Rubber Board. The Board had given a grant of rupees one lakh to the society for the purpose.

Five rollers, each of 18" × 13" size, have already been fitted in the crepe mill which is designed to house 15 rollers when fully developed at a total cost of rupees three lakhs. The present capacity of the mill is one tonne of scrap rubber per shift. When fully equipped it would work two shifts a day.

IRRDB Meeting

Shri K. C. Ananth, the then Director of the Rubber Research Institute of India, represented the Rubber Board at the meeting of the International Rubber Research and Development Board held at Abidjan in Ivory Coast from 3rd to 6th March, 1970. The meeting mainly discussed problems relating to the cultivation of rubber.

Membership of the Board

The Central Government has notified the nomination of the following persons as members of the Rubber Board with effect from the 14th July, 1969 and upto the 21st February, 1971 to represent labour interests :

1. Shri K. P. Raghavan Pillai, General Secretary, Kerala State Committee, Office of the Kerala Provincial United Trades Union Congress, Cantonement, Quilon, Kerala.
2. Shri B. K. Nair, Indian National Trade Union Congress Office, Alleppey, Kerala.
3. Shri K. V. K. Panikkar, Indian National Trade Union Congress Office, Trichur, Kerala.

The Central Government has notified the nomination of Shri G. Gopinadhan Nair, M. P., President, Kerala State Committee, Office of the Kerala Provincial United Trades Union Congress, Cantonement, Quilon, Kerala, as a member of the Rubber Board with effect from the 14th October, 1969, and upto the 21st February, 1971 to represent labour interests.

The Central Government has appointed, on the recommendation of the Government of Kerala, Shri K. V. Ramakrishna Ayyar, Additional Secretary, Department of Agriculture, Government of Kerala, Trivandrum, as a member of the Rubber Board, with effect on and from the 5th January, 1970 and upto the 21st February, 1971, vice Shri T. V. Swaminathan appointed as Chairman.

The Central Government has notified that Shri S. Kumaran, Member of Rajya Sabha, House No. 941, Thampanur, Trivandrum, Kerala, has been elected by the Rajya Sabha as a member of the Rubber Board for a period of three years with effect from the 19th June, 1970, or for so long as he continues to be a member of the Rajya Sabba, whichever is less.

Rubber Board News

Shri K. C. Ananth, Director, Rubber Research Institute of India, has been appointed Rubber Production Commissioner under the Rubber Board. Shri Ananth assumed charge of the new post on the 14th May, 1970.

Shri Ananth, who joined the Rubber Board in 1963 as Deputy Director was appointed Director of Research in 1968. He also officiated as Chairman of the Board from July to September, 1969.

As Rubber Production Commissioner Shri Ananth will be in charge of the Divisions of Development, Extension, Economic Research and Co-operation of the Board. He will also be ex-officio member of the Board.

Shri K. M. Joseph, Development Officer under the Board, has been appointed Officer on Special Duty in charge of the Pilot Rubber Plantation Project, South Andamans. The post of Development Officer has been abolished.

Consequent on the appointment of Shri K. C. Ananth as Rubber Production Commissioner, Shri V. K. Bhaskaran Nair, Deputy Director, Division of Botany, Rubber Research Institute, will hold charge of the post of Director.

Dr. P. John Jacob, Assistant Rubber Chemist, Rubber Research Institute, resigned from the service of the Board on the 14th July, 1970. He took up appointment as Rubber Technologist under the Premier Tyres, Ltd., Kalamassery, Kerala.

Shri V. K. G. Nair, Librarian, Rubber Research Institute, resigned from the service of the Board on the 27th June, 1970. He joined as Librarian under the Hindustan Machine Tools, Ltd., Pinjore, Haryana State.

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Rubb Board bull (1971), 11 (2), 39–47

Studies on the Physiological Aspects of Rubber Production

2. Physiology of Yield Increase in Double Cut Tapping System [s/2, d/2 (2×2d/4)]

M. R. Sethuraj and **M. J. George**
Botany Division, Rubber Research Institute of India, Kottayam-9

In s/2 d/2 (2 x 2d/4) system of tapping, a high s/2 cut and a low s/2 cut are tapped on alternate panels at two days intervals. Conflicting opinions have been expressed about the advantages of this system of tapping on yield [9, 1, 6]. Both Tobin [9] and de Jonge [1] reported a low d. r. c. and late dripping associated with the yield increase brought about by this system of tapping. The effect of opening a high opposite cut on the d. r. c. and late dripping in the lower cut, though interesting, had not been explained. As this aspect was considered to be of physiological importance, an experiment was started to study the physiological effects of opening of the upper cut on the latex flow pattern and yield of the lower cut. In the earlier reports on this system of tapping the distance between the two cuts was kept at 50" (125 cm) or more in order to avoid merging of drainage areas. But the reported late dripping from the lower panel after the introduction of upper cut indicates some form of interference by the upper cut on the latex flow from the lower panel. In the present experiment the distance between the two cuts was reduced to about 22" (55 cm) so that any effect of the upper cut on the lower cut would be more pronounced.

Experimental

Six trees each from three clones, viz., Avros 255, Tjir 1 and PB 6/9, for which pre-treatment yield data were available, were selected for the study. These trees were planted in 1956 and have been under tapping from 1963 onwards. The upper cuts were opened in March, 1967, in half the number of selected trees under each clone, at 50" (125 cm) from the union on the opposite side. The distance between the upper and lower cuts was about 22" (55 cm). Yield from both lower and upper cuts was recorded every month by cup coagulation. As the post-treatment data for one year indicated a general increasing trend in yield and late dripping in the lower cut of double-cut trees, further studies on latex flow pattern, by recording plugging index, d. r. c. and volume yield, have been conducted during 1968. Plugging index was calculated by the formula :—PI =

$$\frac{\text{Initial flow rate for 5 mts (ml/min)} \times 100}{\text{Total volume yield (ml)}}$$

The d. r. c. was determined by the usual laboratory method. The extent of latex drainage on tapping, from selected positions away from the lower cut and below the upper cut, was also studied by taking latex samples before and one hour after tapping and determining the total solid variation following the method of Ferrand [3] as modified by de Jong [2].

Results

In comparison to the pre-treatment yield data (1966), an increasing trend in yield per tapping of the lower panel was observed in double-cut trees over the yield increase in single-cut trees (Table I). During the first year after the opening of the upper cut, the rate of yield increase was higher in double-cut trees in all clones; the effect was more in Avros 255 and PB 6/9 than in Tjir 1 (Table 1, Figs. I, II and III). In Tjir 1, double cut trees yielded more during peak periods of yield. During the second year after treatment (1968), while Avros 255 trees maintained the same trend of yield increase, the high response to double-cut shown by PB 6/9 trees during the first year of treatment diminished, possibly due to partial dryness in the double-cut trees. The response to double-cut by Tjir 1 was more pronounced during the second year of treatment than in the first year.

The studies on the latex flow pattern of the single-cut and double-cut trees show that the increased yield from the lower panel of the double-cut trees in comparison with the yield from single-cut trees may mainly be due to a reduced plugging index and that the pattern of yield variation is related to the pattern of variation of plugging index in all clones under study.

Data on the plugging index, d. r. c., volume yield and yield recorded during 1968 are graphically represented in figs. IV, V, VI. Data on the extent of latex drainage on tapping of the lower panel from predetermined points (Table 2 a, b, c) show that the latex is drained from a more extensive area, more efficiently in double-cut trees than in single-cut trees and that the total solid content of latex in the drainage area is significantly lower in double-cut trees compared to single-cut trees.

Discussion

Reports by Milford et al [4] on the relationship between tapping system and plugging are based on a comparison between half-spiral and full-spiral systems only. Southorn and Gomez [8] have conducted experiments on the effect of length of the cut on plugging and they have suggested two distinct mechanisms of plugging for very short and longer cuts. The results show that the plugging is lowered as the length of the cut is increased.

In the present experiment, however, the length of the lower cut was not altered; but the plugging was lowered by the introduction of another upper cut on the opposite side. Studies have also indicated a general increase in the dilution of latex *in situ* in the drainage area and a more extensive drainage of latex from an extended area in the case of double-cut trees. It seems that the opening of the upper cut has resulted in dilution of latex in the area of bark below the cut and this area might have merged with the drainage area of the lower cut. This might have resulted in drainage of latex more easily from a more extended area upon tapping of the lower cut, due to dilution of latex.

Positive correlation between plugging and d. r. c. between clones has been reported [4], for which two explanations are given. A higher d. r. c due to higher viscosity may cause earlier plugging of the vessels. Alternatively a lower d. r. c. equilibrium may be attained as a consequence of lower plugging, due to exhaustive drainage. Paardekooper and Somorson [5], however, found that seasonal variation in plugging was not associated with a corresponding variation in d. r. c. values and also that there was no correlation between d. r. c. and plugging index within clones and have concluded that correlation between d. r. c. and plugging index is not perfect.

The results of the present study in turn indicate that plugging index can be modified by an *extension of bark area with dilute latex* (extent of spread of dilution in the bark). This may lead to a greater drainage and consequently a still lower d. r. c.

