

ACHIEVEMENTS IN TEA RESEARCH

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An ordinance to establish the Tea Research Institute was passed in the Legislative Council of Ceylon on the 8th of October 1925. This Institute was established for the purpose of research into and investigation of all problems and matters relating to tea, and the provision and publication of information relating to the same, and to provide such facilities for the education of students in tea research. Accordingly, this Institute was founded and was maintained by funds derived from a cess of 0.1 cent on every pound of tea exported from Ceylon. Mr. T. Petch, a former Director of Agriculture, was appointed the first Director of the Tea Research Institute. The first batch of Senior Staff consisted of Dr. C. H. Gadd, DSc (Mycologist); Mr. S. Steuart Light, ARCS, DIC (Entomologist) and Dr. D. T. Evans, PhD (Biochemist). The initial temporary laboratory was housed in a private bungalow at Nuwara Eliya which was given on a two year lease and the first field experiment was carried out in Scrubs Estate, Nuwara Eliya.

In Decembr 1928, the Institute purchased St Coombs Estate from the Anglo-Ceylon & General Estates Co. Limited, the total extent of which was about 420 acres. The Institute was established with a loan of one million rupees from the Government of Ceylon, for the purchase of the estate and the development of the Experimental Station. Thus the Institute came to be established in the Dimbula district, which is in the heart of one of our best up-country tea districts.

The laboratories at St Coombs were completed by the end of 1930 and formally opened in 1931.

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1930-1939

The now famous classical long-term fertilizer trial, which is the first factorially designed experiment in a plantation crop anywhere in the world, was laid down in 1931 in No. 3 field of St Coombs Estate by Mr. T. Eden, Agricultural Chemist. One of the replicates of this trial is still being maintained as a monumental landmark in tea research. Fertilizer recommendations for tea, based on modern scientific principles, were made possible from the results of this famous experiment.

Detailed investigations were completed on the planting, pruning and plucking of the tea bush and the results of such investigations were published by Dr. F. R. Tubbs in the Bulletin of the Tea Research Institute of Ceylon,

No. 15, 1937. Dr. Eden also published very useful notes on the manuring of tea in the Bulletin No. 16, 1937.

Biological control of one of the most serious pests of tea, the Tea Tortrix (*Homona coffearia*) was attempted by introducing a parasite (*Macrocentrus hormoni*) from Indonesia in 1935. This was the first instance of an attempt to control an insect pest by wilful introduction of an exotic species of parasite in this country.

Significant achievements were obtained in the pioneering work on vegetative propagation of tea during the year 1938. This stands out as one of the very significant contributions of this Institute to the Industry, enabling tea yields to increase very remarkably.

The first recorded incidence of plant parasitic nematodes in Ceylon was made in tea with the observation of the root-lesion nematode on the roots of mature tea and this pest was ascertained to be a limiting factor to productivity in high-grown tea areas.

The first known virus disease of tea in Ceylon, (*Phloem necrosis*) was also recorded for the first-time in 1939.

Four conferences were held since inception and two officers of the Institute were awarded higher degrees for research carried out in tea at the Institute. Mr. T. Eden Agricultural Chemist, was awarded the degree of Doctor of Science (DSc) by the University of Manchester and Mr. F. R. Tubbs (Plant Physiologist) was awarded the degree of Doctor of Philosophy (PhD) by the University of London.

1940-1950

Remarkable success was achieved in controlling the Tea Tortrix caterpillar (*Homona coffearia*) biologically by using the larval parasite that was introduced from Indonesia (*Macrocentrus hormoni*) in 1940. This remarkable instance of biological control remains as one of the outstanding achievements of the Institute and is yet rated as one of the most successful instances of biological control achieved anywhere in the world.

After intensive researching the Institute published detailed accounts of the Shot-hole Borer beetle of tea (*Xyleborus fornicatus*) which had now become a serious pest, affecting vast acreages of tea in the low and mid-country tea areas.

