Reprinted from Rubber Board Bulletin—Vol. VIII, No. 3

Development of Plant Protection in the Rubber Plantation Industry of India

Development of Plant Protection in the Rubber Plantation Industry of India*

K. V. GEORGE ‡

Rubber is a unique agricultural produce. The uses of this product in one form or other in industry and in our day to day life, are numerous.

Planting of rubber in India on a commercial scale is said to have commenced in the year 1902, and today its cultivation extending to 3,83,813 acres, is confined mainly to the three southern States of Kerala, Madras and Mysore. The Rubber Plantation Industry of India, apart from saving a substantial portion of our much needed foreign exchange, is intimately connected with the economic well-being of many, particularly in the State of Kerala, where 95% of its cultivation is concentrated.

Increase in Demand

While the output of manufactured rubber products has increased sharply in this country, domestic production of raw rubber has not increased proportionately; on the contrary, the gap between demand and supply continues to widen. The estimated requirements of rubber for 1965/66 is put at 1,10,000 tonnes against a production target of 50,000 tonnes of natural rubber. The annual requirement of rubber by the end of the Fourth Five Year Plan is estimated at 2·24 lakh tonnes, while the production of natural rubber is expected to be only about 72,000 tonnes. Even after utilising all the synthetic and reclaimed rubber, along with the natural rubber, the manufacturing industry will still need additional quantity of rubber which is estimated at just over 67,000 tonnes annually, at the end of the Fourth Plan period. The area for expansion of rubber cultivation being rather limited, adoption of intensive cultivation methods with a scientific approach, offers the greatest promise of bridging this gap. The role of plant protection in intensive cultivation of rubber to achieve increased production, is by no means small.

Disease A Limiting Factor

Often, diseases act as factors limiting successful development and production of rubber. South America is a typical example. The low acreage of rubber in South America, the native habitat of *Hevea*, is in a large measure due to the ravages of the dreaded disease, viz. South American Leaf Blight. When the rubber tree was growing wild in the mixed tree stands of primeval jungle conditions in the forests of the Amazon Valley, its disease problems were not conspicuous. But, when it was brought under monocultural plantations in vast contiguous stretches, its disease problems became pronounced.

* Paper presented at the UPASI scientific conference held at Coonoor on the 6th September 1965.

‡ Dy. Director (Pathology), Rubber Research Institute of India, Kottayam-9, Kerala State.

In the Far Eastern countries where *Hevea* was planted extensively, the experience in different countries varied. Though the South American Leaf Blight has spared these countries so far, other diseases are prevalent. The climatic factors, particularly rainfall, and its distribution, appear to determine to a great extent the severity of the various diseases in the different Far Eastern rubber growing countries. In countries with moderate and well distributed rainfall, viz. Malaysia and Indonesia, the incidence of foliage diseases is mild, though, in some regions, root diseases are prevalent. In India, in regions of heavy and continuous rainfall conditions, incidence of Abnormal Leaf Fall, a foliage disease, is serious, whereas in comparatively drier areas, the disease is either absent or negligible.

The average yield of rubber per acre in India is low compared to those obtainable in Malaysia, Indonesia and Ceylon and this is partly attributable to the ravages of serious diseases incited by fungal agencies, in this country. When such diseases occur year after year, the trees become devitalised, shoots die off, production of latex goes down and the economic life span of the trees get shortened.

The most Destructive Disease

The most destructive of the foliage diseases of *Hevea* in India, is abnormal leaf fall caused by *Phytophthora palmivora* BUTL. The disease was first recorded in the year 1910, within a few years of the commencement of rubber cultivation in India. Today, the disease is observed in all the rubber growing tracts coming under a predominantly heavy South West Monsoon influence. It makes an annual recurring occurrence during the rainy period of June / July / August and fades away by September. The economic loss caused by this disease is reflected in several ways. On young plants, retardation of growth increases the immaturity period. On older plants, loss of leaf resulting in reduced food synthesis, causes crop losses ranging from 25 to 50%. Deterioration of the trees soon follow.

Investigations

The disease was first investigated in India by McRae from 1914 onwards. In the early years (1918-'20), it was believed that if the twigs showing signs of die back, which were suspected to harbour the fungus during the dry weather, were removed before the onset of the Monsoon rains and destroyed, the survival of the pathogen would be interrupted and the recurrence of the disease during the succeeding rainy season, prevented or minimised. In addition, it was recommended that all the fruits should be removed from the trees before the rain started, so that the multiplication of the inoculum during the beginning of the Monsoon could be reduced. However, these methods proved hazardous, uneconomical and ineffective and have been abandoned by the growers, long ago. Results of trials conducted at the Rubber Research Institute during the years 1957 to 1960, on the effect of mechanical removal of fruits and deblossoming through chemical sprays, in order to assess the efficacy of such methods in the control of the disease, have not been encouraging. The incidence of the disease in the plots where fruits were removed and where deblossoming had been carried out, was as high as the untreated control plots.