TABLE I

Clone	Pre-treatment data on yield (1966–67) gms/tree/tap		Post-treatment data on yield (gms/tree/tap of the lower panel)							
	1966		1967				1968			
	Single cut trees	Trees to be double-cut	Single cut trees	Double cut trees	% increase/decrease over pre-treatment yield		Single cut trees	Double cut trees	% increase/decrease over pre-treatment yield	
					Single cut trees	Double cut trees			Single cut trees	Double cut trees
AVROS 255	31.31	32.71	32.54	51.24	+3 92	+56 64	34.75	55.61	+10.98	+70.00
Tjir 1	42 47	33.79	46.29	42.91	+8 99	+76.99	52.02	57.88	+22.48	+71.29
PB 6/9	48.07	43 98	48.62	68.23	+1.14	+55.13	52.75	58.21	+ 9 73	+32.35

Total solid variation in latex samples collected by puncturing from different distances from tapping cut before and after tapping

TABLE 2 a

Clone TJIR 1

Time of sampling	SINGLE CUT				DOUBLE CUT			
	15 cm below	Same level 10 cm away	15 cm above	30 cm above	15 cm below	Same level 10 cm away	15 cm above	30 cm above
Before tapping	–	56.5	55.3	46.6	49.3	46.7	45.0	44.9
After tapping	–	55.9	53.8	45.9	46 4	43.2	40.7	41.9

TABLE 2 b

Clone AVROS 255

Time of sampling	SINGLE CUT				DOUBLE CUT			
	15 cm below	Same level 10 cm away	15 cm above	30 cm above	15 cm below	Same level 10 cm away	15 cm above	30 cm above
Before tapping	49.9	51.2	52.8	53.3	37.9	37.5	37.3	38.3
After tapping	49.1	50.4	51.6	52.1	36.9	36.8	33.4	33.8

TABLE 2 c

Clone PB 6/9

Time of sampling	SINGLE CUT				DOUBLE CUT			
	15 cm below	Same level 10 cm away	15 cm above	30 cm above	15 cm below	Same level 10 cm away	15 cm above	30 cm above
Before tapping	44·4	44.5	44.9	45.8	42.4	42.4	43.5	44.6
After tapping	43.7	43.8	44.1	43.2	37.3	41.5	41.3	40.9

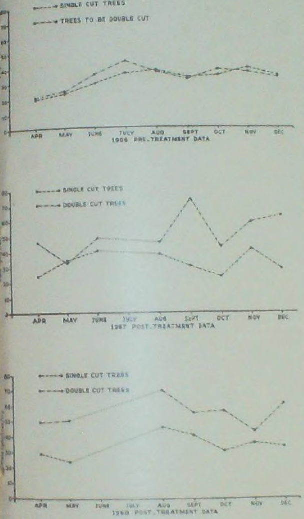

Fig. 1. Pre-treatment and post-treatment data on yield of single and double cut trees (Avros 525)

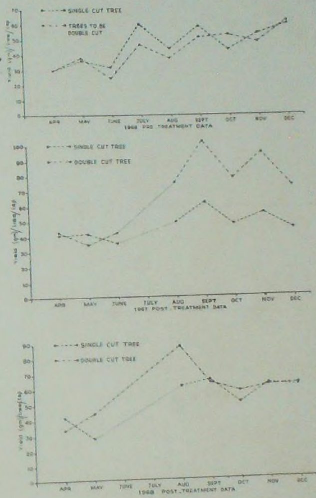

Fig. 2 Pre-treatment and post-treatment data on yield of single and double cut trees (PB 6/9)

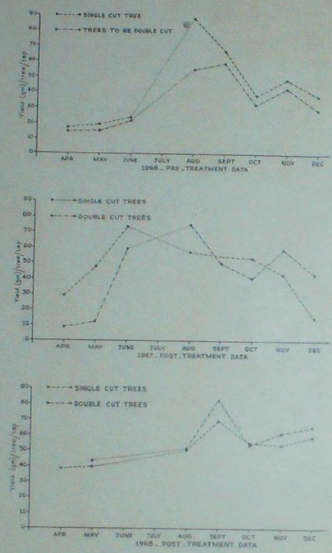

Fig. 3. Pre-treatment and post-treatment data on yield of single and double cut trees (Tjir—1)

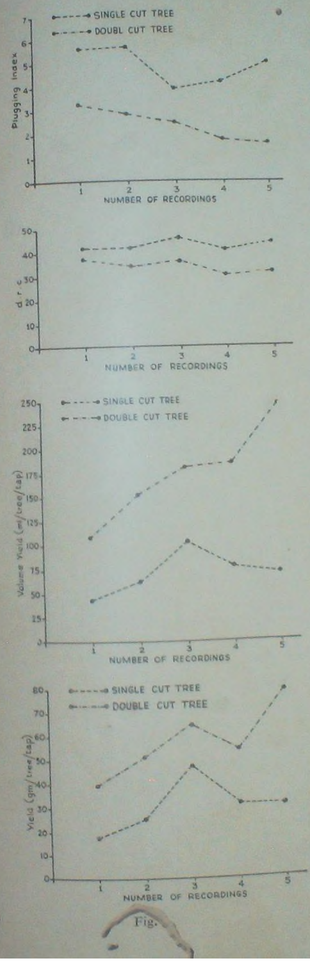
SINGLE CUT TREE
DOUBL CUT TREE
Plugging Index
NUMBER OF RECORDINGS
d r c
NUMBER OF RECORDINGS
SINGLE CUT TREE
DOUBLE CUT TREE
Volume Yield (ml/tree/tap)
NUMBER OF RECORDINGS
SINGLE CUT TREE
DOUBLE CUT TREE
Yield (gm/tree/tap)
NUMBER OF RECORDINGS

Fig.

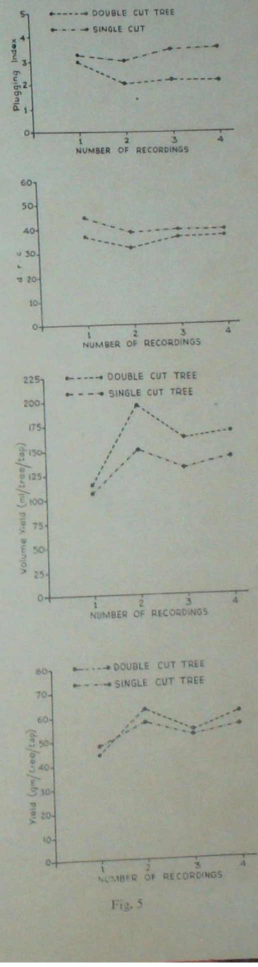
DOUBLE CUT TREE
SINGLE CUT
Plugging Index
NUMBER OF RECORDINGS
d r c
NUMBER OF RECORDINGS
DOUBLE CUT TREE
SINGLE CUT TREE
Volume Yield (ml/tree/tap)
NUMBER OF RECORDINGS
DOUBLE CUT TREE
SINGLE CUT TREE
Yield (gm/tree/tap)
NUMBER OF RECORDINGS

Fig. 5

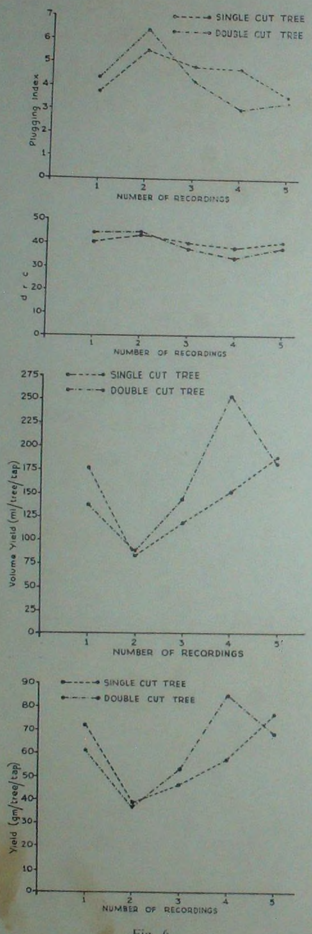

Fig. 6

Fig. 4. Plugging index, d. r. c., volume yield and yield of single and double cut trees (Avros 255)

Fig. 5. Plugging index, d. r. c., volume yield and yield of single and double cut trees (PB 6/9)

Fig. 6. Plugging index, d. r. c. volume yield and yield of single and double cut trees (Tjir-1)

equilibrium may be attained in the double-cut trees. Unpublished data from the work under way at RRII [7] have further supported the contention that the *extent of bark area with dilute latex* near the tapping cut can act as a factor in modifying the plugging index. The ease with which such an area with dilute latex in bark develops on opening a tapping cut may vary in different clones and this may explain the clonal variations found in the response to double-cut tapping systems.

It has to be mentioned that the object of this study was solely to understand the physiology of latex flow in trees with double-cuts and as such, the merits or demerits of this system of tapping have not been considered.

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Rubb Board bull (1971), *11 (2)*, 48–51

Factice From Rubber Seed Oil

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Summary

Sulphur factice was prepared from rubber seed oil under different experimental conditions. A typical product was incorporated into a tread type mix and the effect of factice loading on the cure time and the physical properties of the vulcanisate were evaluated. The product prepared in the laboratory was compared with a commercial factice.

Introduction

Today factice is recognised as a valuable processing aid and is classed among the compounding ingredients of the rubber technologist. This material possesses certain intrinsic properties, which make it indispensible in mixes during milling, calendering, extrusion and injection moulding[5, 9]. In SBR compounds, factice at the levels of 5 PHR, exhibits accelerating powers and permits low accelerator levels without affecting tensile and modulus of the stock. In neoprene compounds, 10 PHR of factice improves the processing behaviour of the elastomer. EPR can be processed into a lightly loaded low hardness compound, in presence of 5 PHR factice. In butyl rúbber, the use of factice imparts good extrusion characteristics, ageing properties to the stock and helps easy black incorporation [6, 15, 7].

