



*Research
and the
Coconut
Industry
1930-1955*

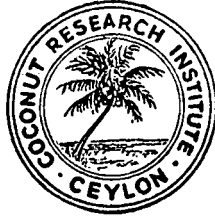
Published by
THE COCONUT RESEARCH BOARD

AUGUST 1955

LUNUWILA



His Excellency
SIR OLIVER ERNEST GOONETILLEKE
G.C.M.G., K.C.V.O., K.B.E.,
Governor General of Ceylon.



RESEARCH AND THE COCONUT INDUSTRY 1930-1955

THE cultivation of coconuts as a plantation crop in Ceylon followed the birth of the soap industry in Europe and so was the direct outcome of the Industrial Revolution in the middle of the XIXth century. The soap industry expanded rapidly and was followed by the invention of a substitute for butter, viz., margarine, further to increase the demand for coconut oil.

Thus the coconut industry has had to depend largely on overseas markets and in consequence its prosperity ebbs and flows according to the supply of and demand for oils and fats in world markets. The continued success of the industry therefore depends primarily on its ability to overcome agricultural and economic difficulties and also on its ability to meet competition from other producing countries by maintaining the quality of its products at a high level and by reducing the cost of production by increasing the yield of nuts per acre.

Historical.

From 1840 to 1860 was the era of planting by Europeans mainly in the Jaffna and Batticaloa districts of the Northern and Eastern Provinces ; thereafter the Ceylonese brought many thousands of acres of jungle under coconut cultivation in the Western and North-Western Provinces where they established many large plantations, estates and small holdings. Cultivation gradually extended into other parts of Ceylon and coconuts were successfully established as a plantation crop even up to 2,000 feet in the hill country, far remote from the sea.

These properties have since all changed hands, either through inheritance or transfer or sale, and in the process have been reduced or fragmented mostly to small estates of about 100 acres each or to small holdings of less than 20 acres. Today, approximately 70% of the 1,000,000 acres under coconuts consists of small-holdings. The coconut industry has thus become predominantly a small-holders industry.

The Coconut Research Scheme.

Although coconuts have thus been growing under plantation conditions for about a century, it was only in recent years that any attempt was made to study the crop on scientific lines.

With the possibility of developing coconuts as the premier agricultural industry of Ceylon, the Department of Agriculture organised the first field experiments on manuring at Peradeniya in 1912. Subsequently experiments to test the value of different fertiliser mixtures and manures were laid down



Coconut Research Scheme in 1930

on estates at Kurunegala, Negombo and Chilaw. These experiments demonstrated the importance of potash to coconuts and the need for added organic matter to maintain and improve the fertility and texture of sandy soils.

The progress of these experiments was regularly reviewed by the Estates Products Committee of the Department of Agriculture and ultimately led to

the proposal for the Scheme for Research on Coconuts. At a meeting of this Committee, held on July 14th 1923, Sir Frank Stockdale, Director of Agriculture proposed that the coconut industry which then covered almost a million acres, should have an experimental station of its own for work on scientific lines in the heart of the coconut growing triangle, viz., Colombo, Kurunegala, and Chilaw.

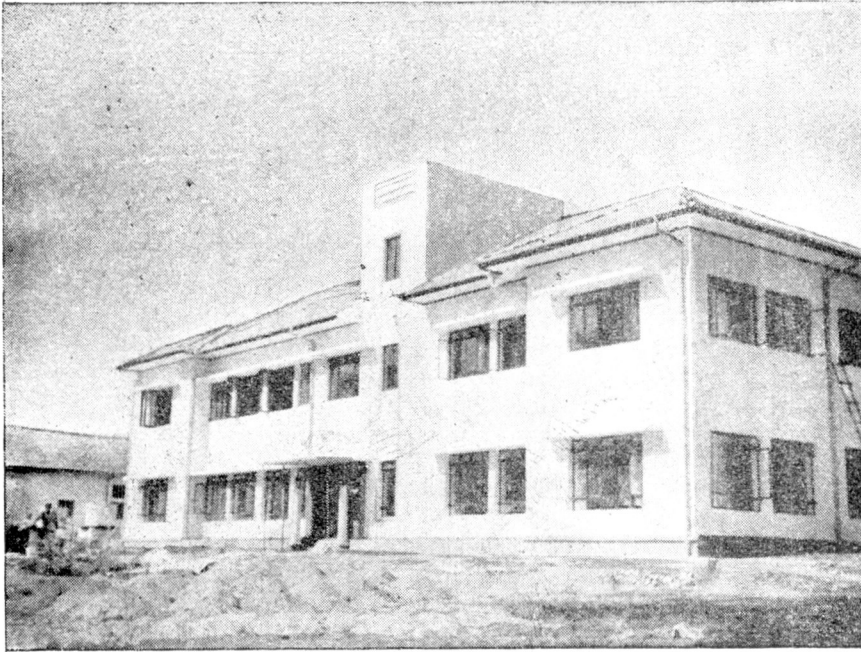
The Coconut Research Scheme was finally launched under Coconut Research Ordinance No. 29 of 1928 for the purpose of :—

