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Annual Report of the Coconut Research Board of the Coconut Research Institute for 1955

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ANNUAL REPORT OF THE COCONUT RESEARCH INSTITUTE FOR 1955

THE present report is the Twenty-Seventh Annual Report of the Coconut Research Institute which was established by Ordinance No. 29 of 1928 dated December, 1928.

REPORT OF THE CHAIRMAN

ON January 1, 1955, the Coconut Research Board consisted of the following :—

Ex-officio Members

Chairman—The Director of Agriculture : Dr. A. W. R. Joachim, O.B.E., Ph.D., B.Sc. (Lond.).

Treasury Representative : Mr. W. D. Gunaratne, C.C.S.

Chairman, Low Country Products Association : Mr. S. Pathmanathan (ex-officio).

Director, Coconut Research Institute : Mr. F. C. Cooke, A.R.C.S., B.Sc. (Lond.), A.M.I.Ch., E.D.

Senators and Members of Parliament nominated by the Hon. Minister : Mr. N. H. Keerthiratne, M.P., Mr. R. Singleton-Salmon, M.P., C.B.E.

Representatives of the Low Country Products' Association : Mr. R. H. de Mel, Mr. Wace de Niese.

Representatives of the Planters' Association : Mr. A. W. Warburton Gray, Mr. C. T. van Geyzel, J.P.

Representatives of the Small Holders nominated by the Hon. Minister : Mr. E. Muttukumaru J.P., Mr. C. A. M. de Silva.

Dr. A. W. R. Joachim was away from the Island on F. A. O. mission during the last quarter of the year. Dr. W. R. C. Paul, Acting Director of Agriculture, acted as Chairman of the Board during this period.

Mr. W. D. Gunaratne, C.C.S., was succeeded by Mr. F. B. Wiratunga, Deputy Controller of Finance, as from February 28, 1955.

Mr. C. A. M. de Silva was succeeded by Mrs. L. J. de S. Seneviratne on March 31, 1955.

Mr. S. Pathmanathan was succeeded by Senator E. W. Kannangara C.B.E., J.P., as from March 28, 1955.

Mr. N. H. Keerthiratne and Mr. R. Singleton-Salmon, M.P., C.B.E., were re-nominated for a further period of three years.

Mr. E. Muttukumaru was granted leave of absence during the first quarter of the year owing to ill-health, and again from June 8 to August 10 on account of his participation in the Trade Mission to Europe.

Mr. Wace de Niese and Mrs. L. J. de S. Seneviratne were away from the Island on a holiday during the month of December.

His Excellency the Governor-General, Sir Oliver Goonetilleke, G.C.M.G., K.C.V.O., K.B.E., unveiled the memorial plaque on August 29, which commemorated the Silver Jubilee of the Institute and the completion of the laboratories.

Meetings

Eight meetings of the Coconut Research Board were held during the year—February 25, March 26, May 28, August 12, October 18, November 8, November 12 (emergency) and December 9.

Committees

Administration Committee (Personnel at 1st January)

(1) Dr. A. W. R. Joachim, Chairman.
(2) Mr. C. A. M. de Silva.
(3) Mr. Wace de Niese,
(4) Mr. S. Pathmanathan,
(5) Mr. W. D. Gunaratne, C.C.S.,
(6) Mr. F. C. Cooke, Director, Coconut Research Institute.

13th and 14th metings were held on May 19 and October 15.

Research Committee (Personnel at 1st January)

(1) Mr. R. H. de Mel, Chairman,
(2) Dr. A. W. R. Joachim,
(3) C. T. van Geyzel,
(4) Mr. E. Muttukumaru,
(5) Mr. R. Singleton-Salmon,
(6) Mr. F. C. Cooke, Director, C. R. I.

13th, 14th and 15th meetings were held on May 19, September 17, October 8.

Extension Committee (Personnel at 1st January)

(1) Mr. Wace de Niese, Chairman.
(2) Mr. A. W. Warburton Gray,
(3) Mr. E. B. Wiratunga,
(4) Senator E. W. Kannangara,
(5) Mrs. L. J. de S. Seneviratne,
(6) Mr. N. H. Keerthiratne.

12th and 13th meetings were held on March 21 and October 15.

Buildings Sub-Committee (Personnel at 1st January)

(1) Mr. R. H. de Mel,
(2) Senator E. W. Kannangara,
(3) Mr. E. B. Wiratunga,
(4) Mr. Wace de Niese,
(5) Mr. F. C. Cooke, Director, C. R. I.

Three meetings were held on September 3, November 8 and November 23.

ANNUAL REPORT OF THE DIRECTOR

THE Staff of the Coconut Research Institute at the end of 1955 was as follows:—

ADMINISTRATION DIVISION (1955)

Director: Mr. F. C. Cooke, A.R.C.S., B.Sc. (Hons.), A.M.E.Chem.E., E.D.

Secretary/Accountant Mr. S. C. Kahawita, B.Com. (Lond.).

SOIL CHEMISTRY DIVISION

Soil Chemist: Dr. M. L. M. Salgado, B.Sc. (Lond.), Ph.D. (Cantab.), Dip. Agric.

Research Assistant to Soil Chemist: Mr. D. A. Nethsinghe, B.Sc. (Ceylon), A.R.I.C.

CHEMISTRY DIVISION

Chemist: Mr. W. R. N. Nathanael, B.Sc. (Lond.).

Research Assistant to Chemist: Mr. T. S. Balakrishnamurthi, B.Sc. (Lond.)

BOTANIST DIVISION

Botanist: Dr. D. V. Liyanage, B.Sc. (Lond.) Ph.D. (Manch.).

Research Assistant to Botanist: Mr. C. A. Wickramasuriya, B.Sc. (Ceylon).

AGRONOMY DIVISION

Agronomist: Mr. T. B. Paltridge, B.Sc. (Lond.), Colombo Plan. Research Assistant to Agronomist: K. Santhirasegram, B.Sc. (Ceylon).

INDUSTRIAL RESEARCH DIVISION

Industrial Research Assistant: Mr. A. Maheswara, B.Sc. (Ceylon).

PLANTING AND ADVISORY DIVISION

Planting Officer: Mr. P. D. L. Fernando. Assistant Planting Officer: Mr. C. W. S. de Silva.

PUBLIC RELATIONS DIVISION

Public Relations Officer: Mr. L. R. N. H. Perera.

CROP PROTECTION DIVISION

Crop Protection Assistant: Mr. J. K. F. Kirthisinghe.

ANIMAL HUSBANDRY DIVISION

Animal Husbandry Officer: Mr. G. C. M. Goonesekera.

AGRI-METEOROLOGY STATION

Technical Assistant: Mr. V. Abeywardene.

ESTATES DIVISION

Superintendent, Bandirippuwa Estate: Mr. D. F. Withana

Superintendent, Ratmalagara Estate: Mr. H. J. F. Peiris

MECHANICAL DIVISION

Senior Mechanic: Mr. R. Werapermall.

Mr. T. B. Paltridge, Agronomist (Colombo Plan) assumed duties on August 12, 1955.

Dr. M. L. M. Salgado, Soil Chemist, was away in Australia on a Senior Fellowship awarded under the Colombo Plan for Technical Co-operation to study soil surveys at the Commonwealth Scientific and Industrial Organisation, resumed duties on 25th March.

Mr. G. C. M. Goonesekera was also away in Australia on a Colombo Plan Fellowship for a course of training in Animal Husbandry at the Queensland Department of Agriculture.

Mr. W. R. N. Nathanael, Chemist, Dr. D. V. Liyanage, Botanist, Mr. P. D. L. Fernando, Planting Officer, Mr. D. A. Nethsinghe, Research Assistant to Soil Chemist, Mr. M. A. P. P. Manthiriratne, Technical Assistant to Botanist and Mr. J. K. F. Kirthisinghe, Crop Protection Assistant, were away for two weeks to visit the Coconut Research Stations in India.

Mr. V. Abeywardene, Technical Assistant (Computer), underwent a course of training in meteorology at the Colombo Observatory, and in statistics at New Delhi, the scholarship being awarded by the F. A. O.

Mr. A. W. Middleditch, audio-visual expert, was assigned for a period of one month to the Coconut Research Institute under the Colombo Plan to train the personnel of the Institute in photography and methods of display and instruction.

Field Days

The Coconut Research Institute was represented at the following Field days :—

All Ceylon Stock held on 4th and 5th March at Negombo.

Field Day and Exhibition at Urupila on July 2, 1955.

Agricultural Livestock and Industrial Exhibition at Kadawata on July 29, 1955.

Binara Mela Exhibition at Marawila on September 10, 1955.

The Director and staff participated in the following opening ceremonies, which were attended by Ministers of State:—

The Isolated Seed Garden at Ambakelle on April 23, 1955.

The New Carmel Nursery at Kurunegala on October 14, 1955.

Conferences

The following conferences were held during the year :—

Second Technical Conference of the Institute on 7th March, presided over by Hon. S. C. Corea, Minister of Commerce, Trade and Fisheries.

Dr. V. T. Venkatraman, Visiting Entomologist of the South Pacific Commission, addressed the members on Pests and Diseases, and a discussion followed on the subject of his talk.

Coconut Conference on 29th August presided over by His Excellency the Governor-General, Sir Oliver Goonetilleke, C.M.G., K.C.V.O., K.B.E. The following papers were read before the Conference :—

" The Commercial Possibilities of manufacturing High Grade Vinegar from Coconut Toddy "—by Mr. W. R. N. Nathanael, Chemist, C. R. I.

" Planting Material for Coconuts "—by Dr. D. V. Liyanage, Botanist, C.R.I.

" Some New Aspects of Coconut Manuring "—by Dr. M. L. M. Salgado, Soil Chmist, C. R. I.

" Agronomy and the Coconut Industry "—by Mr. T. B. Paltridge, Agronomist, Colombo Plan.

A conference of the Technical Officers and Advisory Field Officers of the Institute on 10th May.

A conference of the staff and the Indian Research Officers on 17th December.

A conference of the Technical Officers and Advisory Officers of the Institute on 21st December, to outline the policy and the programme of work in connection with the Rehabilitation of the Coconut Industry.

The Coconut Research Institute was represented at the 11th Biennial Conference of the Tea Research Institute held in March.

Meetings and Articles

The Director and Technical staff attended the Annual General Meetings of the Kurunegala Planters' Association on 19th February and the Chilaw-Negombo Planters' Association on 17th March.

The Director contributed the following articles to the Press :—

(i) "Milk Production on Coconut Estates" to the Special Supplement of the Press to mark the formal opening of the Milk Pasteurizing Plant of the Colombo Co-operative Milk Union.

(ii) "The Future of the Coconut Research Institute" to the Industrial Supplement of the "Ceylon Daily News".

(iii) "Research and the Coconut Industry" lecture to the Southern Province Planters' Association.

Publications

The following publications in English and Sinhalese have been produced:—

"The Commercial Possibilities of Manufacturing High Grade Vinegar from Coconut Toddy'" by Mr. W. R. N. Nathanael, Chemist, Coconut Research Institute.

"Planting Material for Coconuts" by Dr. D. V. Liyanage, Botanist, C.R.I.

"Some New Aspects of Coconut Manuring" by Dr. M. L. M. Salgado, Soil Chemist, C.R.I.

"Agronomy and the Coconut Industry" by Mr. T. B. Paltridge, Agronomist (Colombo Plan), Coconut Research Institute.

"Research and the Coconut Industry" by Mr. F. C. Cooke, Director, C.R.I.

"Coconut Rehabilitation Project" (in Sinhalese) by Mr. L. R. N. H. Perera, Public Relations Officer, Coconut Research Institute.

The monthly Sinhalese journal entitled "Pol Pawath" by Mr. L. R. N. H. Perera, Public Relations Officer, Coconut Research Institute.

Welfare

The following committees of management have been actively engaged in the development of welfare work of the staff of the Institute which has considerably increased with the implementation of the Institute's reorganisation proposals :—

Medical Aid Fund

Personnel at 1st January.

Mr. F. C. Cooke, Chairman,
Mr. S. C. Kahawita,
Mr. W. R. N. Nathanael,
Mr. F. H. B. Felix Silva, Secretary,
Mr. M. M. Perera.

Twelve meetings were held during the year and 203 applications for aid have been approved for payment at these meetings. A panel of doctors have been appointed to enable the members to obtain credit and other facilities for their benefit. The Medical Aid Fund which has been operating since January, 1954, is working very satisfactorily although it is now apparent that it will be necessary to revise the rates of contribution to the Fund as the present rate of Rs. 5 for Senior Staff and Rs. 3 per month for the junior and minor staff are not really enough to meet hospitalization claims, especially in the case of married officers with children.

Recreation Club (personnel at 1st January)

Mr. F. C. Cooke, President.
Mr. F. H. B. Felix Silva, General Secretary.
Mr. R. B. Rodrigo, Tennis Secretary.
Mr. T. S. Balakrishnamurtie, Indoor Games and Badminton Secretary.
Dr. D. V. Liyanage, Vice President.
Mr. G. W. M. Wijetunge, Treasurer.
Mr. V. Abeywardena, Cricket Secretary.
Mr. J. K. F. Kirthisinghe, Library Secretary.

Two general meetings and two committee meetings were held during the year. The Recreation Club provides recreation facilities to all members and the necessary equipment is supplied from the funds of the clubs and from an annual grant made by the Coconut Research Board. Cricket became very popular this year as the club entered the Government Services Tournament. An excursion to Nawalapitiya was arranged in March and several members and their families participated. At the end of the year there was a very successful social, sports meet, Christmas tree and variety entertainment which was attended by the officers and their families ; all the children of all those employed in the office and estate were given gifts.

C. R. I. Co-operative Welfare Society Ltd. (Personnel at January 1, 1956)

Mr. S. C. Kahawita, President.
Mr. K. C. de Pinto, Vice President.
Mr. C. W. S. de Silva, Vice President.
Mr. F. H. B. Felix Silva, Secretary.
Mr. M. B. S. Kurera, Treasurer, and
Messrs. G. W. M. Wijetunge, V. Abeywardena, O. D. J. Wanasinghe and D. F. Withana.