At the end of October 1946, the dreaded Blister Blight leaf disease of tea caused by the fungus *Exobasidium vexans* first made its appearance in Ceylon on an estate in the Dolosbage district. It was observed in St Coombs during the first week of December 1946 and had spread to all tea planting districts

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by the end of the year. During the year 1948, the entire staff of the Institute were fully occupied with the work on Blister Blight control and intensive work was carried out throughout the year. The outbreak of this disease was threatening the very existence of this industry.

During 1949 two conferences were held in connection with Blister Blight work. A special vote of Rs. 150,000/- was sanctioned by the Government of Ceylon for intensification of the Blister Blight campaign. By 1951 the Blister Blight leaf disease was successfully brought under control and this remains yet a monumental achievement in the history of the Institute and is an outstanding classic example of the benefits accruing to the industry through research. The Tea Research Institute Monograph No. 6, entitled "Commoner Diseases of Tea" by Dr. C. H. Gadd was published in 1950.

1950-1960

Since 1952 the total extent of tea in the up-country was under fungicidal protection against Blister Blight during both monsoons.

In 1952 a Clonal Supply Station was established at Vogan Estate, Matugama, which served as a Distributing Centre for supplying VP planting material to estates and smallholders in the low-country areas. The highest yielding clones selected by the Institute included the famous TRI 20 series: 2023, 2024, 2025 and 2026.

In 1953 symptoms of potash deficiency in tea were defined and illustrated. A classical fertilizer experiment testing different levels of nitrogen, phosphorus, potassium and magnesium was laid down in the low-country at Endane Estate, Kahawatta, designed to investigate the fertilizer requirements of the low-grown tea. This experiment provided very useful information for increasing the yields of tea in the low-country.

The Shot-hole Borer beetle that had surfaced as a very serious pest in the low and mid-grown tea areas was successfully brought under control by recommending the use of a long persistent organochlorine insecticide, Dieldrin, even though the initial trials themselves showed that there could be possible outbreaks of the tea tortrix following such insecticidal applications. Despite this possible side-effect this insecticide was recommended on account of the seriousness of the pest that was threatening tea fields in the low and mid-country areas. A special symposium was held in Ratnapura on the control of the Shot-hole Borer beetle and the services of a fulltime Entomologist was obtained for working exclusively on the Shothole Borer beetle in 1958.

The TRI Monograph No. 4 entitled "Tea Manufacture in Ceylon" by Mr. E. L. Keegal, was published and this was very well received by the entire industry.

In 1958, the Institute launched its scheme for the rehabilitation and re-planting of uneconomical tea lands through the Government of Ceylon. The Institute held a symposium in Colombo during this year on all aspects of re-planting of tea in order to inaugurate a scheme.

One of the most outstanding achievements in 1959 was the development of a soluble instant tea which was superior to all other soluble teas then available on the market. The product was pioneered by the TRI and developed jointly by the TRI and the CISIR.

During 1959, the Tea Research Institute Board decided to seek the services of expert scientists in the United Kingdom to form an Advisory Committee and this was established with the following scientists: Dr. F. R. Tubbs (Director, East Malling Research Station) who functioned as Chairman/Convenor; Mr. F. C. Bawden, FRS (Director, Rothamsted Experimental Station); Professor T. A. Bennet-Clark, FRS (Professor of Botany, King's College London) and Professor G. E. Blackman, FRS (Siphthorpiian Professor of Rural Economy University of Oxford). This Committee helped the Institute in the training of local young scientists who were to proceed on overseas training for postgraduate studies. They advised and arranged suitable places for such post-graduate students from the Institute and they also helped in the selection of suitable overseas candidates for short-term assignments at this Institute.

During 1959 Oil-spot disease was discovered in some of the estates in the Nuwara Eliya district. Investigations on the pathogenic effects of this disease were initiated in the Plant Pathology Division.