A wide range of vegetable oils are employed for factice preparation. Linseed, rape seed, cotton seed, soyabean and fish oils are some of the widely used glyceride oils[16]. There is indigenous production of factice from linseed oil and rape seed oil[12].

At present India produces 400 tonnes of factice annually and approximately the same is the consumption[14]. Presently, only Ceylon produces rubber seed oil on a large scale[13]. A survey undertaken by the Oil Technological Institute[1], Ananthapur, reveals the production possibilities of rubber seed oil in India.

In the present work, a factice has been prepared from rubber seed oil. The purpose of the work was to explore the possibilities of more and more commercial utilisation of rubber seed oil.

Experimental

Crude rubber seed oil (A. V=9.79, I. V=138.1, S. V=194.1) was heated to the desired temperature and powdered sulphur was mixed in. At first, sulphur dissolved in the oil forming a colloidal dispersion. The viscosity of the mixture gradually increased and finally instantaneous gelling occurred. The colour of the reaction mixture also changed during the progress of the reaction. It was light yellow initially and dark brown towards the final stages. The product was cooled, leached with water and dried. The final qualities of the product were determined by the temperature of the reaction, amount of sulphur and the catalyst used.

With crude rubber seed oil, products were prepared with 15, 20, 25 and 30 parts of sulphur per 100 parts of oil. With 25 parts of sulphur to 100 parts of oil, products were prepared in presence of diethanol amine at different temperatures. With blown rubber seed oil (I. V=100–115), products were prepared with 15, 20, and 25 parts of sulphur. MBT was tried as catalyst in some experiments. All the products were analysed for aceton extractables [3, 2], free sulphur [3], total sulphur [3] and the time to

TABLE 1

	Conditions of preparation	Acetone extract	Free sulphur sample	Free sulphur acetone extract	Total sulphur	Time to form Posnansky solution in minutes
1	25 parts sulphur/100 parts oil Temperature 150–55°C	49.56	3.24	3.45	13.08	115
2	25 parts sulphur/100 parts oil Temperature 170–75°C	60.02	4.46	5.25	10.58	115
3	25 parts sulphur/100 parts oil Temperature 150°–55°C. Diethanol amine 3–4% on the total weight of oil and sulphur	60.43	3.18	3.93	12.17	115
4	25 parts sulphur/100 parts oil Temperature 160–65°C Diethanol amine 3–4%	47.29	3.60	3.59	12.71	115
5	25 parts sulphur/100 parts oil Temperature 170–75°C MBT 3–4%	51.00	3.75	3.72	12.25	not formed in 340′
6	25 parts sulphur/100 parts oil. 3–4% diethanol amine. Temperature 170–75°C	51.76	1.76	2.66	13.13	220
7	15 parts sulphur/100 parts oil Temperature 170–75°C	54.80	0.84	1.38	10.09	not formed in 340′
8	30 parts sulphur/100 parts oil Temperature 170–75°C	53.40	4.86	4.97	16.10	200
9	20 parts sulphur/100 parts oil Temperature 170–75°C	45.54	4.28	4.79	12.11	200
10	25 parts sulphur/100 parts blown oil Temperature 170–75°C	52.24	5.65	5.19	13.92	220
11	20 parts sulphur/100 parts blown oil Temperature 170–75°C	49.23	3.82	3.72	11.52	220
12	20 parts sulphur/100 parts blown oil 3–4% diethanol amine Temperature 170–75°C	48.40	3.98	1.42	15.73	200
13	15 parts sulphur/100 parts blown oil Temperature 170–75°C	43.13	1.03	1.09	0.902	not formed in 340′
14	Commercial factice	55.65	3.07	2.28	11.75	120

TABLE 2

Tread Type Mix

Smoked sheets	Parts by weight 100	Process oil	Parts by weight 4
Zinc oxide	5	MBS	0.85
Stearic acid	2	Nonox D	1
HAF Black	48	Sulphur	2.25
		Factice	0, 5 & 10

TABLE 3

Scorch and cure characteristics of the compounds containing factice

Sample PHR of factice	Scorch time in minutes at 120°C	Calculated cure time in minutes at 140°C
Blank	15.5	19.0
PF 5	14.0	19.0
CF 5	14.0	19.0
PF 10	14.5	20.0
CF 10	11.5	19.0

TABLE 4

Effect of factice incorporation on the physical properties of the vulcanisates before ageing

Amount of factice	Tensile strength Kg/cm	Modulus at 300% elnogation Kg/cm²	%elongation at break
Blank	301.8	211.1	430
Prepared factice 5 PHR	301.9	214.0	400
Prepared factice 10 PHR	277.6	180.6	420
Commercial factice 5 PHR	296.5	211.0	410
Commercial factice 10 PHR	303.7	210.6	420

TABLE 5

Effect of factice incorporation on the physical properties of the vulcanisates after ageing 48 hrs at 85°C

Amount of factice	Tensile strength Kg/cm²	Modulus at 300% elongation Kg/cm²	%Elongation at break
Blank	237.3	225.9	310
Prepared factice 5 PHR	303.9	235.7	390
Commercial factice 5 PHR	288.3	230.8	360
Prepared factice 10 PHR	243.2	178.7	390
Commercial factice 10 PHR	286.8	219.1	400

form Posnansky solution.[8] The time to form Posnansky solution was determined according to the method adopted by Flint (Triethanol amine was used instead of dicyclohexyl amine).

A typical product prepared with 15 parts of sulphur and 100 parts blown rubber seed oil at 170-75°C, was incorporated in a tread type mix and the effect of factice incorporation on the processibility of the compound and physical properties of the vulcanisate was studied. The cure time was determined according to the Juve's extended Mooney Test [11]. The ageing characteristics of the vulcanisates were also evaluated. The results of chemical analysis and technological evaluation of the prepared product were compared with those obtained with a commercial sample of factice.

Results and Discussion

From table 1, it may be seen that products prepared with proportions of sulphur above 20 parts analysed for high free sulphur. With blown rubber seed oil, 15 parts of sulphur to 100 parts oil was found to be suitable. However, with raw rubber seed oil, an amount of 15–20 parts of sulphur may be employed.

Factice prepared with 25 parts sulphur to 100 parts unthickened oil at a lower temperature gave products with lower free sulphur value. In presence of diethanol amine, which is known to promote polar reactions [4] a higher temperature may be preferred. Use of diethanol amine gave products with comparatively low free sulphur. With blown rubber seed oil, soft friable gels are obtained with low proportions of sulphur in a relatively shorter time for gelling

When factice was loaded at the levels of 5 PHR and 10 PHR, there was no appreciable change in the scorch and cure characteristics of the compound. The sample containing 10 PHR commercial factice was a little more scorchy than all the other samples. The scorch time of the compounds containing factice was slightly lower than that of the blank. Both the prepared and commercial factice gave similar cure times in Juve's extended Mooney Test to determine the optimum cure time.

Incorporation of factice into the mix at the levels of 5 and 10 PHR did not seriously affect the tensile strength. In this case, both the prepared factice and commercial factice behaved similarly. There was little variation in the modulus of the vulcanisates containing factice and the blank. The modulus of the compound containing 10

PHR prepared factice was slightly lower than all the other samples. The elongation at break of the vulcanisates containing factice was the same as that of the blank. Factice incorporation has considerably improved the ageing characteristics of the vulcanisates. The tensile retention of all the compounds containing factice was almost complete after ageing for 48 hours at 85°C. The tensile strength of the blank showed considerable decrease after ageing. Retention of modulus of the samples after ageing was almost complete. Elongation at break of the vulcanisates after ageing showed slight decrease.

Economics

"The factice manufacturer is blessed with some uncertainty in the matter of costs. Since the main raw material, the oil, is an agricultural or natural product, there is price variation and the pattern of oil prices determines to a considerable degree, the type of oil used in manufacture. The variation in the prices of oils has not resulted necessarily in corresponding variation in the price of factice, because of the fortunate fact that, within limits, the oils can be changed with hardly any significant difference, in the resulting factice."[4] Based on the above picture of factice production economy, rubber seed oil may be an ideal substitute for other factice making oils, for a factice manufacturer. The approximate cost of raw materials (oil and sulphur) for making 1 kg of factice from rubber seed oil will be around Rs. 2.45.

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Epoxidation of Rubber Seed Oil

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Summary

In situ epoxidation of crude rubber seed oil using 18% and 30% hydrogen peroxide, has been found to give products with satisfactory oxirane content. The mole ratio of acetic acid and hydrogen peroxide to oil reaction temperature and catalysts are critical for obtaining a product with acceptable oxirane oxygen.

Introduction

The epoxidized oils and epoxidized esters of unsaturated fatty acids are widely used in polyvinyl chloride and its copolymers in conjunction with other substances to impart a spectrum of properties, eg. heat and light stability, superior ageing and low temperature flexibility. Epoxidized products also find their use in the formulation of anticorrosive coatings, adhesives and alkyd resin casting [3, 7].

Attempts have been made to make use of non-edible oils, instead of ground nut oil, which is at present employed for epoxidation in India[6] Khuddus[7] et al have reported the epoxidation of cotton seed, safflower and tobacco seed oils. Nagiah[9] and others have studied the epoxidation of linseed oil, castor oil and sardine oil. Jain and Bhatnagar [6] worked out the conditions for the preparation of epoxidized acetylated castor oil. Malliah[8] et al investigated the epoxidation of watermelon seed, sesame, nigerseed, ricebran and ajowan seed oils.