Two general meetings and 9 committee meetings have been held during the year. The Society was registered under the Co-operative Societies Ordinance of 1936, Chapter 107, as amended by Act No. 21 of 1949 on June 28, 1955, and started its business on 1st July. A current and savings account at the Bank of Ceylon have been opened and several members have contributed to the Savings Deposit Account of the Society. Eighty-six applications for loans have been approved for payment to members during the year. The main functions of the Society have been to encourage thrift and savings, by providing means whereby such savings may receive a reasonable interest without risk and without having removed from the control of members and to afford relief to members in need by enabling them to obtain loans for useful or really necessary purposes at reasonable interest and with easy terms of repayment, to afford advancement of loans to the Stores and Canteen sections and to do all such things as are incidental or conducive to promote the economic interest of its members. The Committee of Management is now contemplating to obtain financial assistance from the Coconut Research Board for the establishment of a Holiday Home, long-term Housing loans and furniture and equipment for a Stores and Canteen.

REVIEW OF THE WORK OF THE COCONUT RESEARCH INSTITUTE IN 1955

General

Following the increase in the cess for research in late 1954, plans for expanding the scope of the research work of the Coconut Research Institute, recruiting and training technical officers, and improving its advisory and propaganda services were at once begun. A two-storey extension to provide additional office and laboratory accommodation was completed in less than eight months and it was formally opened by His Excellency the Governor-General, Sir Oliver Goonetilleke, G.C.M.G., K.C.V.O., K.B.E., on August 29, in the presence of a large and distinguished gathering who subsequently attended the Technical Conference of the Institute.

Three officers have been sent on overseas study leave: Dr. M. L. M. Salgado, Soil Chemist (Australia) ; Mr. V. Abeywardene, Meteorologist and Computor (India). The Board has also approved study leave for Mr. D. A. Nethsinghe, Research Assistant (Soils) who will be leaving for England, early in 1956.

Exchange visits between technical officers of the Coconut Research Institutes of India and Ceylon, which also have been arranged, have provided valuable information and useful personal contacts. Six C. R. I. officers were sent to India and four came from India to Ceylon.

Mr. T. B. Paltridge, Agronomist (Colombo Plan) has joined the staff during the year to study the development and management of pastures under coconuts under various climatic and soil conditions and the wider problem of maintaining and improving the fertility of poor and exhausted coconut soils Mr. A. W. Middleditch, a Colombo Plan expert in audio-visual training gave instruction to senior officers of the Institute for a period of one month.

Mr. L. R. N. H. Perera, Public Relations Officer, was appointed to coordinate the publicity of the Institute and to present to the public the results of research. He is acting as Assistant Editor of the " Ceylon Coconut Quarterly " and as Editor of " Pol Sangharawa " and " Pol Pawath ", and will be responsible for the issue of planting leaflets in three languages.

Altogether the year 1955 has been one of great activity, unparalleled in the history of the Institute, a year of change, transition and rapid expansion. Nevertheless research has not been neglected and replanting has far exceeded the programme laid down by the Board, but in spite of this, demand for selected seedlings continues to exceed supply.

Botanical Division

The following research problems were under investigation during the year: systems of replanting, size of planting holes, methods of mass selection, progeny trials of hybrid crosses, variations in seedling characters, cytological examination of roots and flowers, control of the rhinoceros beetle.

An apparently satisfactory cross has been obtained between the tall (typica) and the dwarf palm (nana) in which the latter is the male parent. The palms are vigorous and early flowering; the first crop is obtained in the 5th year, the nuts are of medium size and the derived copra is of good quality. Further work is required to prove this cross.

Work on the Isolated Seed Garden in Ambakelle Forest Reserve has proceeded according to plan. When completed, this 200 acre estate of high-yielding mother palms will eventually supply seednuts for the whole of Ceylon. Planting with selected seedlings produced by the controlled pollination of high-yielding parent palms has been started. This incidentally is a project which is unparalleled in any other coconut-producing country.

Soil Chemistry Division

Work in this division mainly consists of long-range research. The following field experiments were continued: N.P.K. manurial experiment on old palms (Bandirippuwa 20th year) ; N.P.K. manurial experiment on young palms (Ratmalagara 6th year) ; N. P. K. manurial experiment on under-planted palms (Letchemy Estate 16th year) ; manurial-cultivation experiment (Ratmalagara 6th year) and methods of application trials (Marandawila 6th year).

The manurial experiment at Letchemy has proved conclusively that the application of a complete mixture is essential prior to replanting. The original control (no treatment) plots which are now also being manured are responsing well.

The manurial experiment with young palms at Ratmalagara in which N.P.K. fertilizers are applied at three levels are now showing striking differences. At Marandawila, the method of application trials shows that that there is no significant difference between ring-manuring and broadcasting under the conditions prevailing in this estate, but this important conclusion does not of course apply to all conditions under which coconuts are grown in Ceylon.

In the laboratory, the analysis of coconut water to determine the nutrient uptake and the phosphate availability in the soil is being continued. A study of soil nitrogen is also in progress.

In the field, systematic soil surveys have been carried out to determine the suitability of new lands for coconut cultivation under various Colonisation Schemes. Out of 30,000 acres inspected, 25,700 acres have been approved for coconuts.

Division of Agronomy

This new division was only initiated in September. Preliminary trials with selected pasture grasses and two comprehensive nutrient trials, using all the known plant foods have commenced on two estates. A modern greenhouse, specially designed for work with trace elements, for the determination of the nutrient status of soils by means of indicater plants, is under construction. The purpose is to determine what are the nutrient deficiencies in Ceylon coconut soils.

Plant Chemistry

The following empirical trials which will be supported by foliar analysis were laid down during the year :—application of "fritted" trace elements to seedlings (Andigama), treatment of yellow palms with calcium, magnesium and boron (Maliduakande), similar treatment of healthy palms (Ratmalagara), mounding of yellow palms to induce new root-growth (Waterland).

A set of 12 giant concrete cylinders to serve as flower pots for the hydroponic cultivation of coconut seedlings in pure sand, were mounted in position and trials will shortly commence. Major and minor nutrients will be added to the sand and the object is to determine the complete nutrient requirements of the coconut palm.

Crop Protection Division

This division has been established and is being maintained for routine advisory work pending the arrival of the Crop Protection Adviser (Colombo Plan). It has been found that rhinoceros beetle larvae can be effectively controlled by applications of either Shell soil fumigant or Dieldrex in breeding grounds.

Technological Chemistry

Research work on the new vinegar process has continued and a total of 50 charges of coconut toddy has now been put through the pilot plant. The overall average strength was 7.3 per cent. which is over double that produced by the crude and now obsolete vat process, which unfortunately, is still being followed in most of the vinegar factories in Ceylon.

The improved product has a full aromatic flavour and is uniformly good in colour, clarity and bouquet and in every way equal in quality to the best imported vinegars. The cost of production of this coconut vinegar is considerably less than that of the imported article, so that the protective duty is more than adequate. The generator process is far quicker, more efficient, and simpler to operate than the vat process and occupies nine times less factory space.

The new process is now being adopted by three established manufacturers using generators of 50 and 150 gallon capacity and as the initial results are very promising, it is expected that other licensed manufacturers will follow suit. Serious consideration can thereafter be given to the establishment of a sauce and pickle industry based on the fruits, vegetables, spices, vinegar and salt, all produced in Ceylon.

An inexpensive copra kiln for smallholders or for decentralised copra production on estates has been designed and is now in operation at Bandirippuwa Research Station. The new kiln has the following advantages:—

(1) low capital cost,
(2) low running and maintenance charges,
(3) easy to operate,
(4) rapid drying
(5) high efficiency.

Although the kiln is small in size and constructed only of the simplest materials, its efficiency is such that it will produce in half the time, copra of a much superior quality to that from an ordinary Ceylon kiln.

The kiln has a maximum capacity of only 1,500 nuts per charge but it cannot be increased in size without impairing its efficiency. However, it is possible for estates to adopt decentralised production, save the heavy cost of transporting whole nuts to the copra yard and leave the husk and shell ash in the field where they are needed. The recommended arrangement is one kiln in every 25-acre block.

Animal Husbandry

It has been proved that milk can be produced at a profit from ordinary Sinhala cattle if the animals are given 2 lb. of " Morlac " or parings poonac and are grazed rotationally. The animals also become healthier, heavier and stronger.

The black herd at Bandirippuwa is now in splended condition and has reached the third generation of selective breeding within 5 years. The animals are individually recorded and history sheets are maintained for each.

Bandirippuwa Estate is being planted with *Bracharia brizantha* and *Bracharia milliformis,* and Napier and Guinea grass. At Ratmalagara, the drought-resisting *Bracharia brizantha* is planted on the high land and Napier grass in the low-lying areas. In addition there is of course ordinary mixed grazing available at both stations.

Climate and Crop

The Blometrician has now been made responsible for the maintenance of the records of the meteorological station at Bandirippuwa and for the establishment of sub-stations in areas, which at present appear to be marginal for coconuts. The object is to place this work on a true research footing, to determine exactly the optimum and limiting conditions for coconuts and to examine statistically the variations in crop and the characteristics of the nuts with seasonal and annual variations in atmospheric and soil conditions. He will work in close co-operation with the Agronomist.

Coconut Replanting

The Coconut Replanting Project is developing satisfactorily. In 1954, about 9,000 acres were planted with C.R.I. seedlings; in 1955, with the increased funds now provided 850,000 seedlings sufficient for 13,380 acres were supplied to the public. Nevertheless, the demand for seedlings still exceeds the supply and production is being gradually stepped up so as ultimately to provide seedlings for 16,000 acres per annum. There has been no relaxation of the high standard of quality; all rejected seedlings are counted and destroyed.

Fifteen nurseries with a total capacity of 1,303,430 seednuts have been maintained during the year. In addition a new nursery, established on model lines, was formally opened by the Hon. J. R. Jayewardene, Minister of Agriculture and Food, at Ibbagamuwa near Kurunegala. New nurseries are also being established at Chengkaladi (E.P.) and Koggala (S.P).

Public Relations

A new division has been established to organise the propaganda and publicity work of the Institute. An officer, who is an expert Sinhalese scholar, has been appointed and he is responsible for all publications, posters, and the printing of advisory leaflets, and also the organisation of shows and demonstrations.

The following publications have been issued during the year:—

Research and the Coconut Industry
Proceedings of the Third Technical Conference
The Coconut Rehabilitation Project
Pol Pawath (Sinhalese)
Ceylon Coconut Quarterly, Vol. V., No. 4

The Institute has participated in four agricultural shows in 1955.

The Coconut Industry

The coconut crop and the exports of coconut products during the past year were the highest on record—an increase of 78 per cent. over the low crop of 1947 when the steady decline in crops led to the appointment of the Ceylon Coconut Commission. This remarkable reversal in the fortunes of the industry, while it is partly to be accounted for by the favourable weather conditions in 1954, is mainly due to the good work done by estate proprietors and coconut growers during the past five years, during which period the crops have steadily improved.

REPORT OF THE SOIL CHEMIST

Field Experiments

(i) *3 × 3 × 3 N.P.K. Experiments (Bandirippuwa Estate)*

The twentieth year of this experiment was completed in November, 1955. The tenth biennial manuring was completed in November, 1955. As in the 9th manuring the stepped up potash levels remained the same since the manuring in November, 1951.

K_0 is K_1	.. ·75 lb. K_2O
K_1 is K_2	.. 1·50 lb. K_2O
K_2 is K_3	.. 2·25 lb. K_2O

For the Nitrogen comparison (i.e., comparison of sulphate of ammonia, calcium cyanamide, and an oil cake) Sediment Poonac was used containing 6 per cent. nitrogen as groundnut cake was not available.

The yield data for the main effects for 1955 are given below :—

Nitrogen	*Lb. Copra per Acre*	*Calculated as Percentage*	*Difference in lb.*	*Copra outturn Nuts per Candy*
N_0 ..	2,078	100	—	1,089
N_1 ..	2,159	104	81	1,109
N_2 ..	2,069	100	—9	1,149

Phosphoric Acid

P_0 ..	2,044	100	—	1,089
P_1 ..	2,122	104	78	1,124
P_2 ..	2,140	105	96	1,132

Potash

K_0 (Now K_1)	1,851	100	—	1,166
K_1 (Now K_2)	2,172	117	321	1,105
K_2 (Now K_3)	2,282	123	431	1,083

Significant difference (P·05)—147 lb. per acre.

Nitrogen at the higher level yet continues to cause a depression in yield.

Phosphoric Acid.—Continues to produce no significant response.

Potash.—With the change in the potash levels as from November, 1951, the yields of the original K plots (now K_1) have now been considerably stepped up as shown below :—

	Lb. Copra per Acre			
	1952	*1953*	*1954*	*1955*
K_0 ..	1,195	1,267	1,326	1,851
K_1 ..	1,742	1,588	1,837	2,172
K_2 ..	1,994	1,704	2,040	2,282

The foliage of the original K_0 plots have now turned green and the new fronds show improved vegetative growth.

OBSERVATION PLOTS
(BANDIRIPPUWA ESTATE)
NUTS PER ACRE
PLOTS
TREATMENTS
1 N.P.K. MANURING ENTIRELY SUSPENDED FOR 6 YRS. COIR DUST DRESSING AND HARROWED ANNUALLY.
2 CONTROL. HARROWING ONLY.
3 ALL PLANT PRODUCTS EXCEPT OIL RETURNND TO THE SOIL.
4 N.P.K (STANDARD) MANURING WITH MINERAL FERTILIZERS.
5 CRUSHED COCONUT POONAC (2016s) AND ASH PER ANNUM.
6 ESTATE AREA.
6000
5000
4000
3000
1950
1951
1952
1953
1954
1955

Potash Response

No.	Year	Lb. Copra per Acre K_1-K_0	Lb. Copra per Acre K_2-K_0
1	1936	26	50
2	1937	47	80
3	1938	47	114*
4	1939	28	120*
5	1940	190*	249†
6	1941	122	196†
7	1942	352†	196†
8	1943	300†	407†
9	1944	362†	546†
10	1945	329†	422†
11	1946	312†	447†
12	1947	382†	512†
13	1948	442†	582†
14	1949	401†	546†
15	1950	542†	711†
16	1951	664†	846†
17	1952	547†	799†
18	1953	321†	437†
19	1954	511†	714†
20	1955	321†	431†
Total for 20 years		6,246	8,405
Mean per annum		312	420

* Significant at P ·05 † Significant at P ·01.