“ Managing, conducting and furthering scientific research in respect of coconut and problems connected with the coconut industry, and in particular the growth and cultivation of coconut palms, the prevention and cure of diseases and pests and the utilisation and marketing of the products of the coconut palm.”

The first meeting of the Board of Management took place in the Legislative Council Chambers in Colombo on April 27th, 1929 but it was not until 1930 that Mr. W. E. de B. Diamond was appointed the first Director of Research and the headquarters of the Coconut Research Scheme were established on Bandiripuwva Estate, Lunuwila,—exactly 25 years ago.

It was an irony of fate that the Scheme was launched at a time of acute economic depression and was established on the basis of a cess on coconut products and grant from Government revenue, which together were inadequate. For 21 years, the Scheme has struggled on in the face of ever-increasing financial difficulties without any increase in income owing to the steadily declining value of money.

The “ Scheme ” finally became the “ Coconut Research Institute of Ceylon ” in December 1950 when, under the Coconut Research Amending Act No. 31 of 1950, the cess was also increased. A subsequent further increase (Coconut Research Amending Act No. 22 of 1954) has made it possible to extend the work of the Institute and develop its activities so as to cover not only research, but also the cost of advanced technical training overseas, the application of the results of research in the field and the administration of the Coconut Replanting Project of 1954.



Coconut Research Institute 1955 nearing Completion

Work of the Institute

The Institute today consists of twelve divisions, viz., Administration, Botany and Plant Breeding, Soil Chemistry, Plant Chemistry, Technological Chemistry, Agronomy, Animal Husbandry, Crop Protection, Industrial Research, Planting, Advisory and Public Relations, which includes instruction, publicity and propaganda.

The Institute administers two estates at Bandirippuwa and Ratmalagara as field research stations and is establishing an isolated coconut seed-garden in the heart of Ambakelle Forest, near Chilaw. In addition it maintains 20 coconut nurseries for the production, selection and distribution of high-grade coconut seedlings and negotiations are in progress for the acquisition of land to serve as research sub-stations and demonstration centres under different environmental conditions.

Research Progress.

Botany and Plant Breeding.—The future of the coconut industry will mainly be determined by the improvement in yields which can be obtained by selection and breeding. As a result of a statistical experiment which was laid down in



A good Seedling and a bad Seedling

1939, selection at the seed-nut and seedling stage has been placed on a sound basis on which the Coconut Replanting Project is being developed over the next 10 years.

The salient features of the present methods of seedling selection are :—

- (a) Palms derived from seed-nuts, that germinate early, flower earlier are more productive than those from seed-nuts, that germinate late.
- (b) A stringent selection of seedlings will reduce the frequency of “duds” or weak palms in a plantation.
- (c) If only selected seedlings are planted the crop is increased by about 10 per cent.

Breeding work on the other hand is a long-range project. Over a long period of years, a number of mother palms have been systematically recorded and the floral biology of the palm has been studied. The results of this work are now being applied in the establishment of the Isolated Seed Garden, using seed-nuts produced on selected mother palms by artificial pollination. These isolated mother palms will begin to yield high-grade seed-nuts in 10 years time, when the subsidy for Coconut Replanting ends.

A number of crosses using different varieties have been made and nearly 300 progenies are now under test. The most promising of the inter-varietal crosses appears to be Tall x Dwarf; the illustration shows a $4\frac{1}{2}$ year, old heavy bearing palm.

Soil Chemistry.—The first series of modern field experiments on the manuring and cultivation of coconuts were those started in 1935 at Bandirippuwa and in 1938 at Ratmalagara. Experiments on the manuring of palms under different environmental conditions and of new replantings have been laid down on a number of other estates.

