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RUBBER RESEARCH IN SRI LANKA - THE PAST 100 YEARS AND THE FUTURE

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In the year 2009, Sri Lanka completed one hundred years of Research and Development activities on Natural rubber (NR). Further, Sri Lanka was the first NR producing country in the world to achieve this significant milestone, an achievement that Sri Lanka can be very proud of. The continuous service for a period of 100 years and also the technologies used to-date to drive the industry in to what it is today are clear proof of the contribution made by the Rubber Research Institute of Sri Lanka to the betterment of the rubber industry of the country.

Discovery of natural rubber and its potential

The plant that provides us with NR, *i.e*. *Hevea brasiliensis* is native to the Amazon forest in South America and the first recorded evidence of a natural rubber producing tree to the world outside its native land was when Christopher Columbus made his voyage to the Americas during 1493- 1496. He observed inhabitants of Haiti playing with balls made out of a gum like substance and found that this substance is obtained from the *Hevea brasiliensis* tree. Many years later in 1772, a British Chemist named Joseph Priestly found that latex obtained from this plant in its dried form is capable of erasing or rubbing out pencil marks. Due to this character of the material, the dried latex of the *Hevea* plant was named "Rubber" and the tree providing the material the rubber tree. During this time it was also discovered that the latex of the rubber plant can be used for water proofing of fabrics by treating them with a solution of rubber dissolved in turpentine. Charles Macintosh in Glasgow, Scotland further developed this technology and established factories to produce raincoats called Macintoshes. Subsequently, to cater to the demand for raincoats and other water proof garments, he opened factories in the United States of America, England and in other European countries. However, these products had the draw back of bad smell and also becoming either sticky or brittle under hot and cold weather conditions respectively. Therefore, such products could not be utilized universally and also during all seasons of a year in any country, making rubber a commodity of limited use.

The discovery made by Charles Goodyear in 1842 converted NR from a commodity of limited use and little value to one of the world's most important and versatile natural products. This process known as vulcanization made rubber usable universally and also under different weather conditions. The other development that made NR indispensable to the mankind was the discovery of the pneumatic tyre in 1888 by J.B. Dunlop. Nevertheless, the annual consumption of the world NR gathered momentum only after the advent of the motor car in 1900.

Forest to cultivated rubber

The technological advances and product developments resulted in a heavy demand for NR in the world. Once it was realized that forest rubber plants are unable to meet the increasing world demand for NR, the concept of cultivating rubber in countries outside its origin came in to light. As a result on the instructions of the curator of Kew Gardens in UK Sir Henry Wickham in 1876 collected rubber seeds from the Amazon forest and shipped them to Kew Gardens in UK. These seeds were initially germinated in a green house prior to shipping to Asian countries like Sri Lanka, Singapore and Malaysia. However from this initial batch of germinated seeds dispatched to the Asian countries only the seedlings planted in Sri Lanka survived. In Sri Lanka the rubber seedlings were planted in both Peradeniya and Henarathgoda Botanical gardens. It is reported that by 1881 the rubber plants planted at both Peradeniya and Henarathgoda Botanical Gardens had started flowering and producing seeds too. In 1883 these rubber seeds were used for initiating commercial scale planting of rubber in Sri Lanka. Further, Sri Lanka is also known to have exported rubber seeds to other Asian countries during this period. The very high global demand that had existed for natural rubber together with the attractive return on investment had driven growers to cultivate rubber very extensively during this period and it is evident from the statistics given in Table 1.