The mean yields (lb. per acre) for the various treatment combinations are given in the two-way tables below :—

	N_0	N_1	N_2	*K-Total*
K_0	1,890	1,899	1,765	1,851
K_1	2,132	2,287	2,097	2,172
K_2	2,213	2,290	2,344	2,282
N—Total	2,078	2,159	2,069	2,102

	P_0	P_1	P_2	*K—Total*
K_0	1,818	1,863	1,874	1,851
K_1	2,157	2,141	2,218	2,172
K_2	2,155	2,363	2,328	2,282
P—Total	2,044	2,122	2,140	2,102

	P_0	P_1	P_2	*N—Total*
N_0	1,978	2,169	2,088	2,078
N_1	2,152	2,093	2,231	2,159
N_2	2,001	2,103	2,102	2,069
P—Total	2,044	2,122	2,140	2,102

(ii) ($K \times P \times C$) *Manurial × Cultivation Experiment (Ratmalgara Estate)*

The sixth biennial application of manures of this experiment was carried out in May, 1955, and the cultivation operations (ploughing) which form one of the treatment comparisons in May.

This factorial experiment includes all combinations of the following treatments and is of the $3 \times 2 \times 2$ type and consists of 6 blocks of 6 plots each. The interactions P.C. and K.P.C. are partially confounded with block differences.

K^0— No potash
K_1— 1 lb. K_2O per palm
K_2— 2 lb. K_2O per palm

$\times$

P_0—N_0 phosphoric acid
P—1 lb. P_2O_5 per palm

$\times$

C_0—No ploughing
C—Ploughing once in two years at the time of manuring

All plots are given a basic application of 3 lb. Sulphate of Ammonia per palm. The first biennial application of manures was carried out in June, 1943. The yield data for the main effects from the second year (1944–45) up to the twelfth year are summarized below :—

Lb. Per Acre

Treatment	*1944–45* *2nd Year*	*1945–46* *3rd Year*	*1946–47* *4th Year*	*1947–48* *5th Year*	*1948–49* *6th Year*	*1949–50* *7th Year*	*1950–51* *8th Year*	*1951–52* *9th Year*	*1952–53* *10th Year*	*1953–54* *11th Year*	*1954–55* *12th Year*
K_0	1,771	1,691	1,415	1,841	1,438	1,342	1,631	1,978	1,663	1,827	1,883
K_1	1,935	1,674	1,395	1,842	1,466	1,327	1,677	1,957	1,684	1,924	2,011
K_2	1,893	1,738	1,492	1,975	1,589	1,449	1,760	2,167	1,813	2,006	2,044
Significant difference P·05	194	152	181	215	161	173	202	123	200	264	185
P_0	1,792	1,625	1,276	1,711	1,353	1,095	1,487	1,798	1,434	1,574	1,582
P	1,938	1,777	1,592†	2,061†	1,643*	1,651†	1,891†	2,270†	2,006†	2,264†	2,377†
C_0	1,783	1,615	1,372	1,851	1,450	1,320	1,654	2,020	1,708	1,942	1,977
C	1,949*	1,787†	1,496	1,921	1,547	1,426	1,725	2,048	1,732	1,896	1,981
Significant difference P·05	158	123	149	176	131	145	165	151	163	216	151

* Significant at P·05

† Significant at P·01.

As before phosphate response alone continued to be marked and significant and has now risen to a peak of 795 lb. per acre per annum.

Year	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*	*11th*	*12th*
Lb./Acre	144	152	316	350	290	556	404	472	572	690	795

(iii) *3 × 3 × N. P. K. Manurial Experiment on Young Palms (Ratmalagara)*

The seventh annual manuring was carried out in October/November 1955. The basic rates of manuring were stepped up as follows :—

Nitrogen (N_1) ; Sulphate of Ammonia $\frac{3}{4}$ lb. to 1 lb. per palm.

Phosphoric acid : (P_1) Saphos Phosphate $\frac{1}{2}$ to 1 lb. per palm.

Potash (K_1) : Muriate of Potash $\frac{3}{4}$ to 1 lb. per palm.

(*a*) *Palms in Flower :*

Up to the end of November, 1955, there were 510 palms in flowers, the distribution is shown below according to the main effects :

Palms in Flower

N_0	140	P_0	71	K_0	155
N_1	184	P_1	216	K_1	168
N_2	186	P_2	223	K_2	187

Phosphate manuring has a marked effect on flowering.

(*b*) *Yield of nuts.*

The distribution of *nuts* of the plot palms are shown below according to the main effects.

N_0	250	P_0	20	K_0	350
N_1	593	P_1	903	K_1	672
K_2	714	P_2	634	K_2	535

Here again the effect of phosphate is particularly striking.

(*c*) *Leaf Counts.*

Two leaf counts were done during the year 1955 in January and July. The extra leaves that emerged during the year are shown below.

	Total Leaves	*Calculated as per cent.*	*Leaves per palm*
N_0	3,464	100	10·7
N_1	3,558	103	11·0
N_2	3,562	103	11·0
P_0	3,116	100	9·6
P_1	3,684	118	11·4
P_2	3,784	121	11·7
K_0	3,511	100	10·8
K_1	3,507	100	10·8
K_2	3,566	102	11·0

On leaf development too phosphate alone seems to produce a significant response.

Co-operative Manurial Experiments.

(i) *Manurial Experiment on Underplanted Young palms. (Letchemy Estate, Nattandiya).*

This experiment was commenced in 1940 on underplanted palms put out in October, 1939. The treatments are (*a*) Cover vs. No cover and (*b*) O, N. K., and N. P. K. in five randomised blocks of six plots each.

The first palm came into bearing in 1945 in the 6th year after planting. By 1952, the entire old stand was removed.

In 1955, there were 467 palms flowered (out of a total of 540) and their distribution according to manurial treatments is shown below :—

Manurial Experiment on underplanted Young Palms

(*a*) PALMS IN FLOWER

Treatments	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
O	—	12	43	68	99	119	132	136	148	153	157
N.K.	—	16	49	77	97	120	124	130	136	141	145
N.P.K.	1	12	41	75	117	135	146	154	161	164	165
Total	1	40	133	220	313	374	402	418	445	458	467

Yield data relating to number of nuts, copra and outturns are shown in Tables (*b*), (*c*) and (*d*) :—

(*b*) YIELD OF NUTS

Treatments	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
O	—	92	325	864	976	1,618	2,424	2,661	4,822	6,847
N.K.	—	87	668	1,030	1,638	2,559	3,526	4,302	6,976	8,373
N.P.K.	15	191	656	1,785	2,091	3,379	4,556	5,876	10,345	11,719
	15	370	1,649	4,279	4,705	7,556	10,506	12,839	22,143	26,939

Manurial Experiment on underplanted Young Palms—contd.

(c) YIELD OF COPRA

Treatments	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
O	—	44	111	269	501	819	1,117	1,262	2,465	3,494
N.K.	—	45	281	497	878	1,417	1,846	2,159	5,771	4,496
N.P.K.	11	120	272	605	1,158	1,912	2,519	3,030	5,852	6,627
	11	209	664	1,371	2,537	4,148	5,482	6,451	12,088	14,617

(d) COPRA OUTTURNS (NUTS PER CANDY)

Treatments	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
O	—	1,171	1,175	1,122	1,091	1,106	1,215	1,181	1,096	1,097
N.K.	—	1,083	1,158	1,084	1,045	1,011	1,070	1,116	1,035	1,043
N.P.K. ..	764	821	945	1,051	1,011	990	1,013	1,086	990	990

The complete mixture (N.P.K.) continues to give the highest yields and the best outturn.

(ii) *Manurial Experiment on Methods of application of Manures. (Marandawila Group, Bingiriya)*

This experiment is of the unreplicated 3 × 3 × 3 factorial design and consists of all combinations of N. P. K. applied in the following ways :—

No—No nitrogen Nc—Nitrogen applied in in circular trenches Nb—Nitrogen broadcast and ploughed	Po—No phosphoric acid Pc—Phosphoric acid applied in circular trenches Pb—Phosphoric acid broadcast and ploughed	Ko No potash Kc Potash applied in circular trenches Kb Potash broadcast and ploughed

One year's premanurial records were completed in May, 1949, and manures were applied in June, 1949. So far six years data have been recorded since first biennial application of manures.

The data of the second to sixth year of this experiment statistically analysed, are shown below :—

Lb. Copra per Acre

(YIELDS ADJUSTED BY COVARIANCE ANALYSIS)

	M-II 1950–51 Second Year	*M-III 1951–52 Third Year*	*M-IV 1952–53 Fourth Year*	*M-V 1953–54 Fifth Year*	*M-VI 1954–55 Sixth Year*
No	1,917	1,493	1,436	1,337	1,934
Nc	1,929	1,561	1,563	1,496	2,145
Nb	1,835	1,538	1,500	1,476	2,064
Po	1,833	1,416	1,400	1,343	1,901
Pc	1,907	1,575	1,560	1,491	2,132
Pb	1,941	1,600	1,539	1,476	2,111
Ko	1,814	1,482	1,401	1,408	1,874
Kc	1,938	1,472	1,528	1,418	2,116
Kb	1,929	1,639	1,570	1,484	2,154
Sig. Diff. P·05	83	217	141	403	342

Significant Responses

	M-II	*M-III*	*M-IV*	*M-V*	*M-VI*
Nitrogen	Nc>Nb	None of the responses are significant	Nil	None of the responses are significant	None of the responses are sigficant
Phosphoric Acid	Pb>P		Pc>Po		
Potash	Kc>Ko Kb>Ko		Kc>Ko Kb>Ko		

(iii) *Observation trial on Immature Nut-fall*

This simple observation experiment was commenced in November, 1954, to find out the cause of round the year immature nutfall in a smallholder's property at Hirigolla in Hettipola area : The experiment consists of four plots with 20 palms each. Two plots were kept as 'Controls' and the other two were given the following treatment last year :—

(*a*) ¾ lb. 60 per cent muriate of potash
¾ lb. Saphos phosphate
¾ lb. sulphate of ammonia
1 lb. Dolomite

(*b*) Husk burying between the rows of palms.

Records of immature nuts fallen and mature nuts picked of individual palms are kept. Nut-water samples were taken from three affected and three unaffected palms to analyse for potash.

Water samples were taken from the drinking well and some of the wells closer to the land for analysis. The results of these analyses are discussed under Laboratory investigations.

(iv) *Observation Plots* (*Bandirippuwa Estate*)

An observation trial was commenced in 1950 for comparing the following five treatments :—

Plot (i) Coir dust applied at the rate of one double bullock cart load per square. In some years dry milled coir dust where the potash of the original husk is retained in the dust was applied.

Plot (ii) Control. Ploughing and disc-harrowing only.

Plot (iii) All plant products except coconut oil returned to the soil.

Plot (iv) Manuring with inorganic fertilisers only. The following mixture was applied biennially in circular trenches ; Sulphate of Ammonia 3 lb.; Saphos Phosphate 2 lb.; and Muriate of Potash 2 lb.

Plot (v) Manuring with "organic" manures ; Crushed Coconut Poonac and ash to supply 0.6 lb. Nitrogen, 0.6 lb. Phosphoric Acid and 1.2 lb. Potash (the equivalent of the mixture of inorganic fertilizers).

Each treatment consists of a *single* plot consisting of 80-90 palms.

The sixth year of this trial ended in December, 1955. Given below are the yield data in nuts per acre per annum, considering the four years 1952-55 as the effective period for a measure of the treatment effects. The data have been corrected for initial differences in the plot yields by the method of linear regression using the data for 1950 and 1951 as the premanurial period.

Treatment	*Nuts/Acre/Annum (1952–1955) adjusted Yields*
1. Coir dust only	5,026
2. Control	4,626
3. All plant products returned to soil	4,681
4. Inorganic manures only (NPK)	5,436
5. Organic manures	5,202

Observation plots are of value only where spectacular differences are shown. Nevertheless there is an indication that the highest yields were obtained by the use of inorganic manures only, with "organics" a close second.

The unadjusted data for each year are shown graphically indicating the yield trends.

Laboratory Investigations

(*a*) *Soil Moisture Studies.* (*Ratmalagara Estate—Young Plantation*)

Three sets of soil samples were taken for moisture estimations on February 28, March 11 and 21, from the manure circles of guard row palms with and without husk mulches, and also from the centres of squares—as was done earlier. The samples were taken to a depth of 9 inches only.

Statistical analysis of the moisture contents which were in the order of 2-6 per cent. showed no significant differences between the husk mulched, no husk mulched and square samples.

This is perhaps due to the fact that no prolonged period of drought was experienced prior to the dates of sampling, as shown by the rainfall figures for Ratmalagara given below :—

Rainfall figures of Ratmalagara Estate

Date	*January*	*February*	*March*
2	0·22	—	—
7	0·72	—	—
8	—	0·41	—
9	—	0·46	—
12	—	0·16	—
20	—	—	0·86

(b) *Soil Nitrogen Studies*

In continuation of the work on the soils at Bandirippuwa Estate, already reported, soil samples were taken from the Manurial Cultivation Experiment at Ratmalagara Estate and analysed for nitrate, ammoniacal and total nitrogen. The figures given in Table II confirm the earlier results, based on soils of Bandirippuwa Estate which indicated that there is a considerable amount of ammoniacal nitrogen present both in the top and sub-soils of coconut lands in contrast to the low concentration of nitrate nitrogen.

TABLE II

Soil Nitrogen Studes—Ratmalagara Estate Soils

Sample No.	*ppm NH_4 nitrogen*	*ppm NO_3 nitrogen*	*ppm Total nitrogen*	*Percentage Clay*	*Total bases*	*Exchangeable me./100 gms.*
Plot 3 S. T.	—	2·5	677	11·1		4·01
S. S.	14·21	1·4	721	8·5		3·76
Plot 8 S. T.	14·3	1·8	607	4·8		1·71
S. S.	11·7	1·7	770	5·7		0·98
Plot 14 S. T.	12·9	1·6	670	10·6		0·57
S. S.	15·5	1·9	497	7·1		0·81
Plot 23 S. T.	13·3	2·6	634	10·1		0·71
S. S.	9·6	1·5	541	2·4		0·51
Plot 27 S. T.	14·42	1·7	500	4·2		0·81
S. S.	10·8	1·6	392	7·0		0·69
Plot 35 S. T.	12·6	1·9	507	6·6		0·55
S. S.	10·2	1·5	429	10·3		2·09

S. T. means—Square Top (0-9″)

S. S. means—Square Sub (9-18″).

The clay fraction and total exchangeable bases in these soils were also determined and are given in the above Table.