In the present work, crude rubber seed oil has been epoxidized to obtain products with satisfactory oxirane content. The work was undertaken with a view to finding new uses for rubber seed oil for industrial purposes.

Experimental

In a typical experiment, 25 grams of crude rubber seed oil (I. V = 138; 0.135 moles of double bond), 6 grams of benzene, 4 grams of acetic acid (0.5 mole/mole of double bond in oil) and sulphuric acid (2% on the total weight of hydrogen peroxide and acetic acid added as 1 : 1 acid) were mixed under stirring in a three necked flask, provided with a thermometer and a condenser. 30% hydrogen peroxide (23 grams, 1.5 mole/mole of double bond in oil) was added slowly over a period of 2 hours and the temperature was maintained at 60–65°C for 14 hours. The epoxidized oil was isolated [6] and vacuum-dried. The products were analysed for their oxirane oxygen[2], iodine value and acid value [1].

Results and Discussion

With 18% and 30% hydrogen peroxide the optimum concentration of acetic acid was found to be 0.5 mole/mole of double bond in oil. With 0.25 and 0.75 mole ratios, of acetic acid to oil, the oxirane contents were lower. At the optimum mole ratio of acetic acid to oil, both 18% and 30% hydrogen peroxide gave comparable products (Table 1 A). The mole ratio of hydrogen peroxide to oil also affects the extent of epoxidation. 1.5 mole of hydrogen peroxide to oil, giving the highest value for oxirane oxygen (Table 1 B). Lowering the temperature of the reaction to 50–55°C gave products with lower oxirane contents (Table 1 C) The relative efficiency of the three metal catalysts zirconium sulphate, ceric sulphate and

TABLE 1

Epoxidation of crude rubber seed oil with peracetic acid. Time 14 hours.

Mole ratio of acetic acid to oil	Mole ratio of hydrogen peroxide to oil	Strength of hydrogen peroxide %	Catalyst	Temperature in C	% oxirane oxygen	Iodine value	Acid value
(A) *Effect of strength of hydrogen peroxide and mole ratio of acetic acid to oils* :—							
.25	1.5	18	H_2So_4	60–65	2.8	72·7	1.6
.50	1.5	18	H_2So_4	60–65	4.5	76.2	0.4
.75	1.5	18	H_2So_4	60–65	2.8	76.9	1.5
.25	1.5	30	H_2So_4	60–65	3.5	61.9	0.5
.50	1.5	30	H_2So_4	60–65	4.6	57.6	0.1
.75	1.5	30	H_2So_4	60–65	3.2	61.3	0.6
(B) *Effect of mole ratio of hydrogen peroxide to oil* :—							
.50	1	30	H_2So_4	60–65	3.4	63.7	1.2
.50	1.25	30	H_2So_4	60–65	4.1	57.6	0.3
.50	1.50	30	H_2So_4	60–65	4.6	57.6	0.1
(C) *Effect of temperature* :—							
.25	1.5	30	H_2So_4	50–55	3.2	60.9	0.8
.50	1.5	30	H_2So_4	50–55	3.2	66.1	0.9
.75	1.5	30	H_2So_4	50–55	2.6	56.7	1.5
.25	1.5	30	H_2So_4	60–65	3.5	61.9	0.5
.50	1.5	30	H_2So_4	60–65	4.6	57.6	0.1
.75	1.5	30	H_2So_4	60–65	3.2	61.3	0.6
(D) *Effect of metal catalysts* :—							
.50	1.5	30	Sodium tungstate	60–65	4.3	58.3	0.1
.50	1.5	30	Ceric sulphate	60–65	4.0	65.3	0.5
.50	1.5	30	Zirconium sulphate	60–65	4.4	66.1	0.5

sodium tungstate employed (2% on the total weight of hydrogen peroxide and acetic acid) in the investigation was in the order zirconium sulphate > sodium tungstate > ceric sulphate > (Table 1 D).

Conclusion

Our results show that for the epoxidation of crude rubber seed oil :—

(1) The most effective mole ratio of acetic acid to oil is 0.5.

(2) The most effective mole ratio of hydrogen peroxide to oil is 1.5.

(3) The optimum temperature for epoxidation is 60–65°C (for 14 hours).

(4) The most effective of the catalysts is sulphuric acid.

(5) Of the metal catalysts employed, zirconium sulphate gives an oxirane content nearly equal to that of sulphuric acid.

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Occurrence of Tension Wood in Hevea

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The occurrence of tension wood is indicated by the presence of gelatinous wood fibres and has been recorded in a number of Indian timber species [2, 4]. Its development appears to be associated with mechanisms effecting movements of orientation in stems and branches of arborescent plants [7] and its occurrence in a large number of species belonging to unrelated families suggests that it does not indicate any close botanical affinity [2].

Transverse sections from the basal portion and subsequently at 25 cm distance apart, from one year old Tjir 1 (*Hevea brasiliensis*) seedlings revealed the presence of tension wood, appearing in concentric rings, the number of which varied. Maximum number of such rings was found in the basal portions, their number decreasing towards the top. The width of such bands of gelatinous fibre wood was not uniform and in some cases they were crescent shaped. Towards the top portions, a few cells were found to have an additional gelatinous wall whose arrangement indicated that they may develop into bands, when fully developed. Tap roots of the seedlings at one inch below the ground level had also shown the presence of gelatinous fibres in the wood.

Mature twigs from trees of *Hevea* clones Tjir 1, Gl 1, RRIM 501 (*H. brasiliensis*), F. 4542 (*H. benthamiana*), IAN 45-717 (*H. brasiliensis* x *H. benthamiana*) and F X 516 (*H. benthamiana* x *H. brasiliensis*) and seedling trees of *H. benthamiana* and *H. spruciana* also showed the presence of tension wood. On more or less horizontally growing branches tension wood was more developed on the upper side and to certain extent on the lateral sides. A few gelatinous fibres were found on the lower side also. An assessment of the proportionate distribution in such branches in IAN 45-717, RRIM 501 and Gl 1 showed that tension wood occupied about 46%, 47% and 55% respectively on the upper half in terms of the total area of the upper half. On the lower half it occupied about 27%, 26% and 13% respectively.

A survey of the presence of reaction wood in a large number of species had shown that about 50% of the species examined exhibited reaction wood in their stems and about 25% in their roots [3, 1, 6]. The walls of tension wood fibres are abnormally thick due to the presence of an unlignified additional inner layer, compared to fibres of normal wood. It is reported that the development of tension wood could be attributed to the necessity to counteract the force inducing change in position or it could be the result of geomorphic response [5, 6, 7]. It may also occur in perfectly straight trees by very small displacements for short periods [6] which would mean that permanent displacements are not necessary for the formation of reaction wood.

Acknowledgement

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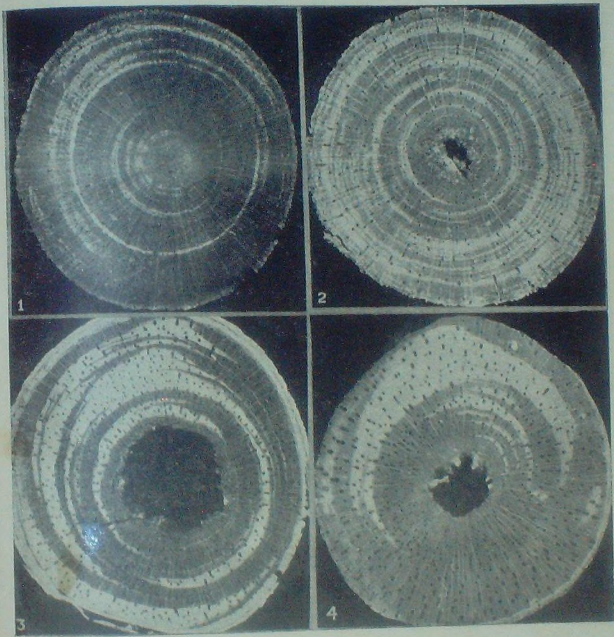

Fig. 1. Transverse section of tap-root of seedling (Tjir 1)
Fig. 2. Transverse section of a seedling stem (Tjir 1)
Fig. 3. Transverse section of a mature branch (Tjir 1)
Fig. 4. Transverse section of a mature branch (Gl 1)

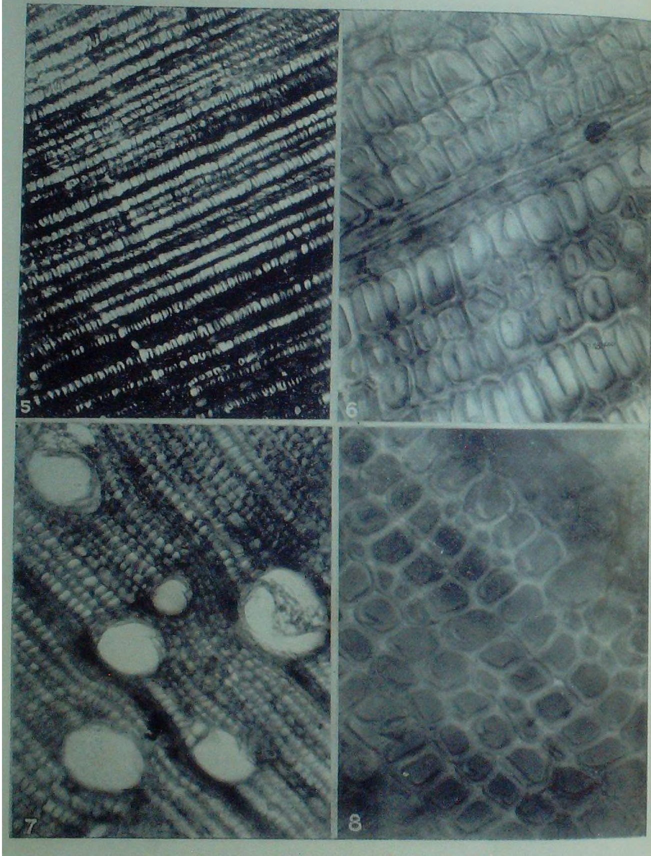

Fig. 5 and 6. Tension wood of a mature branch (RRIM 501) in transverse section.
Fig. 7 and 8. Normal wood of the same branch (RRIM 501) in transverse section.