Use of Fungicides

With the appointment of Ashplant as Rubber Mycologist attached to the UPASI, in the year 1922, experiments on the use of fungicides were commenced. He demonstrated that spraying the rubber trees with 0.75% Bordeaux mixture just before the onset of the Monsoon rains could keep the disease under control. The DSP sprayer was selected as the most suitable one. This method of protection was being gradually

adopted by the growers, when the slump in rubber occurred, further investigations were suspended and the method fell into disuse in many of the plantations. But for this valuable contribution, the rubber plantation industry of India may not have attained its present stature.

With the outbreak of the Second World War, conditions changed, there was great demand for rubber and prices went up. This gave a fillip to boost up production. With the creation of a Pathology division in the Rubber Board during 1955, work on comparative efficacy of different concentrations of Bordeaux mixture was started. Results showed that a 1% concentration was better than the lower concentration of 0.75% previously recommended. Results of comparative tests using various water miscible copper based and organic fungicides conducted during the years 1956 to 1959 indicated that as a single premonsoon spray, 1% Bordeaux mixture effected maximum disease control. Spraying Bordeaux mixture on the tall rubber trees using high volume sprayers is a hazardous and slow operation and necessitates large quantities of water, at a time when acute shortage of water is felt and as a result, many plantations did not take up to spraying. To overcome this difficulty, some progressive planters started using copper fungicidal dust formulations as early as 1950—51. Conflicting reports regarding the degree of disease control resulting from such dusting operations were prevalent. Based on the results of a trial conducted by the UPASI during 1953, it is reported that a satisfactory control of the disease could be achieved with a 6% dust if properly timed and applied. Dusting trials conducted at RRII during 1956 and 1957 using different copper fungicidal dust formulations as well as an organic fungicidal dust showed that disease control effected was far lower than that resulting from spraying with 1% Bordeaux mixture, and occasionally, as bad as the untreated control plots, in spite of 4 rounds of dusting carried out. Consequently, it was felt that dusting was not an efficient and dependable method of disease control, particularly under the prevailing heavy rainfall conditions.

Low Volume Mist Spraying

The next step was to experiment with types of low volume mist blowers which could throw up the spray from the ground and thereby avoid the hazards of climbing the tree. As water-borne fungicides were unsuited for this type of mist spraying of tall trees, trials were started with oil based copper fungicides dispersed in diluent spray oils, in the year 1957. Preliminary trials conducted with an improvised mist blower gave encouraging results. Several grades of mineral oil and copper formulations were screened for avoiding phytotoxicity. After testing various types and makes of low volume air blast machinery, finally, the Micron 420 sprayer was selected as the most suitable one for spraying the tall rubber trees. In the first year of trials, defects were observed both in the machine and in the fungicide. In the succeeding year(1958) following improvements, results of trials were promising. Encouraged by the favourable results obtained in these early attempts, large scale field trials were laid out and conducted at the RRII and in private plantations during 1959, 1960 and 1961 seasons and the relative efficiency of disease control assessed. The results showed that oil based copper oxychloride discharged through the Micron 420 gave, in many instances, as good protection as with spraying of Bordeaux mixture, employing high volume sprayers. Among the concentrations tried, 4 lb of metallic copper per acre, gave as much disease control as the higher concentrations. Further, two rounds of spraying, one towards the end of April and the next towards the middle of May, resulted in greater protection than a single application.

The sprayer could, however, afford protection only to a height of 50 ft. With further improvements to the atomiser assembly, the later models were found capable of efficient spray coverage up to 65—70 ft. A great disadvantage with this machine is that it is very heavy and hence operating it in the difficult terrain encountered in rubber plantations, is rather difficult and calls for large number of mazdoors and provision of contour pathways between rows of trees. It has, however, the advantage of coverage of 10 to 15 acres per day, doing away with water requirements and at the same time effective and economical. During the years 1962 to 1964, a number of demonstration plots were opened in private plantations, to demonstrate the efficient economic use of the Micron spraying technique.

During early 1964, a miniature model of the Micron 420, viz. Minimicron 77, was imported from UK and tested out in different planting districts. This unit was found to be efficient, light and could be carried by two people, could cover about 10 to 15 acres per day, and could give a spray coverage up to 55 ft height. This model is now being manufactured in India by a local firm in collaboration with the foreign manufacturers. Many improvements for increasing the efficiency, durability and easy transportability under field conditions, found necessary after field tests, have been incorporated.

Aerial Spraying

The effective spraying period being limited to about 40 days, even the Micron sprayer with 10 to 15 acres coverage capacity per day, was found to be not ideally suited for the very large plantations. Since 1960, some areas have been aerially sprayed, as a result of a joint venture between certain enterprising planters, pesticide manufacturers, oil firms and aircraft companies. The demonstration trials conducted during 1960, the development trials of 1961 and the commercial sprayings of 1962 to 1965, have opened possibilities for successful aerial spraying of large areas of rubber. The experience of the last few years' aerial spraying has given, on the whole, encouraging results, even though, disease control effected has not been as uniform as that of ground application. One may not be far wrong, in stating that about 75 to 80% of the sprayed area show satisfactory to good disease control, the rest 20 to 25% representing missed patches and lanes, show only erratic disease control. The greatest advantage of aerial application is that, the operation being quick, large areas can be covered in a short period and hence is essentially suited to large plantations.