The predominant role of potash has been conclusively proved, the heavy doses of phosphates, formerly used, have been found to be unnecessary and the use of excessive amounts of nitrogen in fertiliser mixtures has been found to depress yields. On the basis of these investigations balanced manurial mixtures for different soil types have been recommended and considerable financial economies and improved yields have resulted. High responses have been obtained on poor, lateritic soils.



Tall X Dwarf hybrid plan, $4\frac{1}{2}$ years old.

The manuring trials of new replantings have proved conclusively that replanting in a soil, on which coconuts have been growing for 60 years or more, is futile unless the condition of the exhausted soil is improved by manuring. Unmanured "replants" take 10 to 15 years to fruit and remain uneconomic owing to low yields, manured "replants" give good yields in 6 to 7 years.

Plant Chemistry.—A promising new field of work was started in 1952, viz., the study of the role of the so-called trace and minor elements in the nutrition of the coconut palm. It is believed that the absence of certain essential elements in an exhausted tropical soil may be a limiting factor in the development of the plant even though the amounts required may be very small indeed.

Favourable responses have been obtained from the application of the mineral element, magnesium, in the form of dolomite, $\text{Ca Mg}(\text{CO}_3)_2$, or epsom salts, Mg. SO_4 , in the form of improved vegetative growth and colour of foliage. These long range trials are still proceeding and the effect on fruiting is not yet known.

The need for magnesium may explain why coconuts are found growing mostly near the sea and in land only where there are adequate reserves of calcium and magnesium already in the soil, as in the Matala region.

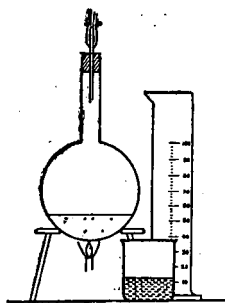


A Tapering Palm

A new field of investigation has just been commenced, viz., the hydroponic cultivation of coconuts in chemically-purified sand with various combinations of added plant foods in giant concrete pots.

It is now considered that tapering disease is a form of malnutrition brought about by root failure as it can be corrected by inducing new root growth.

Technological Chemistry.—Since 1931, this division has contributed materially to the development and improvement of subsidiary industries dependant on the coconut, *i.e.*, consumption research. A special study has been made of coconut shell charcoal and of the various products of dry distillation, viz., acetic acid, creosote, carbolic acid, wood naphthta, tar and pitch. This work which was published in 1939 provided the basis for the commercial production of these products at the Government Acetic Acid Factory at Madampe, during the War.



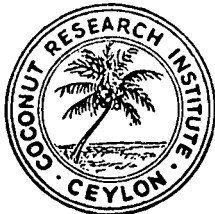
Glassware used in scientific research.

Between 1939 and 1942, useful work was done in collaboration with the Government Analyst and the Excise Commissioner for the production of an improved grade of arrack by double distillation. There are no difficulties in the application of this work, if the demand for a superior grade of arrack should arise.

A very large number of analyses of copra, obtained from various sources over a long period of years, has been carried out. A full account of the oil content of copra produced in various districts in Ceylon and seasonal variations in oil content has been published. Fallen nuts gave a higher yield of copra but the quality was not so attractive. Copra from rejected seedlings although of inferior quality was abnormally rich in oil (*i.e.*, over 77%).

Many inquirers have shewn interest in the preparation of superfine, edible, white oil and in the refining, bleaching and deodorising of inferior grades of oil (including drain oil) but no commercial developments have resulted. The use of coconut oil as a Diesel fuel, alone and in combination with kerosene, has not been found economic, when Diesel oil is freely available.

A survey of the quality of coconut toddy vinegar produced by the existing manufacturers has revealed that there is vast room for improvement both in the method of production and in the quality of the product. In some cases wasteful loss of alcohol occurs owing to injudicious handling of the raw material during the various stages of manufacture.