Nitrogen determinations were also carried out on a further set of soil samples from Bandirippuwa Estate taken during a period of dry weather. Here again there is a high concentration of ammoniacal nitrogen and very low concentration of nitrate nitrogen. The results are given in Table III.

The soil fom the Botanist's block is of a sandy texture, and it is seen that in this sandy soil there is a much lower concentration of ammoniacal nitrogen.

TABLE III

Soil Nitrogen Studies—Bandirippuwa Estate

Sample No.	*ppm NH_4 nitrogen*	*ppm NO_3 nitrogen*	*Total nitrogen*
Plot 18—S. Top (0—9″)	12·4	0·6	427
S. Sub (9—18″)	10·1	0·8	390
S. Sub (18—30″)	12·7	0·6	336
Plot 2—S. T.	12·5	0·4	534
S. S. (1)	10·2	0·8	420
S. S. (2)	10·3	0·6	326
Botanist's S. T.	2·2	2·3	281
Block S. S. (1)	2·2	0·5	205
S. S. (2)	0·0	0·0	124

(c) *Studies on Soil Phosphorus*

Studies on the fractionation of soil phosphorus were continued on a few soil samples collected in 1944 from the manurial circles of P_0 plots of the N. P. K. Experiment at Bandirippuwa Estate from the manure circles. Table IV compares the fractionation figures for the 1935 and 1951 samples obtained previously with those for the 1944 samples. It is seen that there is a definite increase in the total alkali soluble fraction from 1935 to 1951 (See Annual Report—C. R. I. 1954).

The above analyses were all carried out on the 2 m.m. samples. Fractionations were carried out on the same samples finely ground to pass through 100 mesh sieves and the results shown in Table V below again indicate an increase in the total alkali soluble fraction in the period 1935-51. It is also seen that the 100 mesh sample has released a greater amount of acid soluble phosphate.

(TABLE IV—See page 24).

TABLE V

Plot No.	*ppm. Acid soluble P_2O_5*		*ppm. Total alkali soluble P_2O_5*		*ppm Inorganic P_2O_5 Alkali soluble*		*ppm organic P_2O_5 Alkali soluble*	
	1935	*1951*	*1935*	*1951*	*1935*	*1951*	*1935*	*1951*
8	177	65	280	366	216	216	64	150
23	136	165	280	375	165	173	115	205
45	177	95	280	270	181	160	124	110
54	157	95	280	310	244	187	116	123

Fractionations were also carried out on some combined soil samples taken from the centres of squares of the N. P. K. plots at Bandirippuwa Estate in 1935 and 1955. In these too an increase of the alkali soluble phosphate fraction is shown in the 1955 samples. These increases are probably due to the fact that there are ample reserves of mineral phosphates in these soils which are being weathered into available forms at a rate faster than the available forms are being removed from the soils.

TABLE IV

Fractionation of Soil Phosphorus—Summary of Data on 1935, 1944 and 1951 M.C.T. Samples from N. P. K. Experiment at Bandirippuwa Estate

Plot No.	*ppm Acid Soluble P_2O_5*			*ppm Total Alkali Soluble P_2O_5*			*ppm Inorganic P_2O_5 Alkali Soluble*			*ppm Organic P_2O_5 Alkali Soluble*		
	1935	*1944*	*1951*	*1935*	*1944*	*1951*	*1935*	*1944*	*1951*	*1935*	*1944*	*1951*
8	40	35	30	140	280	384	116	138	192	24	142	192
23	25	20	25	140	261	360	104	144	112	36	117	188
45	15	24	25	140	151	300	80	146	104	60	5	196
54	15	30	35	140	265	300	120	216	136	60	49	164

Calculate Total P added from 1935 to 1951

TABLE VI

Fractionation of Soil Phosphorus—Square Centre top Samples from N. P. K. Plots at Bandirippuwa Estate

Plots Combined	*Sample No.*	*ppm Acid Soluble P_2O_5*		*ppm Total Alkali Soluble P_2O_5*		*ppm Inorganic P_2O_5 Alkali Soluble*		*ppm Organic P_2O_5 Alkali Soluble*	
		1935	*1955*	*1935*	*1955*	*1935*	*1955*	*1935*	*1955*
1+ 4+ 7..	1	26	—	190	—	138	—	52	—
11+14+17..	5	41	—	182	—	138	—	44	—
21+24+27..	9	27	—	131	—	74	—	57	—
30+33+36..	12	28	63	190	212	138	170	52	42
38+41+44..	14	30	80	170	243	166	186	4	57
46+49+52..	16	26	20	216	298	160	211	56	87
47+50+53..	17	28	31	195	312	86	202	109	110
48+51+54..	18	38	31	200	312	90	211	110	101

(d) Phosphate Content of nut water in relation to phosphate availability in the Soil and response to phosphate manuring

It has already been shown that potash content of nut water can be used as an index of the potash status of the soil.

The lack of a quick and simple routine method for determining phosphate in nut water has so far stood in the way of investigating the possibilities of similarly using the phosphate content of nut water as an index of the phosphate status and its availability in the soil.

This difficulty has now been successfully overcome by a modification of the photometric method for determining inorganic phosphate using the phospho-vanado-molybdate complex.

The method can be applied on the fresh nut water : the procedure is very simple and quick, 12 determinations carried out in one hour.

The method as applied to nut water samples from the manurial experiment at Ratmalagara, where the phosphate response is highly significant, and of the N. P. K. experiment at Bandirippuwa where no response is obtained, indicate that the method can be used as an index of phosphate response. 100 mgms. of phosphoric acid per litre appears to be a *critical value* below which response to phosphate manuring can be expected.

(e) Potash Content of coconut water

N. P. K. Manurial Experiment (Bandirippuwa Estate)

The determination of the potash content of coconut water samples from the N. P. K. manurial experiment at Bandirippuwa Estate, which had been discontinued since 1949, were commenced again in January, 1954, in order to study the effect of stepping up the levels of potash applied to the palm since November, 1951.

A comparison of the figures for the concentration of potash in nut waters with those of 1947 show that the stepping up of the levels of potash had so far no effect in increasing the uptake of potash by the palm :—

TABLE VII

gms. K_2O per litre nut water

Pick	1947			1954			1955		
	K_0.	K_0. ·75	K 1·5	K_0. 75	K 1·5	K 2·25	K_0. 75	K 1·50	K 2·25
1	1·06	1·56	1·95	0·97	1·55	1·93	1·27	1·80	1·99
2	1·08	1·64	2·07	0·98	1·51	1·94	1·29	1·75	1·96
3	0·99	1·47	1·82	1·00	1·55	1·90	1·02	1·56	1·93
4	0·92	1·51	1·90	1·02	1·53	1·92	1·05	1·49	1·80
5	1·06	1·59	1·98	1·06	1·55	1·89	1·11	1·62	2·04
6	1·04	1·59	2·05	1·09	1·61	1·98	1·05	1·48	1·88
Mean	1·03	1·56	1·96	1·02	1·55	1·93	1·13	1·62	1·93

(f) Effect of manuring on Soil reaction

Determinations of pH values were made on a series of soil samples taken from the manurial circles of the 3 × 3 × 3 N. P. K. Experiment at Bandirippuwa. The soil samples were taken in 1935 before the first application of manure and subsequently in 1940 (series II), 1944 (series III) and 1951 (series V).

The manures were applied in November, 1935, and subsequently biennially.

The results are given in Tables VIII and IX. Table VIII gives the pH values for the plots where no nitrogen had been applied and in Table IX the pH values for plots receiving nitrogen are arranged according to the type of Nitrogen manure, e.g., Sulphate of Ammonia, Calcium Cyanamide and Groundnut cake.

There does not appear to be any consistent trend in the effect of manuring on changes in the reaction of the soil.

The possibility of the continuous use of Sulphate of Ammonia increasing the acidity of the soil could only occur where it is used alone, without the addition of Saphos Phosphate, as in plot 3 (Treatment N_1 P_0 K_1) where the pH drops from 5.43 to 4.70 and Plot 2 (Treatment N_2 P_0 K_1) where the pH drops from 5.43 to 4.70 and Plot 2- (Treatment N_2 P_0 K_2 where the pH drops from 5.25 to 4.40. Where Saphos Phosphate is used both the calcium in the calcium phosphate and the free lime as Calcium Carbonate present in Saphos Phosphate can be expected to neutralise any change in reaction due to the use of Sulphate of Ammonia, as shown in plots 11 (N_1 P_1) and plot 14 (N_2 P_1)

TABLE VIII

pH Values

SOIL SAMPLES FROM MANURE CIRCLES

3 × 3 × 3 N. P. K. EXPERIMENT (BANDIRIPPUWA)

No nitrogen Plots

Treatment	*Plot No.* K_1	K_1	K_2	*Series I—1935*	*Series II—1940*	*Series III—1944*	*Series V—1951*
	8			5·29	5·32	4·94	5·09
	28			6·21	5·43	4·98	5·66
		18		5·21	5·25	5·02	5·18
N_0P_0		39		—	—	4·91	—
			21	—	—	5·53	5·07
			46	5·58	4·97	—	5·13
	26			—	5·33	—	—
	50			5·52	5·41	—	5·61
		1		5·36	5·27	—	5·27
		29		—	—	—	—
N_0P_1			12	4·99	5·46	—	5·18
			41	5·73	5·39	—	5·41
	15			5·02	5·31	—	5·52
	37			5·68	5·45	—	5·52
		27		5·99	5·41	—	5·66
N_0P_2		51		5·63	5·23	—	5·68
			5	5·38	—	—	5·46
			33	—	—	—	—

TABLE IX

pH Values

SOIL SAMPLES FROM MANURE CIRCLES

3 × 3 × 3 N. P. K. MANURIAL EXPERIMENT—(BANDIRIPPUWA)

Nitrogen Plots

	Plot No.			*Ammonium Sulphate*				*Plot No.*			*Calcium Cyanamide*				*Plot No.*			*Groundnut Cake*			
	K_0	K_1	K_2	*1935 Series I*	*1940 Series II*	*1944 Series III*	*1951 Series V*	K_0	K_1	K_2	*1935 Series I*	*1940 Series II*	*1944 Series III*	*1951 Series V*	K_0	K_1	K_2	*1935 Series I*	*1940 Series II*	*1944 Series III*	*1951 Series V*
$N_1 P_0$ ..		3		5·43	5·19	4·53	4·70	20			—	—	5·68	—			13	4·99	5·25	4·80	4·66
		35		—	—	4·79	—	54			5·03	5·31	5·20	5·29			45	6·01	4·97	5·23	5·04
$N_1 P_1$ ..	11			5·08	5·31	—	5·08			9	5·06	5·66	—	5·61		25		—	—	—	—
	43			—	—	—	—			30	—	—	—	—		47		5·38	5·06	—	4·99
$N_1 P^2$ ..			24	—	—	—	—		10		5·12	5·43	—	—	6			5·31	5·19	—	5·32
			52	5·34	4·63	—	5·19		42		—	—	—	—	31			—	—	—	—
$N_2 P_0$ ..			2	5·25	5·19	4·36	4·40	17			6·03	6·96	6·19	5·33		23		6·25	5·23	5·24	4·69
			34	—	—	4·79	—	40			—	—	—	—		48		5·39	5·06	4·63	4·82
$N_2 P_1$ ..		14		4·98	4·96	—	4·82			22	—	—	—	—	4			5·45	5·35	—	4·88
		44	—	—	—	—	—			49	5·66	7·03	—	6·62	36			5·82	5·39	—	5·67
$N_2 P_2$ ..	19			5·20	4·99	—	5·07			7	5·33	—	—	5·78			16	5·11	5·19	—	5·23
	53			5·22	4·33	—	4·86			32	6·62	6·13	—	6·46			38	—	—	—	—

(g) *Observation Trial on nut-fall (Kobeigane)*

In connection with the observation trial on nut-fall at Kobeigane it was observed that both the ground waters (well) and surface waters (pond) were very saline. Besides chlorides, the well waters contained calcium and magnesium in fair amounts. The salt concentration as gms Nacl per litre are given below :—

	Gms Nacl/litre
Well water ..	.. 0·85
Pond ..	.. 0·81

Mechanical analysis and pH determinations on soil samples taken up to a depth of 102 in. were made. The soil was found to be a sandy loam up to a depth of 30 inches, overlying a clay pan. The deeper layers were definitely calcareous.

1. pH OF THE SOIL

Depth	*pH*
0– 9″ ..	.. 5·88
9–18″ ..	.. 5·75
18–30″ ..	.. 5·45
30–42″ ..	.. 5·55
42–54″ ..	.. 6·55
54–66″ ..	.. 8·43
66–78″ ..	.. 8·56
78–90″ ..	.. 8·56
90–102″ ..	.. 8·63

Note.—In the last four layers of the soil presence of carbonate was detected.

2. MECHANICAL ANALYSIS

Soil Depth	*C. Sand*	*Fine Sand*	*Silt*	*Clay*
0– 9″ ..	71·42 ..	17·60 ..	1·8 ..	8·7
9–18″ ..	70·85 ..	16·88 ..	1·8 ..	8·8
18–30″ ..	81·13 ..	2·06 ..	12·4 ..	8·4
30–42″ ..	78·30 ..	7·38 ..	2·6 ..	14·2
42–54″ ..	60·05 ..	7·44 ..	8·5 ..	22·0
54–66″ ..	46·33 ..	19.12 ..	10·3 ..	24·2
66–78″ ..	71·90 ..	6·11 ..	5·2 ..	18·3
78–90″ ..	55·08 ..	23·33 ..	6·0 ..	15·7
90–102″ ..	62·17 ..	12·84 ..	9·4 ..	17·1

(h) *Soil Surveys*

Soil surveys of Crown jungles in the following areas were carried out during the year for purposes of land development with coconuts as the main crop :—

Province	*District*	*Location*	*Suitable Acreage*
Northern ..	Mullativu ..	Alampil	5,000
		Vattapalai	4,500
		Kokkuthoduai	1,500
		Ampalavanpokkanai W. ..	1,000
		Puthukudirippu	6,800
Southern ..	Hambantota ..	Gonadeniya	None
N. W. P. ..	Puttalam ..	Mahauswewa	400
		Karaitivu	1,000
		South of Vanativillu-Karaitivu Road) ..	3,500
Uva Province ..	Bibile ..	Bakinigaswewa	250
	Wellawaya ..	Veherayayakelle	1,000
N. W. P. ..	Wanni Hatpattu ..	Kadigawa	750
		Unagolla	600
		Total ..	26,300

Of the areas surveyed Mullaitivu appears to be the most promising for extensive development under coconuts.