Control Methods

Summing up the various methods of control of abnormal leaf fall disease through application of fungicides, it may be stated that high volume Bordeaux spraying is effective, but is essentially suited to small holdings only, since it is a slow process; spraying of oil based copper fungicides employing Micron sprayers is effective, economical and well suited to small and medium sized holdings; but, for spraying extensive contiguous stretches of rubber, aerial application appears to be most suited because of the quick coverage.

Influence of Manuring

Field trials conducted during 1957 to 1959 to find out the influence of manuring on disease incidence, is reported to have shown that application of a complete NPK mixture combined with a copper fungicidal spray, gave better results compared to spraying alone or manuring alone.

Disease Resistant Varieties

Coming to the aspect of developing disease resistant or tolerant varieties of rubber, field observations have shown that Gl 1, BD 10

and AVROS 255 are rather tolerant to the disease, compared to the highly susceptible materials like PB 86, TJIR 1 etc; however, their correct reactions under artificial infection conditions are not fully studied. It is often noticed that shy seeders, usually, show less disease incidence compared to prolifically seeding trees. There does not appear to be any genetic correlation between these two factors and it would appear that since the fruits are comparatively more susceptible than the leaves, a large number of fruits would provide ample disease inoculum for later development of the disease on the leaf.

In most of the plantations, indvidual trees are noticed to exhibit good leaf retention, though unprotected, standing out markedly amidst a population of trees, practically bereft of leaves. As these are suspected to show resistance, their multiplication and establishment at the Rubber Research Institute, to assess their correct reactions, are being carried out. A few foreign clones, reported to have shown resistance to the disease in other countries, have also been obtained and these also await screening tests.

Powdery Mildew

Coming to the next important disease of rubber in India viz. Powdery Mildew, caused by *Oidium heveae* Stein., the first report of its occurrence in this country was only in the year 1936. Since then, it has been observed to build up and spread gradually and by 1956, its prevalence, practically, in all the rubber growing districts of South India, has been noticed. Successive waves of infection inducing defoliation and refoliation result in rapid depletion of stored reserves in the plant. Deterioration of the trees and fall in latex production, soon follow. Cloudy days, cool nights, dew or over-hanging mists and light drizzling rain during the refoliation period, all favour the disease incidence.

Control Measures

Most of the clones and seedlings, now commercially exploited in this country, show susceptibility to the disease. Spraying or dusting of sulphur has been found to be effective, whereas, copper fungicides do not control the disease satisfactorily. Spraying of wettable sulphur is found to be more effective than dusting and could be adopted in nurseries and for young plants with advantage; however, this would be uneconomical for mature trees as repeated rounds to cover the newly forming flushes are required. For mature trees, it has been found that dusting of sulphur of 325 mesh fineness at the rate of 10 to 12 lb per acre and repeated 4 to 6 times at intervals of 7 to 12 days during the refoliating period gives satisfactory control of the disease. Trials with different combinations of sulphur and inert materials, showed that a mixture of sulphur and talc in the proportion of 70 : 30 also gave satisfactory disease control. After screening out a number of dusting appliances, it has been found that Mistral II AB power duster is best suited for dusting mature rubber trees.

Other Diseases

Investigations on the other diseases affecting rubber in this country with reference to the life histories of the causative organisms, the factors favouring their incidence and intensity etc., with the main objective of formulating effective economical disease control measures, are being carried out at the Rubber Research Institute. Some of the major developments resulting from these studies are treatment of Pink disease with Bordeaux paste mixed with raw linseed oil, treatment of Panel diseases, Patch canker, Dry rot and Brown root disease with organo-mercurial fungicides and waterproofing wound dressing compounds. The methods of treatment have also been standardised.

Pests of Rubber

Insect pests of rubber, today, are not very serious in this country; however, to meet the possible future challenge of any of the present minor pests assuming a major role later on, a small Entomology Unit has started functioning at the Rubber Research Institute. Studies have been initiated not only on the insect pests of rubber but also on the role of insects in the pollination of rubber, cover crop pests, including insects and nematodes, and on snails and slugs causing damage to rubber.

The Challenge

The day may not be far of, when the Natural Rubber Industry may have to face keen competition from the Synthetic Rubber Industry and the rubber grower may be called upon to reduce his cost of production so as to enable him to sell the produce at a price lower than that prevailing in India today. The only rational way to meet this possible challenge of competition with synthetic rubber in the future as well as to meet our country's increasing demands for the present day, will be by increasing unit area production. The role plant protection measures have to play in achieving this goal of increased production, by way of reducing crop losses due to pests and diseases, is substantial.