COCONUT RESEARCH INSTITUTE

(CEYLON)

ADVISORY LEAFLETS

- No. 1—Seed Selection.
No. 2—Nursery Management and Selection of Seedlings.
No. 3—Cover Crops suitable for Coconut Estates.
No. 4—Transplantation.
No. 5—Utilization of Husks on Coconut Estates.
No. 6—Coconut Shell Charcoal.
No. 7—Advisory Visits to Estates.
No. 8—Manuring of Young Palms.
No. 9—Locally Available Materials of Manurial Value.
No. 10—Soap Making by the Cold Process.
No. 11—Yield Recording and the Issue of Planting Material by the Coconut Research Institute.
No. 12—Notes on the Manuring of Coconut Palms.
No. 13—The use of Lime and Salt for Manuring Coconut Palms.
No. 14—Further Notes on Seedling Selection.
No. 15—The Ceylon Copra Kiln.
No. 16—Instructions for Soil Conservation Practice in Small Holdings and Highland Allotments.
No. 17—Cover Crops for Coconuts.
No. 18—Planting Coconuts.
No. 19—Advisory Service.
No. 20—How to Make a Barbecue.
No. 21—Planting Coconuts on Old Rubber Lands.

Issued free to local residents.

OTHER PUBLICATIONS FOR SALE

- “The Ceylon Coconut Quarterly.”—A popular Journal devoted to Coconuts—Published by the C.R.I. Price Re. 1 plus 12 cents postage. (Annual Subscription Rs. 4 plus 50 cents postage.)
“Illustrated Guide to Coconuts”—Price Rs. 2.50 plus 30 cts. postage.
“Illustrated Picture of the Coconut Palm”—Price 25 cts. plus 15 cts. Postage.
“Sinhalese Booklet”—(Sinhalese translation of the above Advisory Leaflets Nos. 1-14)—Price 50 cts. plus 12 cts. postage.
“Pol Sangarawa”—A Sinhalese book, issued annually. Price Rs. 3.

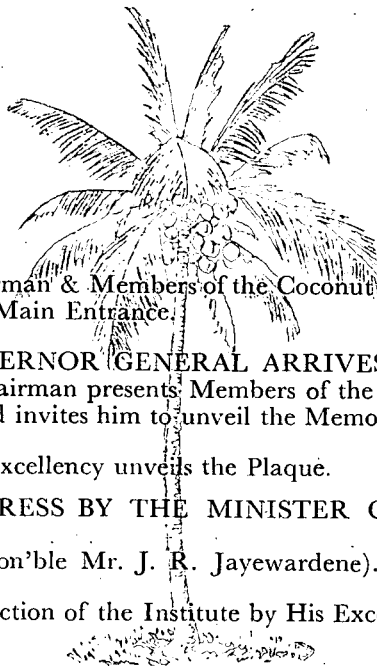
The above rates are applicable to local residents only. Overseas residents may only obtain these publications for an all-in payment of Rs. 15 per set (per year). Please apply to the Secretary, Coconut Research Institute (Ceylon), Bandirippuwa Estate, Lunuwila. V.P.P. Orders are not accepted.

His Ex
THE GOVERNOR

Visit to the Coconut

29th Aug

PROGR



- 9-55 a.m.** Chairman & Members of the Coconut Research Board assemble at Main Entrance.
- 10-00 a.m.** **GOVERNOR GENERAL ARRIVES**
Chairman presents Members of the Board to His Excellency and invites him to unveil the Memorial Plaque.
- 10-02 a.m.** His Excellency unveils the Plaque.
- 10-05 a.m.** **ADDRESS BY THE MINISTER OF AGRICULTURE & FOOD**
(Hon'ble Mr. J. R. Jayewardene).
- 10-10 a.m.** Inspection of the Institute by His Excellency.
- CONFERENCE**
- 11-00 a.m.** **HIS EXCELLENCY ADDRESSES THE COCONUT CONFERENCE**
- 11-20 a.m.** Vote of thanks by Chairman.
(Dr. A. W. R. Joachim, O.B.E., J.P.)
- 11-25 a.m.** His Excellency leaves.