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Anatomical Studies on the Union of Stock and Scion in Hevea

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Budgrafting is an established method of propagation in *Hevea*. It reproduces trees which are genetically uniform, being derived from a single individual. Budgrafting is effected by inserting a small piece of bark containing a dormant bud under the bark of a young stock seedling. The seedling stem is sawn off above the grafted bud, when the tissues of the budpatch and those of the seedling have become firmly united, allowing the grafted bud to grow out to form a new plant with the characters of the particular parent from which it has been taken. It is opined that cambium of the stock as well as the scion grow together to form one new cambium which produces xylem towards the inside and phloem towards the outside [5]. It is also reported that after forming the first linkage, the new cambium is formed entirely from the tissues of the patch and become united to the cambium of the stock only around the edges of the budpatch, although exceptions, however, have been observed [6].

Two experiments have recently been conducted to study the effect of spraying on the success of budding (Nair & Cyriac 1967; Sulochanamma 1970). The results of the experiments reveal that spraying the stock plants with Bordeaux mixture does not affect the budding success, whereas spraying the budwood plants affects the budtake adversely for the first few weeks. From the above observations it appears that the cambium of the scion contributes predominantly to the success of bud union and the subsequent growth of the bud sprout. So an experiment was laid out to study the relative role of the cambium of stock and scion in the bud union.

Materials and Method

75 stock seedlings of Tjir 1, of the same age and of almost similar girth, were budded with RRIM 605. Anatomical observations of the bud union were taken at five days interval for fifty days. Cross sections of the materials were examined after appropriate staining. A few samples were also observed on the second day of budgrafting.

Observations

No union or development of new cells was seen either in stock or in scion in samples observed on the second day of budgrafting.

On the 5th day of budding, a brownish red line was seen in between the stock and scion in certain samples (Fig. 1). In others, the exposed regions of both stock and scion produced a few parenchyma cells which intermingled and interlocked (Fig. 2), thus producing a callus tissue. On the 9th day new cambial cells were seen to have developed in the scion just above the callus tissue (Fig. 3). In one sample, however, no callus tissue was seen, but new cambial cells were seen in the innermost region of the scion just outer to the brownish red line (Fig. 4).

On the 14th day, the callus tissue intimately interlocked the two original components of the scion and stock. The newly formed cambium produced xylem elements towards the inside and phloem elements towards the outside (Fig. 5). A slight lignification of the walls of callus cells was also seen. By this time regeneration of vascular elements was also seen in the bark flap of the stock.

On the 19th day the vascular elements formed from the newly formed cambium was very clear. Callus cells also became more lignified (Figs. 6 & 7). After that on each day of observation, more and more vascular elements were seen to have developed from the newly formed cambium.

The cambium newly formed in the bud-patch grafted and the cambium of the stock seedling were found united laterally in transverse sections of samples collected on the 40th day of budding. From the observations on the 50th day of budding it appeared that the scion and the cambium of the stock functioned as a single unit, thus contributing for further growth.

Discussion and Summary

The production of callus tissue is the most important step in the healing process of a successful budding and then the development of new cambium cells from the cells of the scion close to the callus tissue.

The brownish red line seen in between the stock and scion may be the damaged cells of the stock and scion during budding operation. The callus bridge provides passage of water and food materials from the stock to the scion. The newly formed cambial cells begin typical cambial activity, producing new xylem and phloem. In all the cases examined the new xylem formed in the region of grafting, originates from scion rather than from the stock. This is also reported by Hartmann and Kestu, who observed that using bark rings of the 'scugog' apple variety, which has purple xylem, subsequent xylem growth of the tree following grafting was entirely purple in colour just under the 'scugog' ring of bark, whereas the remainder of the xylem remained white [2].

The development of vascular elements in the bark flap further indicates the pronounced regenerative capacity of the phloem cells. In other words, the regenerative capacity of the scion is the most important factor in the success of budtake.

Acknowledgement

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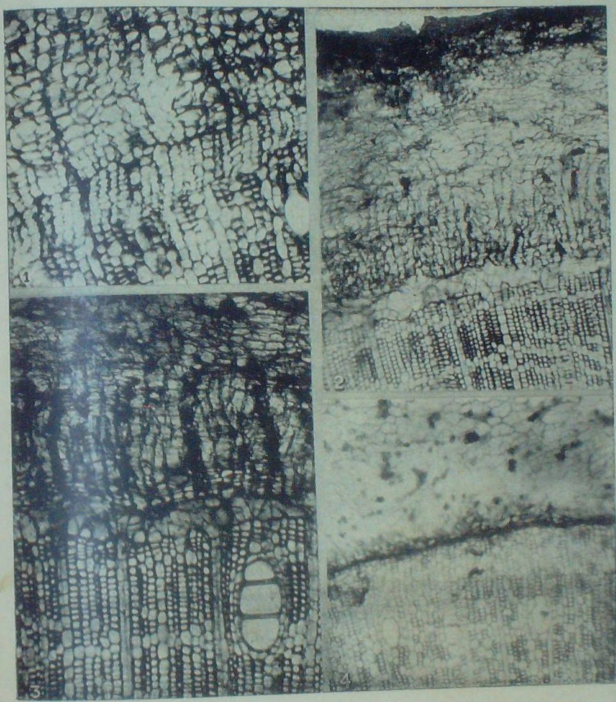

Fig. 1. Development of brownish red line in between the stock and scion.
Fig. 2. Formation of callus tissue.
Fig. 3. Development of cambial cells in the scion just outer to the callus tissue.
Fig. 4. Cambial cells developed in the inner-most region of the scion just outer to the brownish red line

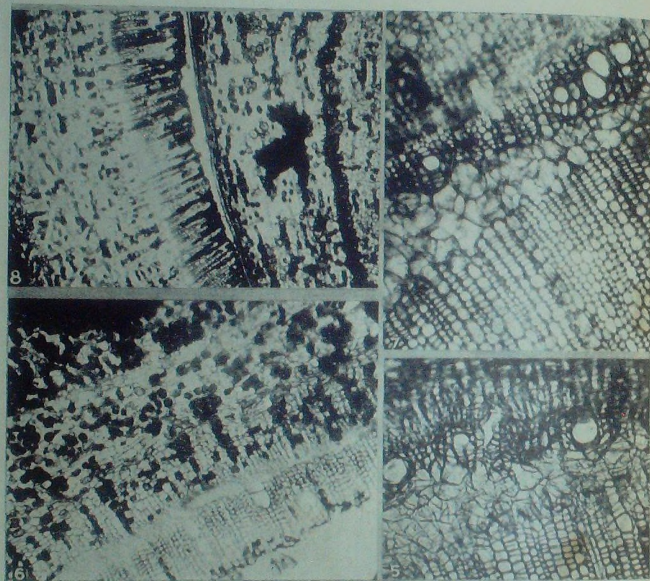

Fig. 5. Development of vascular elements from the newly formed cambium.
Fig. 6. Bark flap showing development of vascular elements.
Fig. 7. Well developed vascular elements and the lignified callus cells.
Fig. 8. Bark flap showing well developed vascular elements.

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The Present Day Need for Rubber Planting Materials

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The spectacular improvement in the productivity of present day agriculture has been made possible through a number of technical and scientific advances. Among these, the application of genetics in the improvement of crops is the most important. The main implication of this tool is that we do not have to depend on natural plant populations to meet our requirement; instead we can tailor plants to our needs through genetic manipulations of factors controlling yield and quality. In all progressive countries where plant breeding has been taken up with enthusiasm, it has resulted in the introduction of a rich diversity of plant life of great economic value.

Evolution of Planting Materials

Application of principles of genetics in rubber cultivation by scientists with the co-operation of progressive planters, has made us today the beneficiaries of a variety of planting materials of superior qualities. To be more specific, as soon as the variation in yield was studied more than 50 years ago, selection was started and with the simultaneous development of budgrafting, the advantage was realised in large measure.

A brief review of the history of evolution of rubber planting materials since its introduction in the East would reveal the tremendous breakthrough that has been achieved during this century. At the outset it was the customary practice to use old unselected materials for planting. The average yield of unselected seedlings rarely exceeded 500 lb/acre/year even with very good husbandry. In poor areas it would, naturally, have been much less. But with the evolvement of clones and selected seedlings, the yield potential was raised two to three fold. The average yield per acre in Malayan estates has risen from 450 lb in 1951 to 940 lb in 1967. The average yield per hectare in Indian estates and small holdings in 1951-52 was 298 kg. In 1968-69 it increased to 580 kg. With the introduction of modern clones such as those of the RRIM 500 and 600 series a radical change in the production trend was noticed.