M. L. M. SALGADO,
Soil Chemist.

REPORT OF THE CHEMIST

1. Experiments on the "Generator" Process for the Manufacture of Coconut Toddy Vinegar

In continuation of the work reported in 1954, 26 more charges of fermented toddy (vinegar stock) were put through the experimental generator quantitatively.

The complete analytical data now available on 50 charges are summarised in Table I below :—

TABLE I

Analytical Data on Charges 2 to 51 (Summarised Results)

(COMPOSITION OF SAMPLES BEFORE AND AFTER PASSING THROUGH GENERATOR)

	Composition of Toddy Used			*Composition of Vinegar Produced*			
Charge No.	*Per. Cent. Total Acidity (as acetic) Gms/100ml.*	*Per. Cent. Alcohol V/V*	*Per. Cent. Total Solids Gms/100 ml.*	*Per. Cent. Total Acidity (as acetic) gms/100ml.*	*Per. Cent. Alcohol V/V*	*Total Solids Gms/100 ml.*	*No. of Hours taken for complete acetification*
2	1·85	5·9	2·74	3·82	1·6	2·57	—
3	1·75	6·7	3·22	6·24	0·0	3·23	168
4	1·88	6·9	3·26	5·86	0·0	3·07	144
5	1·31	7·7	2·93	6·91	0·0	3·24	120
6	1·27	7·4	2·76	7·42	0·0	3·18	144
7	1·52	8·0	3·18	7·29	0·0	3·31	144
8	3·64	5·0	3·06	7·70	0·0	3·28	120
9	1·68	7·7	2·18	7·54	0·0	2·70	144
10	2·50	5·8	2·55	7·32	0·0	2·70	144
11	4·06	3·5	0·98	7·37	0·0	2·19	72
12	2·16	7·2	2·42	7·38	0·0	2·62	144
13	1·84	6·1	2·58	7·36	0·0	2·36	144
14	1·96	6·4	2·74	7·42	0·0	2·46	168
15	1·96	6·4	2·64	7·45	0·0	2·54	144
16	1·81	6·6	2·75	7·42	0·0	2·68	144
17	2·03	6·6	2·20	7·59	0·0	2·40	144
18	2·15	6·5	2·21	7·30	0·0	2·61	144
19	2·01	6·6	2·37	7·44	0·0	2·64	144
20	2·50	6·1	2·39	7·46	0·0	2·61	144
21	1·22	7·4	2·82	7·40	0·0	2·70	168
22	2·24	6·0	2·52	7·46	0·0	2·66	144
23	3·34	4·4	2·36	7·39	0·0	2·57	120
24	3·78	4·0	2·43	7·50	0·0	2·82	144
25	2·38	6·6	2·35	7·52	0·0	2·61	144
26	2·93	6·4	2·62	7·84	0·0	3·20	144
27	2·90	6·1	2·93	7·46	0·0	2·83	144
28	3·72	4·7	2·97	7·29	0·0	2·79	120
29	4·30	3·6	2·21	7·62	0·0	2·36	144
30	3·29	5·1	2·21	7·14	0·0	2·26	168
31	3·33	5·0	2·04	7·83	0·0	2·22	144
32	4·02	4·4	2·17	7·32	0·0	2·27	96
33	5·32	1·8	2·12	7·14	0·0	2·10	72
34	4·78	3·8	2·06	6·99	0·0	2·15	144
35	3·36	5·2	2·06	6·86	0·0	2·16	192
36	4·34	3·7	2·11	7·04	0·0	2·14	144
37	4·92	3·4	2·04	7·11	0·0	2·10	144
38	3·66	4·8	2·19	7·23	0·0	2·27	144
39	3·68	4·7	2·10	7·57	0·0	2·25	96
40	2·25	6·4	2·38	7·45	0·0	2·63	120
41	4·01	4·2	2·59	7·46	0·0	2·58	120
42	2·08	6·6	2·29	7·37	0·0	2·62	144
43	1·90	6·3	2·66	7·39	0·0	2·41	168
44	1·39	7·7	2·97	7·36	0·0	3·24	144
45	2·48	6·0	2·54	7·35	0·0	2·71	120
46	2·20	6·1	2·50	7·41	0·0	2·65	144
47	1·55	7·8	3·20	7·26	0·0	3·35	144
48	2·08	7·4	2·40	7·29	0·0	2·66	144

Charge No.	Composition of Toddy Used: Per. Cent. Total Acidity (as acetic) Gms/100ml.	Per. Cent. Alcohol V/V	Per. Cent. Total Solids Gms/100 ml.	Composition of Vinegar Produced: Per. Cent. Total Acidity (as acetic) gms/100ml.	Per. Cent. Alcohol V/V	Per. Cent. Total Solids Gms/100 ml.	No. of Hours taken for complete acetification
49	1·25	7·3	2·85	7·38	0·0	2·68	168
50	1·65	7·8	2·20	7·46	0·0	2·65	144
51	2·95	6·3	2·58	7·62	0·0	3·15	144
Average	2·66	5·9	2·49	7·26	0·0	2·64	144 (nearest 24 hours)
Range	1·22 to 5·32	1·8 to 8·0	0·98 to 3·26	3·82 to 7·84	0·0 to 1·6	2·10 to 3·35	72 to 192

With the exception of seven charges all the samples when taken to complete acetification had acidities over .7 per cent. ranging between 7.04 and 7.84. The overall average acidity on the 50 charges was 7.26 per cent. Based on the data obtained in these experiments the following observations have been made :—

(*a*) Acetification of toddy can be taken to completion on an average within 144 hours (6 days) using the " generator " process.

(*b*) The finished vinegar could be expected to have an acidity of over 7 per cent.

(*c*) The overall recovery of acid is about 85 per cent. of the theoretical which may be taken as a measure of the efficiency of the "generator" process.

In comparison the recovery of acid in the " Vat " process rarely exceeds 50 per cent. of the theoretical.

(*d*) All samples of vinegar made from the 50 charges were uniformly good in quality.

2. Commercial Vinegar Generators

Two vinegar makers who constructed pilot plant " generators " of 50 and 150 gallon capacities (prior to going into commercial production) carried out trials during the early part of the year with very promising results.

The 50-gallon generator was found to give vinegar of over 5 per cent. strength consistently and the other manufacturer used the larger generator for making 4,000 gallons of vinegar with an overall acidity of 4.77 per cent. This could be regarded as satisfactory, considering the fact that the acetifying toddy used was only of fair quality being a blend of good and poor samples ; some of the fermented toddy put through being even contaminated with rain water.

3. Vinegar from Fermented Sweet Toddy

An interesting observation was made that sweet toddy (using " Hal " bark as a retarder of fermentation) if allowed to ferment under laboratory conditions, could yield a fermented liquor higher in alcohol content than ordinary fermented toddy.

Under the usual conditions of tapping and collecting for fermented toddy about 1 to 1.5 per cent. of alcohol is lost due to injudicious handling. In the case of sweet toddy however where fermentation sets in only after it is received in the laboratory this 1 to 1.5 per cent. of alcohol is conserved, as there are no chances of loss.

It was found that after fermentation and settling for a few weeks the liquor from sweet toddy had a pleasing light golden yellow colour and appealing aroma reminiscent of the bouquet of esters in distilled liquors.

These observations presented the possibility of making a strong vinegar of highly aromatic flavour from fermented sweet toddy. Accordingly ten samples of fermented and settled sweet toddy in various stages of acetification were put quantitatively through the laboratory generator. All ten samples chosen had an initial (acid + alcohol) strength over 9.0 per cent. The results of this experiment are summarized in Table II below :—

TABLE II

(Analytical Data on Vinegar from Sweet Toddy)

COMPOSITION OF SAMPLES BEFORE AND AFTER PASSING THROUGH GENERATOR

Charge No.	Composition of Fermented Sweet Toddy used				Composition of Vinegar produced			No. of Hours taken for complete acetification
	Per cent. Total Acidity (as acetic) Gms/100ml.	Per. Cent. Alcohol V/V	Per Cent. Acidity plus Alcohol	Per Cent. Total Solids Gms/100ml.	Per Cent. Total Acidity (as acetic) Gms/100 ml.	Per. Cent. Alcohol V/V	Per Cent. Total Solids Gms/100 ml.	
1	1·24	7·8	9·04	2·14	8·05	0·0	2·36	192
2	0·78	8·5	9·28	2·21	8·33	0·0	2·50	192
3	0·34	9·3	9·64	2·04	8·44	0·0	2·26	168
4	2·89	6·4	9·29	1·68	8·29	0·0	2·13	168
5	2·72	6·5	9·22	1·94	8·10	0·0	1·81	168
6	0·56	9·6	10·16	1·18	8·73	0·0	1·82	168
7	0·95	8·3	9·25	1·89	8·34	0·0	1·89	168
8	1·48	7·7	9·18	1·85	8·17	0·0	1·93	168
9	0·53	9·4	9·93	1·22	8·65	0·0	1·66	144
10	1·85	7·3	9·15	1·19	8·14	0·0	1·26	144
Average	1·33	8·1	9·43	1·73	8·32	0·0	1·96	168
Range	0·34 to 2·89	6·4 to 9·6	9·04 to 10·16	1·18 to 2·21	8·05 to 8·73	0·0	1·26 to 2·50	144 to 192

It will be seen that, as expected, all ten samples of vinegar when taken to complete acetification have acid strengths over 8 per cent.

The overall average acidity of 8.32 per cent. is one per cent. higher than the corresponding figure of 7.26 per cent (for 50 samples) for vinegar prepared from ordinary fermented toddy. The average time taken for complete acetification however is 168 hours which is 24 hours longer than that taken for ordinary toddy. As against 85 per cent. for ordinary toddy the overall recovery of acid for sweet toddy calculated from the above figures, is 88.2 per cent. of the theoretical. The present results therefore give further support to the previous observations regarding the very much higher efficiency of the " generator " process in comparison with the " Vat " process.

Based on visual and analytical characteristics the finished vinegar from these ten experimental charges of fermented sweet toddy may be stated to be good. In appearance they were clearer and of a better colour than ordinary toddy vinegar and were definitely more aromatic.

4. Experiments on the Maturation of Vinegar

(*a*) Fifty gallons of vinegar prepared from fermented *toddy* using the laboratory generator have been stored in a " halmilla " cask kept nearly full. The toddy used for this experiment was not taken to complete acetification in order to facilitate the production of esters and other aromatic constituents. The composition of the bulked 50 gallons of vinegar on December 31, 1955, was as follows :—

Acidity (as acetic) 6.34 per cent.
Alcohol V/V 1.8 per cent.
Total Solids 2.52 per cent.

The vinegar was of a pale straw colour with an agreeable acetic odour and sharp but palatable acid taste. A haze however was perceptible.

(*b*) Twenty-five gallons of vinegar prepared from fermented *Sweet Toddy* using the laboratory generator were similarly stored in a halmilla cask. In this case too the acetification was not taken to completion. The composition of the bulked 25 gallons of vinegar on December 31, 1955, was as follows :—

Acidity (as acetic) 7.27 per cent.
Alcohol V/V 1.4 per cent.
Total Solids 2.02 per cent.

The vinegar was of a pale golden yellow colour with an agreeable acetic odour blended with esters, and sharp but palatable acid taste. The bulked sample was fairly but not brilliantly clear.

5. Studies on the Fermentation of Toddy and Sweet Toddy

The data quoted above indicate the possibility regarding higher alcohol recoveries from sweet toddy in comparison with toddy.

This interesting observation is being pursued with the idea of getting full quantitative data on the fermentation of coconut sap when collected and fermented under different conditions. The complete results will be reported later at the termination of the investigations.

6. Sand Culture Experiment

Using 12 giant size concrete cylinders as sand culture vessels an experiment is being started to grow coconut seedlings hydroponically under controlled conditions of mineral nutrition. As the cinnamon sand used in these studies is an inert aggregate the nutrients (both "macro" and "micro") will be supplied in the form of pure chemicals. Studies will be made on the visual and analytical characteristics of the vegetative parts associated with specific and multiple nutrient element deficiencies.

It is proposed to plant 12 seedlings *without* husks in the pots and treat them differently as follows :—

Seedling. No.	*Treatment (Nutrients supplied)*	*Deficiencies (Nutrients not supplied)*	*Remarks*
1	No mineral nutrients (minus ALL)	N, P, K, S, Ca, Mg and T. E. (minus ALL)	Only mineral reserves in shell, kernel and apple *of* seedling. Water only supplied
2	N, P, K, S, and T. E.	Ca and Mg	—
3	N, P, K, S, Ca and Mg	T. E.	—
4	N, P, K, S, Ca, Mg and T. E... (plus all)	None (plus ALL)	Micro-nutrients supplied in the form of Pure Chemicals
5	N, P, K and S.	Ca, Mg and T. E.	—
6	P, K, S, Ca, Mg and T. E.	Nitrogen	—
7	N, K, S, Ca, Mg and T. E.	Phosphorus	—
8	N, P, S, Ca, Mg and T. E.	Potassium	—
9	Ca, Mg, S and T. E.	N, P and K.	—
10	N, P, K, S, Mg and T. E.	Calcium	—
11	N, P, K, S, Ca and T. E.	Magnesium	—
12	N, P, K, S, Ca, Mg andF.T.E. (plus ALL)	None (plus ALL)	Micro-nutrients supplied in the form of *F. T. E.* (Fritted Trace Elements)

N = Nitrogen S = Sulphur T. E. = Micro-Nutrients
P = Phosphorus Ca = Calcium F.T.E. = Fritted Trace Elements
K = Potassium Mg = Magnesium

A preliminary experiment carried out in the Botanists' nursery has already shown that *husked coconuts* can be made to germinate and grow without impairment of vigour. It is therefore deemed expedient to select the

12 seedlings for this experiment from seed-nuts germinated in this fashion, in order to minimize complications resulting from reserves of mineral nutrients in the various components of the coconut.