PLEASE C

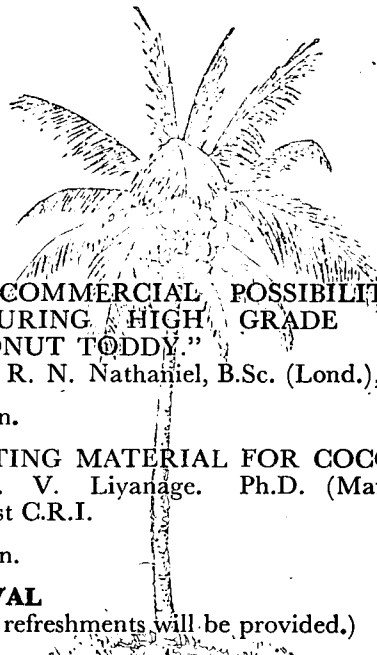
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DR GENERAL'S

Research Institute.

ust, 1955

AMME



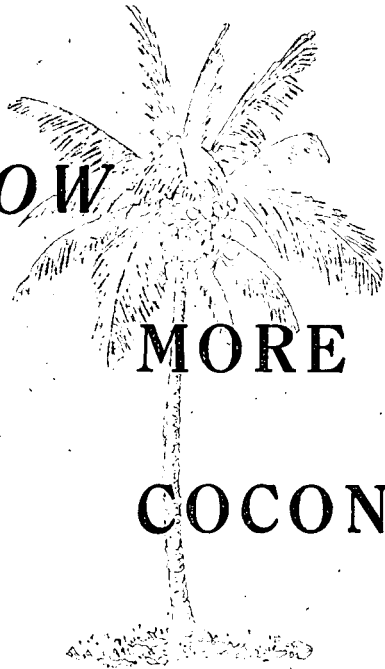
- 11-30 a.m.** "THE COMMERCIAL POSSIBILITIES OF MANUFACTURING HIGH GRADE VINEGAR FROM COCONUT TODDY."
by W. R. N. Nathaniel, B.Sc. (Lond.), Chemist, C.R.I.
- 12-00 noon** Discussion.
- 12-15 p.m.** "PLANTING MATERIAL FOR COCONUTS."
by D. V. Liyanage. Ph.D. (Manch.), B.Sc. (Lond.), Botanist C.R.I.
- 12-45 p.m.** Discussion.
- 1-00 p.m.** **INTERVAL**
(Light refreshments will be provided.)
- 2-30 p.m.** "SOME NEW ASPECTS OF COCONUT MANURING."
by M. L. M. Salgado, Ph.D., (Cantab.); B.Sc. (Lond.), Dip. Agric. (Cantab) Soil Chemist, C.R.I.
- 3-00 p.m.** Discussion.
- 3-15 p.m.** "AGRONOMY AND THE COCONUT INDUSTRY."
by T. B. Paltridge, B.Sc. (Hons.). Agronomist (Colombo Plan.)
- 3-30 p.m.** Discussion.
- 4-00 p.m.** Close Conference.

OME EARLY

GROW

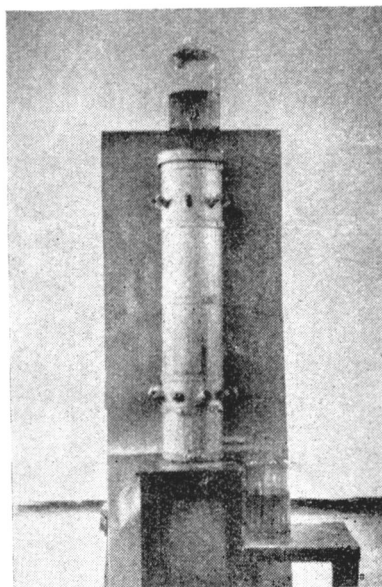
MORE

COCONUTS



The new continuous "Generator" process for the manufacture of high grade coconut vinegar from coconut toddy which was developed during 1954 is quicker, cheaper, more hygienic and much more efficient than the existing vat process.

This old-fashioned process produces vinegar containing less than 4.5% acid in from 3 to 6 months depending on conditions ; the new modern process results in complete acetification in 6 days and an average acidity of 7.2% acid. Two vinegar manufacturers have undertaken to implement the new process for commercial production during the 1955 toddy-tapping season. The production of high-grade vinegar from coconut toddy will make possible the establishment of a sauce and pickle industry using bottles, fruits, vegetables, spices and salt, all produced in Ceylon, and the export of vinegar and vinegar essence to countries overseas.



Vinegar generator

Useful work has also been done on the chemistry of coconut water, coconut toddy and derived yeasts, on the storageability of desiccated coconut in plastic containers, on the production of soaps based on coconut oil and on the utilisation of coir dust in plastic board and bricks, and as a mulch.