The Institute made recommendations to estates on the various means of economising on Blister Blight control, using the sunshine recorder scheme.

An Advisory and Extension Services Division was established for the first-time in 1959 and this was located at St Coombs to provide an efficient liaison between the Institute and the industry and also to relieve research workers of the pressure of advisory work.

With the increasing awareness of nematodes as a serious limiting factor to crop productivity in high-grown tea areas, a separate Division of Nematology was established during this year, having obtained the services of a specialist Nematologist through USAID. The setting up of a special discipline to deal with such pests was the first of its kind in the country.

Symptoms of nitrogen deficiency and magnesium deficiency were defined and illustrated.

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1960-1970

After many years of agitation by the Tea Planters of the low-country, a special Research Station to deal with the problems of tea growing in the low-country was established in 1960 in Ratnapura.

Having recognised the research carried out by the Institute on the production of instant tea, the Government of Ceylon decided to make certain concessions to assist the establishment of an Instant Tea Industry in Ceylon with the object of opening new markets for tea. 1960 therefore was a year that stands as a landmark for product diversification. A German firm, Haelssen & Lyon of Hamburg was allowed to exploit these concessions commercially. In conjunction with Bosanquet & Skirne Limited they registered Cey-Tea Limited in Colombo. The process for obtaining powdered tea direct from green leaf, which was pioneered by the TRI, thereby passed out from the Institute's hands.

An important discovery during 1962 was that zinc deficiency was widely prevalent in Ceylon tea. Symptoms of such deficiency were defined and recommendations were made for its correction by spraying zinc sulphate. Such corrective measures lead to appreciable increases in yield at comparatively low cost.

A comprehensive survey of the infestation of mature tea with the meadow eelworm (*Pratylenchus loosi*) was carried out during 1963. It was discovered that this nematode pest was widely prevalent at altitudes above 2,500 ft and the damage caused was most serious above 3,500 ft. It was also discovered that the optimum temperature for development and reproduction of this pest was between 65-75 ° F.

During this year a soil fumigant DD was used with much success to control a highly destructive *Poria* root disease. Many estates began treating diseased patches of tea which had long been neglected and consequently were expanding. The spread of this dreaded disease thus came under control with the introduction of the Institute's finding to control this disease.

In 1964 a new disease causing the formation of stem cankers on high-yielding clonal tea in the low-country was discovered. Corrective measures were undertaken and the spread of the disease was brought under control.

Yields of 6,000 lb of made tea per acre were recorded for the first-time in Ceylon with the clones introduced by the Tea Research Institute. Such yields were made possible by introduction of selected high-yielding varieties by this Institute.

A new Experimental Factory at St Joachim Estate, Ratnapura, was opened in 1965 and commenced manufacture of St Joachim Estate tea. This

factory has now become one of the largest factories servicing the tea small-holders in and around the Ratnapura district.

During 1965 methyl bromide was found to be a very effective soil fumigant to control the *Poria* root disease. This was a very significant discovery as it tumbled the costs of *Poria* control to such low levels that many estates which could not afford to control this disease before found it economically feasible. This again was one of the significant achievements of the Institute in controlling a dreaded disease that threatened the existence of high-grown tea areas.

During the same year it was discovered that collar and branch canker in young tea, a disease prevalent in the high-country, was caused by a fungus *Phomopsis theae*.

Various aspects of the biochemical changes taking place during tea manufacture were studied, particularly the changes undergone by amino acids, and the role of polyphenols and carotenoids in the development of quality and flavour was successfully revealed.

Yields of 8,000 lb of made tea per acre were recorded in Ceylon for the first-time in the industry's history on a low-country estate growing the clones selected by the Tea Research Institute (TRI 2023 and TRI 2026). Ceylon became the highest exporter of tea for the first-time. Another 'first' was that the country exported more than half a billion pounds of made tea during this year with no substantial increase in the area under tea. This is the best indication of the effect the Institute's discoveries have had on the industry.