7. Relationship between Moisture Content of Copra and Atmospheric Humidity

The results of analyses of a large number of copra samples in this laboratory during the past 25 years show that the moisture content of Ceylon Estate Copra can range between 4.0 and 9.4 per cent. The lowest moisture content recorded for any sample so far received is 3.7 per cent., on a sample of No. 3. Copra prepared from rejected coconut seedlings. The above wide range in moisture content though it mostly reflects the efficiency of the drying operations yet it can (depending on conditions of storage) be contingent on temperature and humidity relationships of the atmosphere.

It is generally understood that the moisture content of edible white copra in Ceylon should be below 6.0 per cent. whereas ordinary estate copra could have moisture contents ranging between 6.0 and 8.0 per cent. It would thus be evident that more nuts of the same size will be required to produce a candy (560 lb.) of edible white copra than the same weight of estate copra because of these moisture specifications.

It is also well known that copra that has once been dried in conformity with these moisture requirements does increase or decrease in weight (depending on conditions of storage) purely in reaction to changes in atmospheric humidity. As the humidity of the atmosphere itself changes with the air temperature, the tendency for these moisture fluctuations in copra becomes all the more evident.

With these facts in mind, a simple laboratory experiment has been started to study the changes in the moisture content of copra under different humidities at the mean temperature for this station 80.8°F.

Using sulphuric acid of strengths ranging from 20 to 100 per cent. (W/V) in vacuum desiccators it has been found possible to get humidities ranging from 1.5 to 100 per cent. A Lufft hair-hygrometer calibrated from 20 to 100 per cent. on the humidity scale and 20 to 110°F. on the temperature scale was employed for registering the humidities in the desiccator chambers.

For each strength of acid used, viz., 20, 30, 40, 50, 60, 70, 80 and 90 per cent. W/V sulphuric acid humidity and temperature readings were taken at hourly intervals from 7 a.m. to 10 p.m. Where this range of readings did not cover the mean temperature for the station, further readings were taken at other times of the day till it was possible to record the humidity at 80.8°F.

Expressed graphically, by plotting the acid strengths along the horizontal axis and the corresponding humidity readings along the vertical axis it was found that five out of the eight points fell on a straight line indicating linear relationship. At humidities below 50 per cent. the hygrometer did not appear to register accurately. The readings used for producing this graph are charted in Table III below :—

TABLE III

Per Cent. Humidity corresponding to various Acid Strengths at 80·8°F. (27·1°C.)

Strength of acid per cent. H_2SO_4 (gms/100 ml.)	20	30	40	50	60	70	80	90	100
Per Cent. Relative Humidity (actual readings)	100·0	88·8	75·5	63·2	50·5	40·5	28·5	20·0	1·5 (by extrapolation)
Per Cent. Relative Humidity (calculated from averages for 16 readings)	98·7	88·1	75·2	63·3	51·3	41·7	30·4	20·5	—

With the aid of this graph and using vacuum desiccators (containing sulphuric acid of different strengths) quantitative studies have been commenced to observe the variations in moisture content of copra when stored under varying conditions of humidity at the mean temperature for this station. Further results on this experiment will be reported later.

8. Examination of Hybrid Palm Copra

Eleven samples of hybrid palm copra sent by the Botanist during the year were examined for moisture and oil content. The results are tabulated in Table IV below :—

TABLE IV

(Analytical Data on Hybrid Palm Copra)

	Palm No.	*No. of Cups*	*Wt. of Copra (gms.)*	*Per cent. Moisture*	*Per cent. Oil*	
					Wet Basis	*Dry Basis*
	112	32	3,516	7·00	63·69	68·48
	114	24	2,666	6·55	65·83	70·44
	122	24	3,034	6·81	64·21	68·90
	146	38	3,573	7·01	62·70	67·42
	148	24	2,694	7·37	64·65	69·79
	85	19	1,474	5·61	61·85	65·50
	104	55	6,181	6·24	62·94	67·14
	110	30	3,686	6·57	62·18	66·45
	111	42	5,359	5·69	62·49	66·26
	113	46	6,152	5·56	60·04	63·27
	134	20	2,524	5·59	62·92	65·85
Average	11 Samples	32	3,714	6·36	63·05	67·23
Range		19 to 55	1,474 to 6,181	5·56 to 7·37	60·04 to 65·83	63·27 to 70·44

It is interesting to note that two of the samples of copra (from palms 114 and 148) have registered reasonably high oil contents of 70.4 per cent. and 69.8 per cent. respectively, calculated on the moisture free basis.

9. Examination of Farmyard Manure

The analysis of a half yearly sample of farmyard manure drawn in June, 1955, was done during the year. Unlike on previous occasions, the animals were all fed on a mixed diet of pasture and concentrates. Consequently it was possible to prepare only one sample of manure, which has been analysed with the following results :—

Farmyard Manure from Cattle fed on Mixed Diet (Pasture and Concentrates)

Date of Sampling	*Per cent. Moisture*	*Per cent. Nitrogen (as N)*		*Per cent. Phos. Acid (as P_2O_5)*		*Per cent. Potash (as K_2O)*	
		Wet Basis	*Dry Basis*	*Wet Basis*	*Dry Basis*	*Wet Basis*	*Dry Basis*
30.6.55	1·43	0·72	0·73	0·33	0·34	1·11	1·12

The concentrations of all the manurial constituents in this sample are lower than the average values found on the previous lots prepared from (*a*) pasture fed, and (*b*) concentrate fed animals.

It is proposed to continue these analyses at half yearly intervals as before.

10. Coir Dust as Mulch

The immature nut-fall recorded (at 10 day intervals) during the year on the coir dust observation plot was compared with corresponding records kept on the control and overgrazed plots as usual. The summarized data for the four quarters are given in Table V, differentiating between large, medium and small nuts.

TABLE V

(Immature Nut-fall recorded during 1955)

Quarter	*Size*	*Coir Plot*	*Control Plot*	*Overgrazed Plot*	*Rainfall (Inches)*
First	Large	28	25	24	6·13
	Medium	28	21	23	
	Small	71	77	72	
Total First Quarter		127	123	119	
Second	Large	15	13	26	34·36
	Medium	23	25	16	
	Small	110	102	113	
Total Second Quarter		148	140	155	
Third	Large	28	25	28	17·94
	Medium	28	33	33	
	Small	141	135	120	
Total Third Quarter		197	193	181	—
Fourth	Large	71	64	43	24·98
	Medium	100	85	54	
	Small	242	202	127	
Total Fourth Quarter		413	351	224	
Total for the Year	Large	142	127	121	83·41
	Medium	179	164	126	
	Small	564	516	432	
General Total—1955		885	807	679	

The general annual immature nut-fall totals for the three plots since the commencement of the experiment are summarized in Table VI. The percentage decrease (or increase) in nut-fall for each year in relation to the 1951 figures is also worked out in the table.

TABLE VI

(General Annual Immature Nut-fall Totals—Period 1951 to 1955)

Year	*Coir Plot*		*Control Plot*		*Overgrazed Plot*		*Rainfall (inches)*
	Total fall in nuts	*Decrease (or increase) as per cent. of 1951 fall*	*Total fall in nuts*	*Decrease (or increase) as per cent. of 1951 fall*	*Total fall in nuts*	*Decrease (or increase) as per cent. of 1951 fall*	
1951	976	—	931	—	919	—	94·09
1952	719	—26·3	605	—35·0	472	—48·6	62·40
1953	578	—40·8	536	—42·4	670	—27·1	88·30
1954	464	—52·5	423	—54·6	706	—23·2	93·70
1955	885	— 9·3	807	—13·3	679	—26·1	83·41

It will be observed that the nut-falls in all three plots have always been lower than the 1951 figures. The coir and control plots which were steadily showing decreases by the year, have shown a sharp rise in immature nut-fall during 1955. There are no indications till now to show that the coir mulch by itself has any favourable effects in checking immature nut-fall.

11. Empirical Field Trials

The following empirical field trials were laid down during the year :—

(*a*) "Trace Element" experiment on 180 newly planted seedlings at Andigama Estate, Giriulla, in order to ascertain whether the essential micro-nutrients supplied in the form of F. T. E. (Fritted Trace Elements) would prove beneficial to their growth and future performance.

(*b*) On 48 yellowing palms at Maliduakande Group, Henegama, Gampaha, to ascertain whether the symptoms were linked up with the major nutrients calcium and magnesium and the "trace" elements boron.

(*c*) On 48 young palms in the Planting Officers Demonstration Plot at Ratmalagara Research Station to ascertain whether the application of baron (singly) or in combination with calcium and magnesium (in the form of Dolomite) would prove beneficial to their growth and future performance.

(*d*) On 6 Yellowing palms at "Walterland" Estate, Horana, to ascertain whether the inducement of new root production by the building of (14 ft. × 14 ft. × 3 ft.) platform bunds using fertile top soil and artificial fertilisers would give a new lease of life to yellowing and tapering palms.

12. Miscellaneous Work

(*a*) Four samples of coconut oil sent by a miller for bleaching and deodorizing trials were treated with Fullers Earth, Kieselguhr and Animal Charcoal in the manner recommended by him for trial. Except for slight improvement in odour in certain samples, the results were negative.

(*b*) A sample of rice bran ash sent by an estate superintendent was analysed for the major manurial constituents. The potash content of the ash was low (0.44 per cent., dry basis), but it contained 2.6 per cent. of phosphorus (calculated as P_2O_5). There was only a trace of organic nitrogen, and sample was found to be grossly contaminated with sand.

(*c*) Two samples of a new brand of coconut vinegar were analysed and duly reported on. The samples were fair as regards quality with a mean acidity of 5.32 per cent. and a residual alcohol content of 0.59 per cent. V/V. The presence of mycodermal growth and other suspended impurities in one sample was however not a desirable feature. The second sample showed a decided improvement in this respect.

(*d*) Four samples of edible white copra sent by a mill owner and stated to be dried in a special type of kiln were examined for moisture. All four samples had moisture contents above 6 per cent. and consequently were reported to be inadequately dried to conform to the moisture specification of this grade.

(*e*) Analytical reports were made on one sample of coconut oil, one sample of expeller poonac, two samples of sediment poonac, and a sample of copra, sent by mill owners seeking advice.

W. R. N. NATHANAEL,
Chemist.

REPORT OF THE BOTANIST

1. The Dwarf Palm

The dwarf palm is a distinct variety of coconuts and a few unsuccessful attempts particularly in Malaya, have been made to establish this variety on a plantation scale. Between 1939 and 1942, a block of nearly 10½ acres at Ratmalagara Estate was planted with Malayan dwarf seedlings to study their toddy yields and productivity of nuts and copra—vide Annual Report for 1940, page 6.

The Chemist carried out tapping trials in 1951 on 24 of these palms and his main conclusion was that, "the Malayan dwarf coconut palm is not of much value for tapping purposes". The yield of toddy was 494 c.c. per palm per day or 49,390 c.c. per acre of dwarf palms whereas from the tall variety of palms, the relative figures were 946 c.c. per palm per day or 61,490 c.c. per acre per day—vide Annual Report for 1951, page 15.

The dwarf palm is early flowering and short in habit. The early flowering character has already been referred to in the annual reports for 1942 and 1943. The internodal length, i.e., the distance between two leaf scars is short and consequently the palm is short in habit.

Field observations have indicated that these palms are adversely affected during periods of drought; drooping of leaves and bunches were unusually heavy and nut size was considerably reduced. The palms were generally less hardier than the tall variety palms and the incidence of Rhinoceros Beetle (*Oryctes rhinoceros L.*) and Red Weevil (*Rhyncophorus ferrugineus L.*) damage was high.

The palms exhibit periodicity in bearing nuts, i.e., in alternate years the yield of nuts per palm is very low (Table I). This periodicity is associated with a resting period in production of inflorescences; after 10 to 14 inflorescences have been produced, the palm rests for 6 to 8 months, and consequently the yield during the corresponding year is low.

TABLE I

The Yield of the Dwarf Palm

Year	*Variety*	*Nuts per Acre*	*Copra per Acre (Cwts.)*	*Nuts per Candy of Copra*
1951	Dwarf	1,456	2·54	2,860
	Typica	2,546	9·84	1,293
1952	Dwarf	6,458	11·23	2,875
	Typica	2,744	12·56	1,092
1953	Dwarf	2,633	6·75	1,948
	Typica	2,724	11·75	1,158
1954	Dwarf	8,302	16·87	2,459
	Typica	3,762	18·88	996
Average per year (1951–54)	Dwarf	4,712	9·35	2,536
	Typica	2,944	13·26	1,135

The comparative data of the typica variety palms, i.e., the tall variety grown commercially, given in Table I is from a block planted in 1939, adjacent to the dwarf palm block with the same soil conditions. The typica palms have not attained their maximum yield yet, although the dwarf palms are in their prime of life. If the averages given in the last row of

Table I are considered it is seen that although the dwarf palms have given 60.1 per cent. more nuts per acre than the typica palms, the nut size is so small that yield of copra per acre is 29.5 per cent. less than from the typica palms.

The high out-turn figures considerably increase the cost of production of copra. Further about 20 to 25 per cent. of dwarf copra is leathery and can be marketed only as Grade 2. Consequently, the dwarf palm is much inferior to the typica palm grown on a plantation scale in Ceylon in relation to production of copra per acre and the quality of copra.

In our plantation, four forms of palms can be distinguished : three colour forms of the dwarf type—ivory yellow, golden yellow and green—and a semi-tall type. The reddish brown and ivory-yellow forms have given larger nuts than the green form, but yet smaller than the typica nuts. The semi-tall form is suspected to be a natural hybrid of Dwarf × Typica and can be easily picked out from the dwarf palms as they have broader stems, longer internodes and larger nuts than the dwarfs. Further they show no periodicity in bearing.

Although the dwarf palms have two advantageous characters of short habit and early flowering, the palms are very susceptible to drought, pests and diseases and the yield of good copra per acre is low, that they cannot be recommended as a plantation crop in areas with similar soil and climatic conditions as at Ratmalagara, i.e., lateritic gravel without a good distribution of rainfall. Even over more wet areas with a loamy soil of average fertility, our observations are that the dwarf palm would not do well as a plantation crop owing to the periodicity in bearing and the small size of the nut.

2. The Seed Garden

The first programme on controlled pollination covers the establishment of an isolated seed garden for coconuts. The seed garden situated within the Ambakelle forest reserve in the Chilaw District was formally inaugurated on April 23, 1955, by the Minister of Agriculture and Food by planting a seed-nut. Since then, considerable developmental work involved in opening jungle land has been in progress. 245 selected seedlings derived by crossing high-yielding palms were planted in December, 1955. Further, 3,503 hand pollinated nuts were harvested and pollinations were done on nearly 16,500 female flowers out of which about 30 per cent. are expected to develop. It is proposed to plant at least 25 acres a year from 1956 onwards.