Toddy products

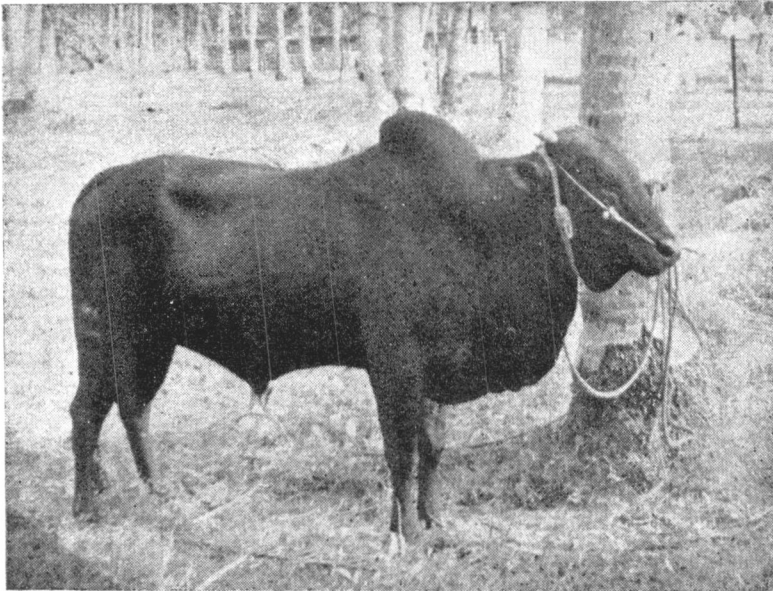
Agronomy. — An Agronomist has been appointed under the Colombo Plan for Technical Aid and has already commenced work. He will initiate and carry out practical field experiments in :—

- (1) The correct method of planting coconuts.
- (2) Soil moisture conservation.

- (3) Irrigation, drainage, soil aeration and cultivation.
- (4) Mechanised farming.
- (5) Establishment of pastures and legumes under coconuts in the wet, dry and semi-dry areas.

Animal Husbandry.—This division was started in 1951 to study the inter-relationship between livestock and coconut *i.e.*, the effect on the palm of keeping cattle, pigs and poultry and producing manures, the maintenance of pastures under shade, the value of these secondary industries in the economics of the industry and to encourage the increased production of milk, meat and eggs in the low country of Ceylon.

No breeding work other than improvement by selection and culling is being attempted, as the object is to see what can be done by improved manage-



Young 'Sinhala' Bull at the Coconut Research Institute

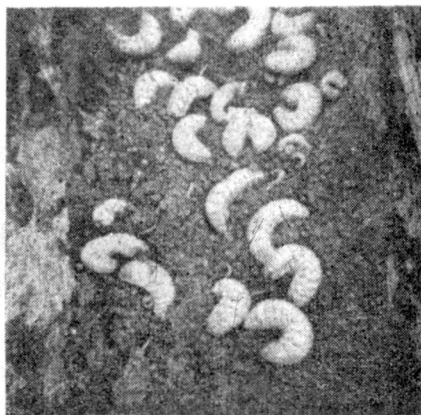
ment and correct feeding with the hardy indigenous Sinhala cattle which the villager knows, understands and can afford. The black herd at Bandirippuwa is now in first rate condition but it will be 20 years before the full results of the work can be seen. The best milking animal has given $3\frac{1}{2}$ gallons per 1,000 lbs. of body weight in a test yield trial at Negombo Show, 1955. The fat content of this milk is over 6 per cent.

Meanwhile farmyard manure is being prepared and applied to the palms and controlled rotational grazing of the estate is carried out on a plan so that the pastures do not degenerate. A part of the estate is being manured by pigs and poultry in portable pens which are moved from square to square at 3 day intervals.

A school for dairying has been started and the course lasts two months.

Crop Protection.—From 1951 onwards, all problems, relating to the pests and diseases of the coconut have been referred to a sub-division of the Botanical Division, with occasional reference to the Entomologist and Pathologist of the Department of Agriculture. No systematic research or investigation has yet been carried out owing to the lack of trained personnel, equipment and facilities.

The Institute has thus acted in any advisory capacity only in respect of the following known pests and diseases:—Black Beetle (*Oryctes rhinoceros*), Grey blight (*Pestalotia palmarum*) Leaf Scale (*Aspidiotus destructor*) Termites (*Coptotermes*) Coconut Caterpillar (*Nephantis serinopa*) Stinging caterpillar (*Parasa lepida*), Rats, lightning strike, Bleeding disease, Red Weevil, (*Rhynchophorus ferrugineus*)



Coconuts beetle larvae
(*Oryctes Rhinoceros*)

Bud-rot, immature nut-fall, tapering disease, locusts, nettle grubs and cattle.