Table 1. *The rapid growth in rubber plantation industry in Sri Lanka during initial years*

Year	Extent (acres)
1904	25,000
1906	100,000
1910	203,900
1925	400,000
1928	534,000

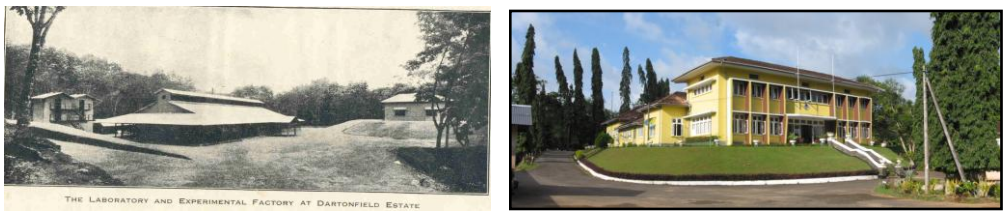
Research and development to establish best practices

With the rapid growth in the rubber plantation industry in the country, the rubber growers realized the need to identify best practices to grow rubber and to process the latex harvested. With this background a committee consisting of members of British Plantation interests in Ceylon was established in 1909 and it had agreed to contribute to a scheme to provide advisory and research facilities to its members. This was the birth of research and development of natural rubber in the country and the origin of the Rubber Research Scheme of Ceylon. The first meeting of the Executive Committee of the Rubber Research Scheme of Ceylon was held on the 19th October 1910 at the Chamber of Commerce, Colombo and Hon. Mr. Edward Rosling was appointed as its first Chairman. Mr L Bellario, an Analytical Chemist was the first Scientific Officer appointed by the Rubber Research Scheme of Ceylon and he was assigned to study the aspects of coagulation of natural rubber latex.

Institutional developments

In 1913 the Rubber Research Scheme of Ceylon was reorganized and renamed as the Ceylon Rubber Research Scheme with the government agreeing to contribute 60% of the annual budget. Considering the increasing responsibilities towards all local growers/producers, Rubber Research Ordinance No.10 of 1930 incorporating the Ceylon Rubber Research Scheme became operative in August 1930. This ordinance provided the collection of a cess of 1/8 cent per pound of rubber exported from Ceylon to be utilized for Research work on NR and to be administered by a Board of Management. In 1932 T.E.H. O'Brien had been appointed as the first Director of Research in the Ceylon Rubber Research Scheme. A 178 acre estate known as Dartonfield in Kalutara was purchased in 1933 for the development of the Research Station of the Ceylon Rubber Research Scheme. The experiments conducted at the Research Station and the information generated and disseminated through articles appearing in journals had been of immense value to the rubber growers/producers. The rubber planters had soon realized the advantages of putting the results of scientific research into practical use. In 1942 a lease of 1,000 acres of jungle land at Hedigalla in the Kalutara District was secured for the purpose of expansion of existing facilities for research. The "Ceylon Rubber Research Scheme" was officially named "Rubber Research Institute" in 1951 by the provisions of Rubber Research (Amendment) Act No 30 of 1951. The work of the Rubber Research Institute had increased greatly in 1953 with the introduction of the subsidized Rubber Replanting Scheme. To facilitate the availability of planting material to the smallholders and small estate owners the Rubber Research Institute established a large nursery at Egaloya in the Kalutara District during this period.

a) **b)**



The Rubber Research Institute during **a)**. initial period and **b)**. to-day

Due to the extensive research and development efforts of the researchers the rubber industry in the country soon reached a status of maturity contributing immensely to the socio-economic development and also contributing to the protection of the environment of the country. Some contributions made to the industry through hundred years of research and development work are briefly discussed below.

Technologies that drives the industry to-day

The commercial yield of the initial Wickham collection together with the then adopted cultural practices was reported to be around 300kg/ha/year. Through genetic improvements with regard to yield and disease resistance and by identifying suitable agronomic practices the scientists have improved the yield potential up to 3000kg/ha/year. This is a basic necessity to sustain the rubber industry in an environment of increasing costs and fluctuating prices.

Rubber cultivation in the country had been restricted to the low elevation areas of the wet zone due to the susceptibility of the then clones to common leaf diseases. Anyhow a need to increase the total natural rubber production in the country was felt to cater to the increasing demand for this commodity. Nevertheless, the availability of land in the traditional rubber growing areas of the country was a limitation for expansion of rubber cultivation. Therefore, suitable agronomic practices and clones have been developed by the scientists to expand rubber cultivation into areas marginal with regard to elevation and rainfall creating opportunities to expand the rubber cultivation in the country. With this innovation rubber is now being extensively planted in the intermediate zone and in areas where the elevation is more than 300m above mean sea level.