Publications reveal that a peak production of 3855 lb of dry rubber per acre per year was touched by RRIM 600 in large scale trial in Malaysia. Yield under commercial planting has also closely followed this trend. Major contribution of this increased yield was by the use of genetically improved materials.

We should take advantage of the fact that the breakthrough in yield has been achieved by the use of genetically improved materials. In India work was programmed under different lines, but with the single motive that the planting materials introduced year by year should be of genetical superiority. Import of improved materials to this country and their multiplication and distribution to the planting community for experimental planting has been in vogue for the last many years.

Need for Modern Clones

(a) From Table 1, it may be seen that most of the high yielding clones available in the rubber growing countries are within our reach. We do not have the correct statistics of the distribution of these materials, in our country now, but a perusal of the records of distribution shows that the best varieties are currently available with most of the planters.

To emphasise the importance of the yield potential of modern materials, I have listed below certain figures. Table 2 gives an idea of the commercial yield trend of some of the older clones in Malaysia and in some of the well managed estates in India. A comparison of the trends in the two countries may be interesting.

Table 3 gives an idea of the commercial yield trend of modern materials in Malaysia. Although these materials are now under planting in India, their yield figures are yet to be obtained. But, I may say that some of them are already under bearing and the yield trend is encouraging. One can, therefore, naturally aspire for richer returns by using such materials.

(b) Importance of Indigenous Materials

With a view to improving our materials further and producing them with better adaptability to our agro-climatic conditions, simultaneous attempt to produce indigenous clones was also made. This was done either by mother tree selections from existing plant community or by adopting artificial methods chiefly by crossing of superior clones. Even though in perennial crops like rubber this is a time consuming factor, we could produce a series of indigenous materials of high promise, a few of which have already been released for experimental planting. The performance of these materials are being watched very closly with interest.

The yield data given are with reference to a few clones at our Experiment Station (Table 4) under small scale trial. Further trials of these clones are already under way. Similarly there are many more clones under testing now, which look promising, and will be available for experimental planting in due course.

(c) Buddings and Clonal Seedlings

One thing which is striking in the evolution of newer planting materials is that the former official research institutes have concentrated more on the breeding and selection of clones than producing new seedling families, except in some private organisations which give equal importance to both as they find that selling of seed would be a better commercial proposition. This paucity in the availability of good seedling families has resulted in recommending planting of large areas with monoclone seeds of Tjir 1, which was considered better than unselected materials. The older clones have slowly given way to the new ones, and similar development in the position with regard to clonal seedlings have not occurred. That explains why even though Tjir 1 seedlings have already been declared as an obsolete planting material elsewhere, we on our side cannot do so. Foreseeing this, we have attempted making polyclone gardens in the south which could produce superior type polyclone seeds comparable to the type obtained from Malaysia. We made our first collection this year (1970), but to reach self-sufficiency we have to make much headway.

Under this circumstance going for budding as much as possible, with modern clones would be the best solution for improving the yield.

The demand of the day is as much higher production per unit area as possible. As regards rubber, though the choice of polyclonal seeds of good vigour is not ruled out, the use of modern clones of high potential productivity would be the answer.

TABLE 1

Introduced Clones

Period of Introduction

Pre 1956 (Important clones)	1956	1962	1963	1964	1966	1969
Tjir 1, Tjir 16,	RRIM 501 (Mal)	RRIM 600 (Mal)	RRIM 632 (Mal.)	PB 215 (Mal.)	703 (Mal.)	Harbel 1 (Lib.)
AVROS 49, AVROS 255,	526 ,,	628 ,,	636 ,,	230 ,,	704 ,,	IAN 713
AVROS 352, LCB 1320,	601 ,,	513 ,,	701 ,,	235 ,,	705 ,,	(S. America)
PR 107, BD 5, BD 10	602 ,,	519 ,,	707 ,,	240 ,,	706 ,,	LAN 873 ,,
(Indo), PB 25, PB	603 ,,	PB 213 ,,	PB 5/51 ,,	242 ,,	Ch 153 ,,	
86, PB 186, PB 5/60,	604 ,,	217 ,,	28/83 ,,	252 ,,		
PB 5/139, PB 6/9,	605 ,,	206 ,,	5/63 ,,	253 ,,		
PB 6/50, Pil B 84,	607 ,,	5/76 ,,	28/59 ,,			
Pil D 65, GL 1, Ch 2,	608 ,,		GT 1 (Indo.)			
Ch 4, Ch 8, Ch 26,	609 ,,					
Ch 29, Ch 30, Ch 31,	610 ,,					
Ch 32, CHM 3, S. Reko	611 ,,					
9, Lun N (Mal.),	612 ,,					
Mil 3/2, Hil 28,	615 ,,					
Hil 55, Wagga 6278	617 ,,					
Waring 4 (Ceylon).	618 ,,					
	620 ,,					
	621 ,,					
	622 ,,					
	623 ,,					
	IAN 45717 (S. America)					
	FX 516 ,,					
	F. 4542 ,, @					
(35)	(23)	(8)	(9)	(7)	(5)	(3)

(@ released only in 1960)

Mal. = Malaysia.
Indo. = Indonesia.

Country of Origin

Ceylon : Ceylon
S. America : South America.

Lib. = Liberia

TABLE 2

Commercial Yield of some older Clones in India and Malaysia
(Kg per hectare per annum)

Sl. No.	Clone	Yield in India		Yield in Malaysia	
		5th year of Tapping	6th year of Tapping	5th year of Tapping	6th year of Tapping
1	PB 86	1078	1206	1149	1234
2	Tjir 1 BG	1085	1171	1238	1444
3	Gl 1	1324	1426	1103	1167
4	LCB 1320	1142	1356	1310	1414
5	Tjir 1 CS	772	1041	1178	1252

TABLE 3

Commercial Yield of some of the newer Clones in Malaysia
(Kg per hectare per annum)

Sl. No.	Clone	5th year of Tapping	6th year of Tapping
1	RRIM 501	1,612	1,649
2	,, 513	1,526	1,547
3	,, 600	1,817	2,033
4	,, 605	1,573	1,706
5	,, 612	1,397	1,310
6	,, 623	1,548	1,574
7	PR 107	1,335	1,430
8	PB 5/51	1,592	1,639
9	,, 28/59	1,910	1,688
10	GT 1	1,631	1,759

TABLE 4

Yield data of RRII Clones till 1969
(Estimated yield in Kg per hectare/year)

Clones		1964–'65 1st year	1965–'66 2nd year	1966–'67 3rd year	1967–'68 4th year	1968–'69 5th year	1969–'70 6th year
RRII	102	936.67	990.72	1880.29	1812.49	3495.30	2652.04
,,	105	1364.18	1663.92	2509.77	3112.57	2577.45	3805.78
,,	106	887.72	1030.73	1718.38	2029.23	2829.88	3265.22
,,	107	1017.76	1280.08	1467.18	2566.82	2827.66	3772.80
,,	109	1036.29	1220.80	1595.00	1868.80	2997.35	3459.36
,,	111	899.20	981.83	1644.28	1878.06	1886.22	1960.32
,,	113	1087.79	1018.88	1821.38	2142.60	3107.38	3350.43
,,	114	951.81	1124.10	1823.23	2253.38	1968.84	22[illegible]1.89
,,	116	1217.46	1341.58	1792.48	2208.55	2399.73	2408.99
Tjir	1	828.81	5[illegible]5.37	802.87	834.74	1265.26	1756.17

NEWS AND NOTES

Meetings of the Rubber Board

68th Meeting

The 68th meeting of the Rubber Board was inaugurated at the Conference Room No. 36 of the Udyog Bhavan, New Delhi, on the 22nd August, 1970, by Shri L. N. Mishra, Minister for Foreign Trade, Government of India. Shri Chowdury Ram Sevak, Deputy Minister for Foreign Trade, Shri C. S. Ramachandran, Additional Secretary, Ministry of Foreign Trade and Shri S. N. Dandona, Deputy Secretary, Ministry of Foreign Trade, attended the meeting on special invitation. Shri T. V. Swaminathan, Chairman, presided.

Chairman's welcome

Welcoming the Hon'ble Minister and the Deputy Minister for Foreign Trade, members of the Board and special invitees, the Chairman spoke as follows :—

"We have to-day the privilege of the presence of the Hon'ble Minister and the Deputy Minister for Foreign Trade with us. We are extremely grateful to them for accepting at short notice our invitation to be with us to-day and guide us in our deliberations.

"As far as the Rubber Board is concerned, we have been doing a great job and rendering a creditable service. The production of natural rubber which was less than 24,000 tonnes in 1955-56 has, during the decade and a half, grown to an estimated production of 92,000 tonnes during 1970-71. Side by side, the consumption requirements have also been growing. Although the rubber plantation industry is not directly export-oriented, it is saving considerable amount of foreign exchange by increasing production and productivity, resulting in lesser imports. As far as 1970-71 is concerned there may be no gap between supply and demand even after providing for the targetted rate of growth of 11 percent from August, 1970, onwards."

Minister's address

The Hon'ble Minister for Foreign Trade inaugurated the proceedings with the following observations :—

"I have great pleasure in accepting your kind invitation to inaugurate the proceedings of the 68th meeting of the Rubber Board."

"The importance of rubber as an industrial raw material of great strategic value cannot be over-emphasised. The rubber plantation industry and the rubber goods manufacturing industry constitute significant factors in our economy. I am happy to note that the production of natural rubber had, during the decade and a half from 1954-55 to 1969-70, increased from 21,774 metric tonnes to 81,953 metric tonnes."