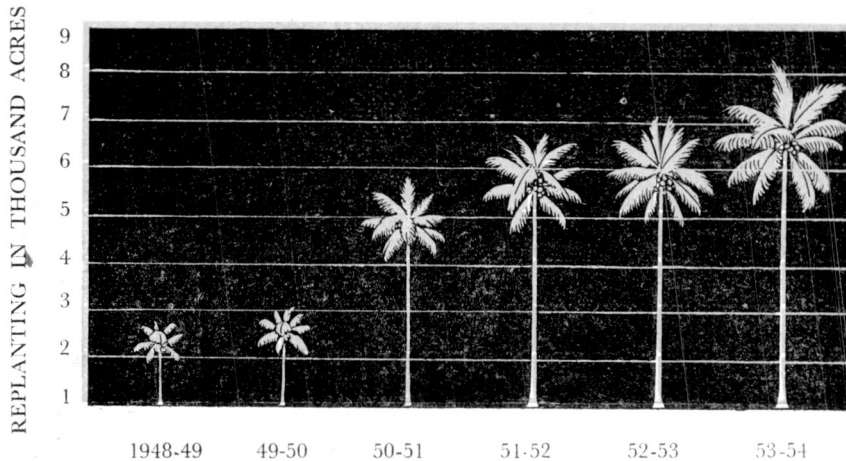
Industrial Research.—The purposes of this new division is to make a survey of existing coconut industries, to carry out middle and factory scale trials, and to make recommendations for improvements in industry and for the utilisation of wasted by-products.

A small-kiln for the production of edible white copra is in course of construction and an investigation of the commercial possibilities of coconut cream for export to manufacturers abroad is under examination.

Extension Work.

Planting Division.—The most important recommendation of the Ceylon Coconut Commission in its Report published in 1949 was that 420,000 acres of coconuts were over 60 years of age and needed to be replanted. Actually the work of replanting old, neglected and low-yielding palms is a continuous and never-ending task as it is estimated that the actual rate of depreciation is $1\frac{1}{2}$ per cent. or 15,000 acres per annum.

The production of planting material for this purpose was delegated by the Department of Agriculture to the Coconut Research Scheme. The work being restricted to and depending on a fluctuating vote and all income derived from the proceeds of the sale of seedlings reverting to revenue. The following table shows the progress of the work since its inception, starting from scratch :—



Progress of replanting since 1934

In addition it is estimated that an equal acreage has been replanted with seedlings produced on estates by private enterprise. However, this was not considered enough and in 1954, the Coconut Replanting Project was launched whereby the production of seedlings was subsidised by a fixed vote of Rs. 500,000/- per annum with all revenue derived from the sale of seedlings remaining with the Institute.

The following is the programme, as approved by the Hon'ble J. R. Jayewardene, Minister of Agriculture & Food :—

Year.				Acreage to be Re-planted.
1955	..	..	..	.. 12,000
1956	..	..	..	.. 14,000
1957	..	..	..	.. 16,000
1958	..	..	..	.. 16,000
1959	..	..	..	.. 16,000
1960	..	..	..	.. 16,000
1961	..	..	..	.. 15,000
1962	..	..	..	.. 15,000
1963	..	..	..	.. 15,000
1964	..	..	..	.. 15,000
10 Years	..	..	..	.. <u>150,000</u> acres

Under this plan a total of 9,000,000 selected seedlings will be produced. In 1955, it was decided by Government to make a further annual grant of Rs. 375,000 to allow for the new planting of a total of 112,000 acres of virgin jungle in the next 10 years under various schemes for colonisation.