During 1966 comprehensive recommendations were made to tea estates for controlling the meadow nematode *Pratylenchus Loosi* in new clearings. Widespread incidence of such nematode attack in new clearings was recognised and in many instances these infestations were traced to the transport and planting of infested material from contaminated nurseries and the new recommendations helped in curtailing such spread. These recommendations also made it possible for the new tea to yield significantly higher than what was hitherto possible with this pest as a limiting factor.

On account of severe side-effect problems of the wide-scale use of Dieldrin as a controlling agent against the Shot-hole Borer beetle, this insecticide had to be withdrawn in 1966. Alternative methods of control were introduced.

New fertilizer recommendations were made to tea estates for mature seedling and VP tea and for young VP tea. The new recommendations were based on the potential yield realisable from the various types of tea in the different districts. Intensive work was done on the use of urea as a cheaper substitute for ammonium sulphate as a source of nitrogen.

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1970-1980

This decade saw many new developments and significant achievements were obtained and the industry gained vastly from the Institute's activities.

The fertilizer subsidy scheme was organised and urea was issued under this scheme.

A large number of herbicides were experimented with over the years and the tea estates were given precise recommendations on how to handle these chemicals and develop suitable programmes of weed management. The outstanding development in this line was the discovery that the dreaded Cootch grass, *Panicum repens*, could be successfully controlled with a newly experimented herbicide, Glyphosate ('Round-up').

Extensive work was undertaken during this decade on soil conservation measures and improving soil fertility. Various measures have been recommended to estates and increased emphasis has been placed on the construction and maintenance of drains and terraces, to soil cultivation, mulching and the planting of the new introduced grass *Eragrostis curvula* on the banks and edges of tea fields in order to minimise soil erosion.

Novel methods of pest management were developed during this decade by scaling down the use of pesticides very significantly and through the development of integrated pest management programmes. Special techniques of pest surveillance were experimented with and insect sex pheromones have been successfully isolated and used in this surveillance programme.

Insect culture techniques have been successfully developed with artificial diets and detailed physiological studies have been carried out and novel methods of insect management are being worked out by using metabolic disruptors which interfere with the development of the insect to adulthood. Such fundamental studies on insect nutrition have enabled the screening of various metabolic disruptors (Semio chemicals) that interfere with development leading to deformity and thus preventing the insects from emerging as normal adults.

Programmes based on pruning practices and other cultural practices have been evolved to manage two of the major pests of tea, namely the low-country live-wood tea termite and the shot-hole borer beetle. By evolving such special strategies it has now become possible to totally eliminate the use of insecticides against these pests.

Besides carrying out research on the propagation of tea through vegetative means, the Institute has also been carrying out investigations on tissue-culture. Investigations on tissue-culture in tea in Sri Lanka was initiated in the early 1970s and we have been keeping abreast with the progress of research

in this area carried out in other Institutes around the world. We have realised there is some potential in the area of plant breeding in tea using this technique of tissue-culture. Tissue-culture lends itself to make hybridisation work less tedious and simpler.

During this decade tea factories have been significantly modernised. The major recommendations of the Institute have been the introduction of withering troughs, the introduction of the rotorvane, the introduction of the CTC manufacture, the testing of LTP processing machines and the most important of all is the introduction of the Fluid Bed Drier that was conceived, pioneered and commercially produced in Sri Lanka. The introduction of the Fluid Bed Drier to the industry has revolutionised the science and technology of tea drying resulting in a significant saving in the energy needed for this process.

The Tea Research Institute has kept abreast of changing market trends by developing processes for the manufacture of new tea based products, such as instant teas, scented teas, liquid and carbonated teas and tea-based wines and sherry, that have received the highest recommendations from reputed international tasters. These processes have been developed up to pilot scale of operation and are now almost ready for commercial exploitation.