3. Intra-specific Hydrids

In the second programme of controlled pollination, crosses between certain varieties of coconut palms are being studied. The main purpose of this work is three fold, viz. (*a*) study the genetical behaviour of certain characters of the parental types, (*b*) study the expression of hybrid vigour in the first generation (F1) palms, and (*c*) select and develop an improved strain of palms suitable for economic exploitation.

The varieties and forms that have been used are :—

Ceylon *typica,* tall in habit, late flowering, cross fertilized, nuts medium sized, about 0.5 lb. of copra per nut, grown on a plantation scale in Ceylon ; *San Ramon,* tall in habit, late flowering, cross fertilised, nuts large, about 0.8 lb. copra per nut, indigenous to the Philippine Islands ; *Dwarf* (nana), short in habit, early flowering, self-fertilized, nuts small, about 0.2 lb. of copra per nut ; *King-coconut,* semi-tall, late flowering, self-fertilized, nuts medium, endosperm thin ; *Natural hybrid,* semi-tall palms suspected to be hybrids of dwarf × typica found growing in dwarf palm populations.

Summarized data of some of the hybrid progenies were presented in the Annual Report for 1954. A very promising cross appears to be Ceylon *typica* × dwarf.

Typica × *Dwarf*. The first generation palms (F1) are early flowering and exhibit hybrid vigour in leaf production and stem formation. Measurements of vegetative characters taken at the end of the 4th year after transplantation are given in Table II. Leaf production was highest in the F1 progenies and the differences with either of the parental types were significant at 5 per cent. level.

TABLE II

Mean Leaf Number and girth of Stem per Palm

	Typica	*F1 of Typica × Dwarf*	*Dwarf*
No. of leaves produced during the fourth year	11·7±2·21	15·8±0·83	13·4±1·49
Girth of stem (in ft.) measured 6 ins. above ground	4·8±0·50	5·4±0·25	2·8±0·35

Dwarf palms have narrow stems, typica palms have broad stems and the F1 progenies between them have broad stems being nearly twice the girth of the former and similar to the latter type. The differences in girth of stem between the F1 palms and dwarfs are highly significant (P=0.01) but that between the F1 and typica palms are not significant.

The flowering-age of the first generation palms and of the parental types are given in Table III. The dwarf variety is early flowering with a mean of 38.0 months, typica is late flowering with a mean of 74.3 months and the F1 palms are early flowering with a mean of 48.6 months. The periods given above and in Table III are from the date of sprouting of seed-nut to the date of emergence of the first spathe of the palms.

TABLE III

Frequency Distribution of flowering age of Palms

Frequency (months)	*Dwarf Variety*	*Typica Variety*	*F1 of Typica × Dwarf**
31–36	10	—	—
37–42	4	—	1
43–48	1	—	13
49–54	1	1	4
55–60	1	—	3
61–66	—	3	1
67–72	—	3	—
73–78	—	1	—
79–84	—	5	—
85–90	—	3	—
Total	17	16	22
Average (months)	38·0	74·3	48·6

One palm not in flower at the end of the 5th year.

Within the first four years, 88 per cent. of the dwarf palms and 61 per cent. of the F1 hybrids were in flower against none from the typica variety. The early flowering character of the dwarf parent appears to be partially dominant.

In the first generation progenies of *typica* × *dwarf*, the out-breeding system of the former parent is completely dominant; the female flowers are receptive only a day or two after the male flowers have fallen. However, due to extra vigour of these progenies in leaf production, inflorescences are produced at shorter intervals so that selfing can occur due to overlapping of the female phase of the older open inflorescence and the male phase of the younger open inflorescence.

Most of the palms flowered in the latter half of 1954 and not more than 4 to 6 bunches were harvested in the year under review. Consequently, it is premature to consider the yield of nuts and copra at this stage. However, some useful data have been collected from 448 nuts harvested in 1955 and they are given below.

Mean weight per husked nut ..	.. 1·62 lb.
Number of nuts required for a ton of copra	.. 4,320
Percentage of No. 2 and 3 copra ..	.. 8·3
Mean oil percent on a dry basis ..	.. 67·1

Thus the first generation palms between Ceylon *typica* × *dwarf*, appear to be a promising strain in that they are vigorous and early flowering, bearing nuts of good size.

Further inter-varietal crosses were done during the year and a summary is given in Table IV. Whenever San Ramon palms have been used as the female parent, setting of female flowers has been very low, but with the same variety as the pollen parent, setting has been good.

TABLE IV

Inter-varietal Crosses done in 1955 at Bandirippuwa

Cross	*No. of Inflorescences*	*No. of Female Flowers Pollinated*	*Per cent. Setting*
Dwarf × San Ramon ..	13 ..	170 ..	51·7
San Ramon × Dwarf ..	8 ..	101 ..	14·8
King Coconut × San Ramon ..	19 ..	300 ..	44·3
San Ramon × King Coconut ..	11 ..	131 ..	30·5
Ceylon Typica × King Coconut	16 ..	179 ..	35·1
King Coconut × Ceylon Typica	18 ..	163 ..	47·8
Ceylon Typica × San Ramon ..	15 ..	273 ..	42·1
San Ramon × Ceylon Typica ..	7 ..	111 ..	14·4
Ceylon Typica × Natural hybrid	7 ..	89 ..	51·6
Natural hybrid × Ceylon Typica	5 ..	94 ..	53·1

The same parents have been used in the reciprocal crosses and it is hoped to collect more precise data from the first generation palms in relation to the direction of the crosses.

4. Seed-hole

A new field experiment was initiated during the year to study relationships, if any, between the size of the seed-hole and growth of coconut seedlings. Four sizes of seed-holes have been tried out as follows:—(*a*) 1 × 1 × 1 ft. (1 cu. ft.), (*b*) 3 × 3 × 3 feet (27 cu. ft.), (*c*) cruciform (81 cu. ft.) and (*d*) post-hole borer type (6 cu. ft.).

The cruciform seed-holes were of two trenches 9 feet long, 3 feet broad and 1½ feet deep, placed at right angles in the form of a cross and the central portion common to both trenches deepened to 3 feet. In the post-hole borer type, 5 holes were made with an augur 12 inch. in diameter and 1½ feet deep ; four of them were at the corners of a square 3 × 3 feet and the fifth at the centre of the square in which the seedling was planted.

Each seed-hole was filled with top soil to a depth of 9 inches and selected seedlings were planted in November, 1955. The design of the experiment is a simple randomisation with 9 plants per plot and 6 replications.

5. Miscellaneous

Besides the problems referred to above, the following were under investigation : (*a*) systems of replantation, (*b*) methods of mass selection, (*c*) progeny trial of uncontrolled matings, (*d*) variations in seedling characters between illegitimate families and (*e*) cytological studies.

Latin Square.—The results of the Latin Square Experiment which has been designed to study methods of mass selection were given in detail in the Annual Report for 1953. The data collected in 1955 are given below :—

	Selected Seedlings	*Unselected Seedlings*
Nuts per acre	4,066	3,617
Copra per acre (cwt.) ..	19·02	16·65
Nuts per candy of copra ..	1,068	1,087

The increase in crop due to seedling selection alone was 12.4 per cent. in yield of nuts and 14.3 per cent. in yield of copra. It is interesting to note that the selected seedlings have given an average of 4,066 nuts per acre during the 16th year after transplantation.

Polyplcidy. The typica and the dwarf palms have a chromosome complement of 2n = 32. Attempts made to see whether there are any natural poly-ploids proved negative. Therefore a number of nuts with developing embryos were treated with 1.0 and 0.5 per cent. colchicine for periods varying between 6 to 24 hours. None of the embryos developed further with these treatments and consequently in a second trial lower concentrations of colchicine were used. These nuts have not been examined yet.

Nursery Trial. A preliminary trial to study the variations, if any, in seedling characters between families was completed. 230 open-pollinated nuts collected from a single pick of 15 mother palms were planted separately and the periods taken for sprouting girth of 'collar' and leaf number of seedlings were scored.

The difference in sprouting-period and seedling characters within families were not significant whereas those between families were significant. This seems to indicate that certain mother palms give intrinsically better seedlings than others. It is proposed to repeat this experiment and collect further information.

D. V. LIYANAGE,
Botanist.

REPORT OF THE AGRONOMIST

THE new Division of Agronomy was started in August, 1955, when Mr. T. B. Paltridge arrived from Australia. Mr. Paltridge, a Principal Research Officer of the Australian Commonwealth Scientific and Industrial Research Organisation (C. S. I. R. O.), has been lent to the Government of Ceylon under the Colombo Plan and he will be stationed at the Coconut Research Institute for the next three years. His assignment is to study two things in this country: (1) the development and management of pastures that might be grown on Coconut Estates and used to provide meat and milk, without detriment to the coconut palm and (2) the wider problem of maintaining and improving soil fertility in areas where the one crop has been, and perhaps, will be grown for hundreds of years. He will also train staff to continue that work when he is recalled to Australia.

A qualified Assistant, Mr. K. Santhirasegaram, B.Sc. (Hons.) (Cey.), was appointed in November, 1955, and the work of the new division is now well under way.

Some preliminary trials with selected pasture grasses and two fairly comprehensive field experiments with all the known fertilizers (including trace elements) have been started, but the major work of the Agronomy Division must of necessity await delivery of special apparatus and equipment that have been ordered from England, U. S. A. and Australia.

There is inevitably some quite considerable delay in starting any new Division, or a new programme of research, because the firms who manufacture scientific apparatus seldom carry large stocks. There may be a delay of four to five months before delivery.

On the other hand some equipment has already been delivered—ex stocks Colombo, and a modern greenhouse, which is required for the work on trace elements is now being erected at Bandirippuwa. The preliminary work is therefore proceeding satisfactorily, and it is anticipated that by the middle of 1956 this new Division will be firmly established.

T. B. PALTRIDGE,
Agronomist (Colombo Plan).

REPORT OF THE COMPUTER

DURING the latter part of the year, an agri-meteorological station was installed at Bandirippuwa Estate in the main coconut growing area to serve as a central reference station ; three sub-stations are to be established in areas which appear to be marginal for coconuts and where the crops are declining.

This long-term project has been started to determine exactly the optimum and limiting conditions for coconuts and to examine statistically the variations in crop and the quality of nuts with seasonal and annual variations in climatic, atmospheric and soil conditions and to serve as an auxiliary unit for other research divisions in work associated with meteorological factors. The main purpose is to determine whether it is climate or soil impoverishment which is responsible for the declining crops.

The previous system of metéorological recordings was found to be unsatisfactory as no single officer was responsible for the work and the aimless collection of data served no useful purpose. This work is now placed on a true research footing and with this end in view, the Computer of the Institute has been made solely responsible. In addition to his other duties, he is responsible for (1) the initiation of a specific programme of agri-meteorological research in close consultation with the Research Officers ; (2) the maintenance of meteorological records and also relevant yield records ; (3) the statistical investigation into agri-meteorological relationships ; and (4) the expansion of the project by way of installing suitable substations, &c.

We are guided in this project by advice received from the Department of Meteorology, Ceylon, the World Meteorological Organisation, the Food and Agricultural Organisation, and a number of eminent agri-meteorologists from all over the world.

The Computer was given special training in statistical methods and experimental designs at the International Training Centre organised by the F. A. O. in New Delhi, India, and subsequently he was given a further 3 weeks' training in meteorological recording at the Colombo Observatory.

Routine Work

Daily at 0830 hours and 1730 hours, records are now maintained of atmospheric temperatures, relative humidity, terrestrial radiation, solar radiation, soil temperatures at various depths, hours of sunshine, wind velocity, cloud conditions and rainfall.

The Botanist, the Superintendent, Bandirippuwa Estate, and the Technological Chemist have agreed to help in the recording of yield data, copra out-turns and the oil content respectively beginning from the first pick of 1956, and the 300 palm block of the Botanist has been set apart for crop recording. This block has been continuously recorded since 1931.

Investigations during 1955

(1) A statistical investigation was carried out with available yield records, into the relative susceptibility of the different stages of development of a bunch of coconuts to changes of the weather.

It was found that from the point of view of weather effects, the first 3 months from inflorescence is the most susceptible period in the cycle of development of a bunch of coconuts. The weather during this period is responsible for nearly 60 per cent. of the total variations of the final crop due to weather.

(2) A further statistical investigation was commenced during the year with a view to determining the extent and the nature of the relationship between rainfall and crops in order to evolve a formula for predicting crops.

(3) The biometrician is co-operating with the various Research Officers in the examination of their results.

V. ABEYWARDENE,
Computer.

REPORT ON CROP PROTECTION

WHEN the expansion of research activities was begun this year, it decided to establish a division to study methods of protecting the palm and its products from the diseases and pests. Laboratory space has been provided in the new building and the most essential equipment for the laboratory was supplied. When the new Crop Protection Division was set up in August, the Botanist was relieved of Crop Protection work.

Chemical Control of Rhinoceros Beetle

The Research Assistant continued to work on problems and advisory correspondence in relation to crop Protection. The investigation into the chemical control of Rhinoceros beetle (Oryctes rhinoceros L.) larvae carried out in the laboratory in 1954 was extended to the field using pits in place of the earthenware pots. The pits which measured 4 × 3 × 1 ft. were made in the ground in the nursery and filled with well decomposed farmyard manure. Thirty black beetle larvae were introduced into each of the pits which were protected against weather by a cadjan roof.

The more effective concentrations of the six chemicals which had been tried out in the laboratory trials were used for treating the pits. One of the pits which remained untreated formed the control. In the case of the D-D soil fumigant 2.5 cc of the chemical were poured into the holes made 11 inches apart and 9 inches deep. These holes were then plugged with cow-dung. In all other cases sufficient quantity of chemical was applied to the pits by means of a watering can, fitted with a fine rose. Mortality counts were recorded daily and the results together with the treatments are indicated below :—

Insecticide	*Concentration*	*No. of Days taken for complete kill*
D-D soil fumigant ..	.. 2·5 c.c. ..	2
Dieldrex ..	.. 0.5 per cent.	4
Gammalin ..	.. 0.1 ,, ..	6
Agrocide ..	.. 0.1 ,, ..	6
Intox ' 8 ' ..	.. 0.1 ,, ..	6
Aldrex ..	.. 0.1 ,, ..	8

From the above summary it is observed that all the chemicals have been effective in controlling the Rhinoceros beetle larvae, but the action of some have been quicker than the others: e.g., D-D soil fumigant and Dieldrex have killed all the larvae within four days of the application.