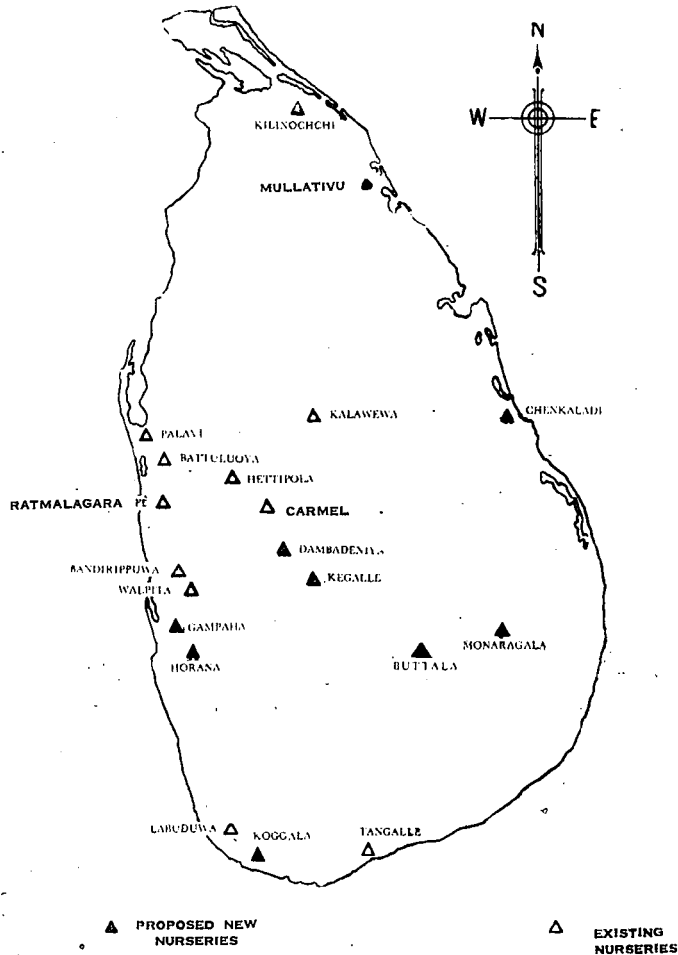
In this connection, several inspections and soil surveys of Crown Lands have been carried out by the Planting Officer and Officers of the Soil Chemistry Division.

The policy with respect to the production of seedlings is to centralise work in 19 nurseries according to the requirements of replanting and new planting. It has been found that this results in better control, stricter supervision and lower overhead cost of production. Selected seedlings now cost -/75 cents to produce and they are sold to the public for -/30 cents each.



A Coconut Nursery

The nurseries are strategically situated in the principal coconut growing areas as follows :—



Map of Ceylon, showing existing and proposed nurseries

Advisory Division.—A Senior Advisory Officer, together with the three Area Advisory Officers are shortly to be appointed to organise an Advisory and Demonstration Service on the basis of one Field Advisory Officer per

50,000 acres. At present there are seven Advisory Field Officers to do this work and provide a follow-up-service in replanting operations.

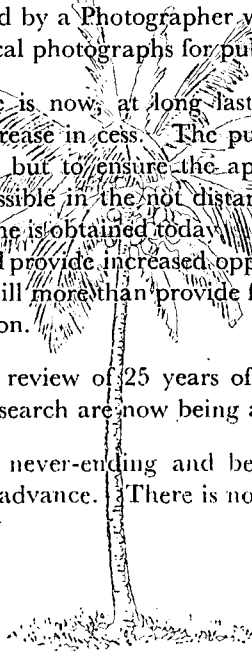
Public Relations Division.—A special Officer has recently been appointed to co-ordinate the publicity of the Institute and to present to the public the results of research. He will act as assistant Editor of the “*Ceylon Coconut Quarterly*” and as Editor “*Pol Sanghara*” and will revise and edit planting leaflets and other publications in three languages.

He will also organise courses of instruction for conductors, superintendents, and overseas students in the science and practice of coconut cultivation and for this purpose will be assisted by a Photographer who will prepare technical films, Koda-slides, and technical photographs for publication and exhibitions.

Conclusion.—The Institute is now, at long last, established on a sound footing though the recent increase in cost. The purpose of all this reorganisation is not merely research but to ensure the application of the results of research so that it will be possible in the not distant future to obtain two or even three nuts where only one is obtained today. This will not merely halve the cost of production, but will provide increased opportunities for employment in the coconut industry and will more than provide for the needs of the rapidly increasing population of Ceylon.

This then completes the review of 25 years of research on coconuts and indicates how the results of research are now being applied.

Research in Agriculture is never-ending and becomes progressively more complicated with every fresh advance. There is no finality—research goes on forever in the march of time.



Conference NOTES

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