"It is encouraging that consumption of rubber has also been steadily increasing during this period from 26,332 metric tonnes in 1954-55 to 86,213 metric tonnes during 1969-70, exclusive of synthetic and reclaimed rubbers. This has been due to the steady increase in installed capacity during the successive plan periods to meet the growing internal requirements of tyres and other manufactured goods.

"In this welcome growth of production as well as consumption measures, the demand has over these years been higher than the supply, necessitating imports. The greatly enhanced production has contributed directly to reduction in the volume of imports and thereby to conservation of precious foreign exchange. It is very necessary to achieve self-sufficiency as early as possible, at the same time providing for an accelerated rate of growth in manufacturing capacity, local consumption and export of finished products. Self-sufficiency can be achieved by bringing more areas under rubber and also by increased productivity by the use of very high yielding planting materials, which will in turn demand improved cultural practices. When we take into account the obvious limitations on additional areas which are agro-climatically suitable for rubber, it is evident that intensive cultivation, using high yielding planting materials and employing improved cultural practices, assume tremendous importance."

"I am glad to note that the Rubber Board is administering several useful schemes. It is very necessary that the holdings sector, which has historically come to constitute about 65 percent of the total area under rubber contributing presently about 50 percent of the total production, should fully benefit by these schemes. I am sure that the Rubber Board will take all necessary steps to ensure full coverage of the small growers."

"I am not unaware of the anxiety of the rubber growers about a fair price to them which will ensure a satisfactory economic return. A decline in the price of natural rubber during the last few weeks has also come to my notice. An unfortunate fall in consumption by tyre factories, while production estimates have been fulfilled, has obviously contributed to accumulation of stocks and resultant decline in prices. I can assure you that the Government is fully aware of the situation. The report presented by the Tariff Commission in 1969 is currently under active consideration. I am hopeful that it will be possible to announce the decision of the Government shortly."

After the inaugural address by the Minister, the members had a general discussion of the problems confronting the rubber industry, especially the rubber growers and later the items on the agenda were taken up and decisions taken.

Stock position and import policy

After discussions, it was unanimously agreed that the position should be reviewed at the next meeting of the Board early in November, 1970. Meanwhile no import should be allowed.

Election of Vice-chairman

Shri M. M. George was unanimously elected as Vice chairman of the Board for a period of one year with effect from 25-10-1970 or until he ceased to be a member of the Board, whichever be earlier.

Election to committees

As the period of the Executive Committee, Planting Committee, Small Holdings Development Committee, Import-Export Committee, Labour Welfare Committee and Research and Extension Service Committee had expired, new members were elected to these committees.

Pool fund schemes

After detailed discussions, the Board decided that the Pool Fund Schemes of the Board should be continued in their present form without any change or deletion until the close of the Fourth Plan period.

The Board also approved a scheme for providing additional incentives for planting high yielding planting materials.

69th Meeting

The 69th meeting of the Rubber Board was held at the Conference Room of the Madras Rubber Factory, Dhun Buildings, Mount Road, Madras, on the 2nd November, 1970, Shri T. V. Swaminathan, Chairman, presiding.

Before taking up the items on the agenda, the Chairman felicitated Shri M. M. George, the new incumbent to the office of Vice-chairman and thanked the special invitees for their kind presence.

Late Shri George Thomas

The Chairman informed the Board about the demise of Shri George Thomas Kottukappally on 11-10-1970. Shri Kottukappally was a member of the Board representing the Lok Sabha. During the period of his membership, he was taking keen interest in the activities of the Board. As requested by the Chairman all stood up for a minute in silence as a mark of respect to the departed soul.

Chairman's introduction

The Chairman, in his introductory remarks, explained the important developments which had taken place after the 68th meeting of the Board. The prices for different grades of rubber were notified by the Government of India on 12th and 14th September, 1970. On account of accumulation of stocks in the market causing great hardship to growers and with a view to ensuring to growers the notified prices, the State Trading Corporation entered the market on 26-10-1970 with a purchase centre at Cochin with a licence to deal in rubber issued by the Rubber Board. As the growers in the holdings sector were more vulnerable to the constraint for distress sales, the first objective was to ensure them notified prices and insure them against distress sales. The State Trading Corporation was, therefore, buying rubber of the small growers through the co-operative rubber marketing societies.

The Chairman informed the Board that he had attended the 21st Assembly of the International Rubber Study Group in Singapore between the 5th and 9th October, 1970. The important item for discussion was "Review of the estimates of production and consumption of natural and synthetic rubber during 1970 and 1971." So far as India was concerned, the estimates submitted by the Rubber Board were accepted by the International Rubber Study Group. The other important item on the agenda was to lay down international standards for technically specified rubbers like Standard Malaysian Rubber, Standard Indonesian Rubber and Thailand Technically Tested Rubber. It was decided to refer the matter to the International Rubber Research and Development Board.

Other items discussed included *inter alia* opening of an international dialogue with shipping lines on a standard freight structure for transport of rubber and removal of trade barriers by developing countries against import of primary and semi-processed natural rubber. As India was presently and would be in the foreseeable future consuming the total production of natural and synthetic rubber in the country owing to expansion targets of the manufacturing industry, many of these problems are not of immediate significance to India.

The Chairman apprised the members of his study tour to Malaysia and his attendance as an observer of the proceedings of the newly formed Association of Natural Rubber Producing countries at Kuala Lumpur.

Stock position and import policy

At the request of the Chairman, the members offered their views on the stock position and the problem of marketing of rubber at notified prices and a thorough and detailed discussion on the subject was held. Taking into account all the information available and view points expressed it was decided that it was necessary to request the State Trading Corporation to open a few more purchasing points to relieve the strain of accumulated stock on small growers and co-operative societies.

Revised estimates and budget estimates

The Board approved the Revised Estimates for 1970-71 and the Budget Estimates for 1971-72 of the General Fund and the Pool Fund of the Board.

It was also resolved to request the Government of India to permit continuation of the existing schemes of the Board without making the conditions stricter and to grant the full advances required in time. The Board also resolved to permit the Chairman, in the meanwhile, to implement the schemes in their present form and honour the commitments already entered into.

70th Meeting

The 70th meeting of the Rubber Board was held at the Conference Hall of the Coffee Board, Bangalore, on the 25th January, 1971. Shri T. V. Swaminathan, Chairman, presided over the meeting.

The important subjects discussed at the meeting and the decisions taken by the Board are detailed below :—

Stock position and purchase by STC

Initiating the discussions the Chairman said that as the 10,000 tonnes shortfall in consumption during 1970-71, of which 8,000 tonnes would be natural rubber, was inhibiting the price situation, a request was made to the State Trading Corporation (STC) that 8,000 tonnes should be purchased and stocked by them by 31-12-1970. The STC have purchased about 3,500 tonnes so far and was operating four purchasing points.

Giving statistics the Chairman explained that as on 30-11-1970, the dealers and producers were having 18,072 tonnes which was 6,300 tonnes more than one and a half month's stock level based on present monthly consumption capacity. The manufacturers had 18,647 tonnes which was about 900 tonnes less than they should have at two and a half months' stock level. The STC had 932 tonnes. Taking into account the stock with tyre manufacturers alone they had 2,000 tonnes more than two and a half month's stock level. It was therefore the non-tyre manufacturers who had defaulted to the tune of 3,000 tonnes. The Chairman stated that it was decided on 16-1-1971 in New Delhi that the D. G. T. D. would issue circular letters to 53 major non-tyre units pointing out the shortfall on their part and requiring immediate purchase of adequate quantities of rubber. At the meeting of the STC Advisory Committee on 29-12-1970, the Chairman had categorically stated that no rubber should be sold by STC before 31-1-1970 as Janua.y was also a peak production month. It was likely that the STC might release some quantities of rubber not exceeding 2,000 tonnes after 31-1-1971, as part of the stock was more than two or three months old.

There were discussions in detail after which the following resolutions were adopted :—

" Resolved that STC should purchase and stock not less than 8,000 tonnes of rubber before 28-2-1971 and that no sale should be effected before then."

" Resolved that if there should be any release on technological grounds, it should immediately be replaced by an equal quantity by purchase in bulk from the growers in the open market."

It was also agreed that a panel should be constituted to review at frequent intervals the stock and purchase position to take on the spot decisions.

Replanting subsidy

The Board members appreciated and welcomed the scheme for extension of the replanting subsidy to areas planted upto 1962 and registered or applied for registration on or before 1-4-1963.

Budding of Tjir 1 seedlings

After discussions, the Board approved the elimination of Tjir 1 clonal seeds and seedlings from the approved list of planting materials for 1971.

The question of undertaking budding of Tjir 1 seedlings in private nurseries, on request, by Rubber Board, free of charge, was discussed in great detail and the following resolution was adopted ;—

"Resolved to undertake budding departmentally or reimburse the budding charges at the rate of 15 paise per successful budding to the growers upto 50 acres, on request."

71st Meeting

The 71st meeting of the Rubber Board was held at the Council Hall of the Cashew Export Promotion Council, Ernakulam, on the 20th February 1971. Shri T. V. Swaminathan, Chairman, presided.