Quality of planting material for establishing clearings is of utmost importance to achieve the potential yield of the clone used through achieving an optimum stand of vigorous plants. With this objective the young budding technique has been perfected to raise vigorously growing two whorled quality plants with a production period of nine months. These plants are recommended to be field planted with only the base of the poly bag removed to ensure uninterrupted growth of the plant by preventing any disturbance to the root system during transferring to the field.

Circle weeding around the rubber plants especially during the immature period is very much essential though it is costly and labour intensive. Also, the use of manual methods and weedicides are not environmentally friendly. Recently, by using waste rubber from the dipped products industry, a rubber mat has been developed that could effectively and efficiently control the weed growth at the base of the rubber plants.

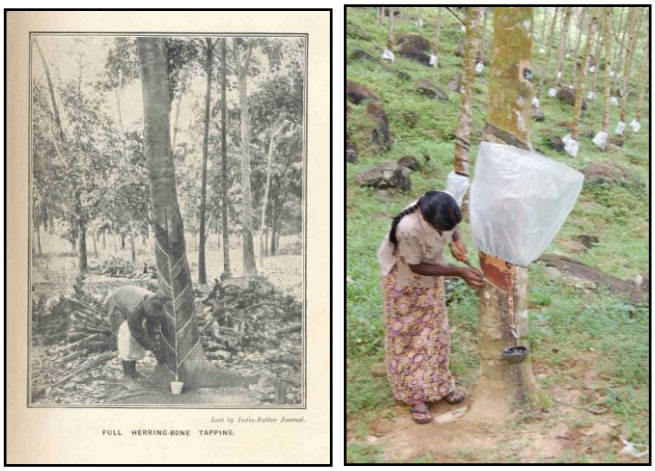
Fertilizer application is one of the many agronomic practices that could influence performance of both immature and mature rubber. It is known as a relatively costly practice for the growers to adopt. Nevertheless, extensive research and development work have enabled the cost of fertilizer application to be kept low. Recommendation of an integrated approach, using locally available fertilizers, cover crops, organic fertilizers and site specific applications, have resulted in reduced costs with no set back on growth and yield.

During harvesting, the recommended standards with regard to slope and depth of tapping cut and thickness of bark shavings have to be achieved. Nevertheless, due to shortage of skilled latex harvesters such standards are not achieved in the field very often. The Rubber Research Institute has developed a tapping knife where even a less skilled latex harvester could achieve the required

quality standards of harvesting. The benefit of this invention to the growers and the country is enormous.

Indiscriminate use of yield stimulants can adversely affect productivity and profitability of rubber plantations. Yield stimulants were initially introduced to the country as a tool for increasing yields with not much concern on sustaining the high yields. The Rubber Research Institute of Sri Lanka through extensive field trials has recommended the judicious use of yield stimulants to the industry. The use of yield stimulants as per the recommendations of the RRISL will help the growers to overcome the shortage of skilled latex harvesters, reduce cost of tapping, and enhance earnings of the latex harvesters and to prolong the economic life span of rubber trees.

a) **b)**



Rubber harvesting. **a).** previous and **b)**. more recent methods

Due to wet weather rubber growers in the traditional rubber growing areas are unable to tap for more than 100 days per annum. With the development of effective bitumen based sealant by the scientists of the Rubber Research Institute, the rainguard technology has been introduced to the industry. With the correct adoption of this technology around 80 lost tapping days could be recovered per annum. This will significantly enhance the earnings of growers and also the latex harvesters.

The plant pathologists have been successful in developing and introducing technologies to keep the rubber plantations healthy despite threats from the ever changing pests and diseases. Integrated pest management systems using cultural, chemical and biological methods are advocated for cost effective control of all economically important pest and diseases. Also, measures have been taken to prevent the entry of devastating rubber diseases found elsewhere in the world.