The Chairman informed the members that the decision of the 70th meeting of the Board that STC should purchase and stock not less than 8,000 tonnes rubber before 28-2-1971, that no sales should be effected meanwhile and that any unavoidable release on technological grounds should immediately be replaced by purchase in bulk of an equal quantity from the growers in the open market, had been communicated to the Government. The Chairman said that the STC had indicated that 2,000 tonnes of rubber in storage had been offered to the manufacturers. The total number of godowns taken by the STC in which rubber was bought and stored was 15. As and when stocks of rubber moved out of these godowns, purchases would begin in the godowns. More purchasing points could be opened if felt necessary.

Review of rubber price situation

Initiating the discussions, the Chairman said that at the end of December, 1970, the total stock of rubber was 41,587 tonnes of natural rubber and 12,730 tonnes of synthetic rubbers. Consumption during December by manufacturers was 11,722 tonnes (8,392 tonnes natural rubber and 3,330 tonnes synthetic rubber), which was encouraging. The tyre manufacturers purchased 7,968 tonnes natural rubber in November, 1970, 6,044 tonnes in December, 1970 and 5,702 tonnes in January, 1971, exclusive of purchase by one manufacturer. The Chairman stated that as per projections drawn by the Rubber Board, 1971-72 would commence with an opening balance of 49,375 tonnes of rubber, comprising 36,177 tonnes natural rubber and 13,198 tonnes synthetic rubber. He furnished the following figures:—

	NR	*SR*
	(In metric tonnes)	
Opening balance as on 1-4-1970	31,788	12,548
Production during 1970-71	92,000	30,000
Imports physically arrived during the year	2,399	3,650
	126,187	46,198
Consumption during 1970-71	90,000	33,000
Balance as on 1-4-1971	36,187	13,198

After discussions, the following resolution was adopted :—

"Resolved that 8,000 tonnes of rubber should be kept in storage as a buffer stock to stabilise prices. If the State Trading Corporation was unable to keep 8 000 tonnes in storage, the Apex Marketing Federation should be enabled financially to undertake this obligation."

Exhibitions and Seminars

A one-day seminar of rubber growers was held at Ranni in Quilon district on the 3rd July, 1970, under the joint auspices of the Rubber Board and the All Kerala Balajana Sakhyam. Topics from planting to processing of rubber were discussed at the seminar which was attended by over 200 rubber growers. In addition to technical officers of the Board who lead the discussions, the Chairman, the Rubber Production Commissioner and the Director of Research also participated in the seminar.

A seminar on rubber was held at Mundakayam in Kottayam district on the 27th September, 1970, under the joint auspices of the Mundakayam Planters' Association, the FACT and the Rubber Board. Shri T. V. Swaminathan, Chariman, Rubber Board, inaugurated the seminar, at which papers on rubber planting materials, manuring of rubber and pests and diseases of rubber were presented and discussed.

Under the joint auspices of the Rubber Board and the All Kerala Balajana Sakhyam, a one-day seminar of rubber growers was held at Kanjirapally in Kottayam district on the 15th May, 1971, which was inaugurated by Shri K. V. Kurian, M. L. A. Technical officers of the Rubber Board presented papers on the various aspects of rubber cultivation. Shri V. K. Bhaskaran Nair, Director of Research, was the chief guest at the concluding session of the seminar.

The Rubber Board participated in the Agricultural and Industrial Exhibition organised at Kottayam during January–February 1971, by the Kottayam Municipality.

Documentary on Rubber

The Rubber Board has produced a documentary film entitled "Romance of Rubber," the screening of which was formally inaugurated at a function held at the Tagore Centenary Theatre, Trivandrum, on the 2nd December, 1970, by Shri N. K. Balakrishnan, Minister for Agriculture, Kerala.

The 30-minute documentary, which deals at length with the cultivation and production of natural rubber and the facilities and amenities provided by the Board for the progress of the rubber plantation industry, has been filmed by the Chitralekha Film Co-operative Society Ltd., Trivandrum, for the Rubber Board.

Speaking on the occasion, the Minister stressed the importance of documentaries in educating the public about the progress achieved in agricultural and other fields. Shri N. E. Balaram, Minister for industries, Kerala, presided. Shri T. V. Swaminathan, Chairman, Rubber Board, welcomed the gathering.

Quota Card System for Rubber Purchase

Shri T. V. Swaminathan, Chairman, Rubber Board, inaugurated on the 19th April, 1971, at Palai in Kottayam district, the quota card system aimed at rationalising, controlling and co-ordinating rubber purchase operations between small growers, rubber marketing co-operative societies, the State Trading Corporation and the Federation of Co-operative Rubber Marketing Societies. The Chairman hoped that the quota card system would eliminate complaints from the marketing co-operative societies and the State Trading Corporation.

The Chairman said that the Board had recommended the inclusion of middle class growers (20 to 75 hectares) who were not members of co-operative societies also within the purview of the quota card scheme. At present, only small growers owning up to 20 hectares, who are members of the co-operative societies were covered by the scheme. This, he said, would mitigate to a large extent the difficulties they experienced in disposing of their produce.

Membership of the Rubber Board

The Central Government has notified the nomination of the following members representing various interests to the Rubber Board. The new members would hold office for a period of three years.

Representing the Government of Kerala :-

1. Shri P. G. Muralidharan, Additional Secretary (Agriculture), Government of Kerala, Agriculture Department, Trivandrum.

2. Shri K. Karunakaran Nair, Managing Director, Plantation Corporation of Kerala Ltd., Kottayam.

Representing the Government of Tamil Nadu :—

3. Shri K. A. Bhoja Shetty, Chief Conservator of Forests, Madras

Representing the Small Growers of Kerala State :—

4. Shri K. M. Chandy, Kizhakkayil, Palai, Kerala State.

5. Shri T. O. Abdulla, Thurackandathil, Thottackattu kara, Alwaye, Kerala State.

6. Shri T. P. Seetharaman, Mathikunnu Estate, Ponnoorkara, Trichur–5, Kerala State.

Representing Rubber Manufacturers :—

7. Shri M. M. Sabharwal, Director, Dunlop India Ltd., 27–A, Aurangazeb Road, New Delhi.

8. Shri K. M. Philip, C/o Madras Rubber Factory Ltd., Jeevan Udyog Bhavan, 278, D. N. Road, Bombay–1.

Representing Labour interests :—

9. Shri K. P. Raghavan Pillai, General Secretary, Kerala Provincial United Trades Union Congress, Cantonement, Quilon, Kerala State.

10. Shri Gopinathan Nair, President, Kerala Provincial United Trades Union Congress, Cantonement, Quilon, Kerala State.

11. Shri R. Ravindran, General Secretary, Kerala Plantation Workers Federation, Pathanamthitta P. O., Kerala State.

12. Shri J. Chittaranjan, General Secretary, Kerala State Trade Union Council, Glass House Junction, Trivandrum–14.

Representing other interests :—

13. Shri M. M. George, Omanapuram Estate, Kulasekharam, Kanyakumari Dist.

14. Shri M. M. Muthiah, 'Tiam House,' North Beach Road, Madras–1.

15. Shri W. H. Armstrong, Senior Superintendent, Travancore Rubber and Tea Co. Ltd., Estates, Kadamankulam, Mundakayam, Kerala State.

16. Shri P. K. Vasudevan Nair, Kappillil, Pulluvazhi, Keezhillam P. O., Via Perumbavoor, Kerala State.

Representing Large Growers in Kerala State :

17. Shri Michael A. Kallivayalil, Maruthy Estate, Peruvanthanam, Mundakayam, Kerala State.

18. Shri M. D. Joseph, Mannipparampil, Kanjirappally, Kerala State.

19. Shri K. T. Thomas, Post Box No. 158, Calicut–1, Kerala State.

Representing the Large Growers of Tamil Nadu :—

20. Shri A. L. N. Ramanathan Chettiar, Managing Partner, Kamadhenu Estate, Nagercoil, Kanyakumari Dist.

Revised Minimum Prices of Natural Rubber

The Government of India has revised the controlled minimum prices of natural rubber as from September, 1970. These minimum prices have been fixed with effect from 12 September, 1970, for RMA 1 grade rubber and 14 September, 1970, for the various grades and qualities of rubber other than RMA 1, and latex of different concentrations, for all classes of business, nearest district headquarters, exclusive of cess and sales tax, and excluding the cost of container.

Grade and quality of rubber	*Minimum price for 100 kg Rs*
Group 1	
RMA IX	520.00
Group 2	
RMA 2	516.70
RMA 3	513.40
Cuttings No 1	496.86

Group 3	
RMA 4	505.68
RMA 5	496.86
Cuttings No. 2	483.64
Group 4	
Precoagulated crepe	532.14
Pale Latex crepe IX	527.72
Pale Latex crepe 1	523.32
Pale Latex crepe 2	521.12
Pale Latex crepe 3 FAO	518.92
Group 5	
EBC Super IX	510.08
Estate Brown crepe IX	501.26
Estate Brown crepe 2X	494 66
Smoked Blanket	501.26
Remilled crepe 2	474.74
Group 6	
Estate Brown crepe 3X	477.02
Remilled crepe 3	472 62
Remilled crepe 4	460 48
Group 7	
Flat Bark	441.74
Preserved normal latex upto 35% concentrates	Rs. 520/- plus a pr[illegible] mium of [illegible] 38.58 per 100 kg o[illegible] DRC.
Preserved latex concentrates of 36% to 50% (both inclusive)	Rs. 520/- plus a pre mium of [illegible] 72.76 per 100 kg of DRC.
Preserved latex concentrates of 51% to 60% and above (both inclusive)	Rs. 520/- plus a pr[illegible] mium of [illegible] 94.80 per 100 kg o[illegible] DRC.