Introduction of rubber based farming systems is another important contribution made by the RRISL to the rubber plantation industry. Improving land

use efficiency, generating an income during the immature period, a steady income during adverse weather for harvesting and during poor trading conditions, are some of the benefits the growers could gain by the adoption of rubber based farming systems.

a) **b)**

Planting material **a)**. Bear root and currently used **b)**. Young budding

Crepe rubber is the purest form of raw rubber available in the world for the rubber product manufacture. It is used in pharmaceutical products, food industry and in manufacturing of toys. The water soluble, non toxic and environmentally friendly bleaching agent used in the manufacture of crepe rubber, developed by scientists of the Rubber Research Institute of Sri Lanka is another significant contribution by the RRISL.

Sheet rubber (RSS) is a common grade of raw rubber produced in the country particularly by the smallholder sector. Until recently the drying period to produce RSS was about 5-6 days which is time and energy consuming. RRISL scientists have now been able to reduce this period to a single day which is a significant achievement cutting down the cost of manufacture and also helping to keep the environment clean.

The Rubber Research Institute has developed and modernized its laboratories to provide analytical services and test reports to facilitate export of different grades of raw rubber and finished products. Further the Institute assists the rubber product manufacturing sector of the country through development of rubber compounds, blends and assisting them in trouble shooting.

Pollution caused by waste water discharged during raw rubber and rubber product manufacture has been an environmental issue for a long time. The RRISL has

developed cost effective systems to treat such effluent water to achieve Central Environmental Authority specified standards prior to releasing to the environment.

Contribution towards economy

With the adoption of technologies recommended by the Rubber Research Institute during the year 2008 Sri Lanka produced 129,000 MT tonnes of Natural Rubber (NR). Around 63% of the NR produced had been utilized within the country for value addition. The rest had been exported as raw rubber. Foreign exchange earnings to the country through the export of both raw rubber and finished products had been more than Rs.72 billion in 2008. With the rubber products used locally and the value of the rubber timber industry it is currently an industry with a value of around 100 billion rupees a year. This benefit from the industry is in addition to the generation of job opportunities and contributing to the environmental protection of the country. In order to sustain the contribution from the rubber industry to the socio economic development and the environmental protection of the country strategies to meet the future challenges the industry has to face need to be developed.

Future challenges

Some challenges the rubber growers have to face are the increasing cost of production and shortage of skilled workers. Enhancing the yield potential further of rubber clones to be recommended to the industry in the future and developing and introducing cost effective agronomic practices that require lesser number of skilled workers are being looked at by the scientists of the Rubber Research Institute to mitigate the adverse effects of such challenges.

In the raw rubber processing and finished product manufacturing sectors, increasing cost of chemicals, availability of skilled workers and high energy costs are certain issues to which solutions are needed. The intervention of the scientists is needed in this regard and the ultimate target of the scientists should be to provide the technical know how and other services to enable the country to add value to 100% of the raw rubber produced in the country.

It is apparent that the low rate of technology adoption by the growers is one major reason for high cost of production of raw rubber. Rectification of this will have immediate benefits to the industry and the scientists need to work in close collaboration with the growers and extension staff to find a quick and a lasting solution to this issue.

Sri Lanka is yet to gain the maximum benefits from its rubber timber industry. Value addition in this sector is at a very low level and as a result country is loosing valuable foreign exchange and employment opportunities.

Though the rubber growers are contributing immensely to keep the environment clean through rubber plantations that have the capacity to fix more than 250 MT of CO_2 per hectare during its economic life span they are not remunerated for it. The scientists are currently working on this matter together with relevant organizations and policy makers and such work will need to be continued giving a

high priority, so that the growers will be able to reap benefits for their contribution towards clean development mechanism.

From time to time there are certain technologies being introduced to the country which may have not been tested using well designed field trials. Exploitation systems yield stimulants and chemicals for the curing various disorders are some examples. Adoption of such technologies can have adverse impacts on the local rubber industry and scientists of the Rubber Research Institute are very much on alert on such imported technologies in order to prevent any deleterious effects to the country.

The strength of a research institute lies mainly in its research staff. Therefore, it is vital that this strength is sustained for the betterment of the rubber industry in the country.