Biological Control of Rhinoceros Beetle

The search for biological control of rhinoceros beetle is a pioneer investigation in this country, which was attempted along with the researches conducted by Dr. Venkatraman, Entomologist of the South Pacific Commission.

In this survey, extensive field observations were carried out in many parts of the coconut-growing districts of Ceylon. The actual investigation was a search for all insects in the breeding places of the Oryctes larvae and studying the habits of these insects to find whether any of them are parasitic or predaceous on the Oryctes beetle.

The breeding places inspected were fallen coconut stumps and other decaying logs in estates and back-gardens. Compost heaps, farmyard manure heaps, fibre dust heaps, coconut husk pits and breeding grounds in toddy collecting stations, were also examined.

Of the many types of insects found in association with the Oryctes larvae, the most promising predator insect was a click beetle larva (Elateridae—order—Coleoptera). Two species of this insect were met with—Agrypnus and the Alaus.

The following are the beneficial features in the Elateridae :—

(1) These larvae are found in the breeding places of the Rhinoceros beetle grubs.
(2) Selective, because they go in search of Oryctes grubs for feeding.
(3) Oryctes grubs in all stages are attacked.
(4) The insect is not known to be harmful to other agricultural crops.
(5) It is not harmful to human beings ; although it can pinch with its mandibles, the ' bite ' is not venomous.
(6) Its larval period is long, and in this stage they predate on a series of Oryctes larvae in succession.

The less desirable features :

(i) Slow growing. The life cycle seems to be long.
(ii) The mass breeding of larvae for field release does not seem to be so easy and feasible.
(iii) They are cannibalistic in habit, so handling is difficult.

Further investigations are necessary before evaluating the real possibility of using this insect as an effective biological means for the control of Oryctes.

Soon after this new organisation was set up, the Crop Protection Assistant (along with the Chemist) visited the Coconut Research Station, Kayangulam, in India, and some other research stations in that country, to study and discuss pest and disease problems common to both countries. A report of this visit was submitted.

Several letters were answered, the larger number of pest control advice being sought on termites. From visits made to estates on pest inspection, one serious incidence of Bud-rot affectation was noticed ; and also a heavy attack of yellow scale infestation. The necessary recommendations were given.

It was reported that Perenox (one oz. two gallons water) sprayed in a young plantation, after our recommendations, against Bud-rot, prevented the spread of the disease in one estate.

J. K. F. KIRTHISINGHE,
Crop Protection Assistant.

REPORT OF THE ANIMAL HUSBANDRY OFFICER

THE amendments to the Food Protection (Estates) Ordinance now provide for exemption from penalty to those coconut estates where Dairy cattle are kept. It has been observed at Bandirippuwa Research Station in the wet zone (rainfall—70 inches) that milk can be produced at a profit from the ordinary Sinhala type village cattle, providing they are improved by selection and by good feeding with proper care and management.

Mr. Gamini Goonesekera, Animal Husbandry Officer, proceeded to Australia on study leave on a Colombo Plan Junior Fellowship and Mr. D. C. Ellewela, Animal Husbandry Assistant, was in charge.

The mixed rough pastures of grasses and legumes under the coconut must not be overgrazed, and the cattle require 3 lb. of poonac a day as concentrates. It has been observed that pastures can be maintained without deterioration if there is rational grazing and a total cattle population of 1 animal to 2 acres is not exceeded, under the climatic conditions at Bandirippuwa.

The Black herd of indigenous Sinhala dairy cattle at Bandirippuwa Estate and the Red herd at Ratmalagara Estate are being steadily improved by selective breeding and good management. The present herd strength is as follows :—

	Bandirippuwa Estate	*Ratmalagara Estate*
Adult Cows	22	5
Stud bulls	2	1
Heifer calves	19	7
Bull calves	16	3

The quickest and surest way of increasing the milk supply is by the improved feeding and proper management of our sinhala cattle. Feeding trials have been carried out for the last three years and a test yield of 9 pints have been achieved by Cow No. C.R.I. 27. This was recorded at the All-Ceylon Stock Show held at Negombo on the 4th and 5th March, 1955. C.R.I. 27 won the Miller's Challenge Cup for the best milking cow of the Sinhala breed with a milk yield ratio of 3½ gallons per 1,000 lb. body weight. Three other animals from the C.R.I. were placed in the 1st and 2nd classes. There has been one casualty during the year under review.

Sixteen heifer calves were being specially fed on the following test feeds during the year :—

(*a*) Pasture grasses Morlac plus Churn minerals
(*b*) Pasture grasses Extralac plus Churn minerals
(*c*) Pasture grasses Parings poonac plus Churn minerals
(*d*) Pasture grasses Churn minerals only.

The experiment was designed on 4 × 4 latin square basis.

A preliminary statistical analysis of the rates of growth in weight of the animals was carried out and the results were as follows :—

Rate of growth of animals (adjusted for initial weight)

Feed	*Rate of Growth per cent.*
A	88·05
B	91·64
C	81·96
D	73·02

It is observed that Morlac and Xtralac are significantly better than the control. The difference between the other feeds were not significant although the figures show that parings too might be better than the control and 'B' better than 'A'.

The experiment is being continued and further analysis of body measurements are in hand.

Morlac and Xtralac are solvent extracted poonac in which the oil content is approximately 2 per cent. and 1 per cent. respectively. The object of this is to give the young animals a good start in life in order to improve the standard of Sinhala cattle in succeeding generations.

The Red herd at Ratmalagara Research Station is being built up for the purpose of studying the correct conditions of maintaining dairy cattle in the semi-dry zone where it is more difficult to maintain pastures under coconuts during long periods of drought.

Both herds are being continuously recorded. Preliminary arrangements are being made at Bandirippuwa Estate to establish a feeding trial with different pastures and fodders, viz.:—Bracharia brizantha, Paspalum commersonii, Bracharia milliformis and Guinea grass.

The estate section has been planted with the following fodder and pasture grasses ; Elephant or Napier grass (Penniselum purpureum) and Bracharia brizantha. This is intended to provide fodder during periods of drought when the ordinary pastures dry up. About 24,000 cuttings of Napier grass have been supplied free to coconut estates.

Pigs and poultry are being used for manuring purposes by being kept in portable pens which are moved from square to square at 7 and 3 day intervals and records of the coconut crops are being maintained. A new poultry run of one acre has been established in the old cover-crop demonstration plot. Beehives are also being maintained in the Botanist's Mother Palm block to improve the setting of the female flowers.

A course of training in Dairy husbandry has been started during the year and 2 students from the Milk Board are at present under training.

D. C. ELLEWELA,
Animal Husbandry Assistant.

REPORT ON INDUSTRIAL RESEARCH

THE Industrial Research Assistant assumed duties on November 1, 1955.

2. A new type of Copra Kiln for Smallholders to prepare white copra has been considered. Experiments are being carried out on it and the results will be published in due course.

The kiln has a capacity of 1,500 nuts per day, and it is producing superior estate copra.

A. MAHESWARA,
Industrial Research Assistant.

REPORT OF THE PLANTING DIVISION

Nurseries. The following quantities of seed-nuts were planted in the Nurseries during the year 1955.

Name of Nursery	*Capacity*	
Ratmalagara ..	178,280	
Carmel and Karaweddana	185,450	
Walpita ..	148,400	
St. Anne's ..	40,000	
Labuduwa ..	39,000	
Hettipola ..	83,000	
Dunugaha and Veyangoda	49,500	
Batticaloa ..	10,000	
Killinochchi ..	85,800	
Kalawewa ..	90,000	
Dematawala ..	149,000	
Wilpotha ..	215,000	
Wennappuwa ..	30,000	
		1,303,430

A 10-acre block of crown land was made available at Karaweddana in Kurunegala District. A large Central Nursery was established here, which was formally opened by the Hon'ble Minister for Agriculture and Food. Pending the final acquisition of the 25 acres of land at Mylambavely Estate, Chenkaladi, for a Nursery and Demonstration Plot, the old nursery site of

the Department of Agriculture at Batticaloa was taken over by us for establishing a Nursery. It is possible to accommodate only a small quantity of seed-nuts in this Nursery. In addition to the land at Mylambavelly Estate, Government has released 25 acres at Koggala, 25 acres of jungle land at Alampil, Mullativu and 12 acres at Eraminigolla, Kegalle, the last being Plant Supply Station of the Department of Agriculture.

Arrangements are being made for nurseries to be established at these Centres without delay. Seedlings will be made available from these nurseries in the coming financial year.

Seedlings. The demand for seedlings continued to be in excess of the available supply and the Coconut Research Board had decided on an equitable allocation to ensure a fair supply of seedlings to all applicants.

About 850,000 seedlings were supplied during the year.

Finance. The following is a Statement of detailed expenditure for the year 1955.

	Rs. c.	*Rs.* c.
Capital—		
Buildings ..	17,120 26	
Vehicles ..	13,599 0	
Tools and equipment ..	1,691 10	
		32,410 36
Salaries		73,421 61
Travelling		19,963 28
Up keep of buildings and machinery		1,518 48
Nursery Working a/c.—		
Seed-nuts	148,959 51	
Transport	28,502 8	
Maintenance	89,843 43	
		267,305 2
		401,753 64

Advisory Work.

Field Days. A Field Day and Exhibition was organised at Udupilla by the Advisory Field Officer, Western Province. It was opened by the Hon'ble Minister for Agriculture and Food.

The Advisory Field Officer at Kurunegala was responsible for organising our Stall at the Kurunegala District Agricultural Exhibition. He also co-operated in the Field Day at Malkaduwa Group, organised at Kurunegala during the Soil Conservation Week.

A large number of estates and small-holdings were visited during the year for general advice.

A large number of requests were received for advice on lining work particularly on the Equilateral Triangular Planting System.

Our Officers have kept in touch with all the organisations such as Rural Development Societies, Co-operative Societies, &c., and periodical visits were paid to these Societies to advise the members on Coconut Cultivation.

The Advisory Field Officer, Chilaw, conducted regular classes for the trainees at the Rural Development Centre at Madampe.

It is gratifying to note that a large number of coconut growers are taking a keen interest in their plantations and I believe that this is due to the good work done by the Field Officers. With the proposed increase of Advisory Officers, it will be possible to give a satisfactory service to all coconut growers.

P. D. L. FERNANDO,
Planting Officer,
Planting and Advisory Division,

REPORT OF PUBLIC RELATIONS OFFICER

Mr. L. R. N. H. Perera was appointed Public Relations Officer with effect from June 16, 1955. Duties assigned to him on appointment were, to act as Assistant Editor, Ceylon Coconut Quarterly, and as Editor, Pol Sangarawa, to revise and edit Planting leaflets, to organize courses of instruction for Conductors and Superintendents and to conduct field days and exhibitions on behalf of the Institute.

Exhibitions.

During the past six months, three exhibitions were participated in.

They are as follows :—

(*a*) Udupila,
(*b*) Kadawatta.
(*c*) Marawila.

Photography.

Mr. D. B. Hettiaratchi was appointed Technical Assistant (Photography) on July 11, 1955, in order to help the Public Relations Officer in preparing photographs for publication and exhibitions. He will also prepare technical films, koda slides and film strips for the purpose of instruction. 230 photographs were prepared during the period, the majority of which were developed, printed and enlarged in our temporary dark-room.

Publications.

The first was the preparation of a Brochure entitled " Research and the Coconut Industry " from material supplied by the Director. This was followed by the printing of a booklet containing papers read at the Coconut Conference on August 29, 1955, in which was included the address of the Governor-General of Ceylon, who declared open the above Conference. The same booklet was translated into Sinhalese and printed as a separate booklet.

The next publication was a brochure in Sinhalese entitled " The Coconut Rehabilitation Project " published and distributed free on October 14, 1955, with the opening of the New Carmel Nursery at Ibbagamuwa.

On a suggestion of the Coconut Research Board a Sinhalese News Sheet entitled " Pol Pawath " was published in November, 1955. This is to continue as a regular quarterly issue. 1,000 copies of the first issue of this paper were found insufficient and 2,500 more copies had to be re-printed in order to meet the demand. The present demand for this News Sheet is in the neighbourhood of 6,000 copies per issue.

Display and Propaganda.

Mr. A. W. Middleditch, the Colombo Plan Audio-visual Expert, came here in July, 1955, in order to instruct the Public Relations Officer and the photographer on visual aid work and photography. The course of instruction lasted one month and a number of display panels were prepared on his advise. More and more display boards are to be prepared and some of these will be on show at the Royal Agricultural Show at Colombo in 1956. It is proposed to make a few film strips during the coming year on directions given by Mr. Middleditch depicting various aspects of the Coconut Industry and Research Progress.

Meetings.

The Public Relations Officer attended a meeting of the Thambarawila Rural Development Society, where he made a speech on "The services rendered by the Coconut Research Institute to the Coconut Growers of Ceylon".

Visitors.

Conducting visitors round the Institute and showing them the work of various Divisions is also a portion of duty of the Public Relations Officer. A few of the parties that were shown round the Institute during the period were :—

A party of students and Teachers from Central School, Lunuwila.

A party of students and Teachers from Bandirippuwa Convent.

A party of students and Teachers from Girls School of Agriculture, Kundasale.

A party representing the Rural Development Societies—from the R. D. Training Centre, Madampe.

L. R. N. H. PERERA,
Public Relations Officer.

REPORT ON THE ESTATES 1955

Ratmalagara Estate

Crops harvested during 1955

Crops	*Nuts from Estate Area*	*Nuts from Research Area*	*Total*	*Avergae 1951 to 1954*	*1954 above or below Average*
I ..	55,974 ..	21,931 ..	77,905 ..	59,474 ..	+31.0
II ..	85,470 ..	33,500 ..	118,970 ..	75,916 ..	+56.7
III ..	84,272 ..	33,518 ..	117,790 ..	99,160 ..	+18.8
IV ..	79,273 ..	30,469 ..	109,742 ..	91,431 ..	+20.0
V ..	54,980 ..	26,237 ..	81,217 ..	78,439 ..	+ 3.5
VI ..	41,340 ..	20,690 ..	62,030 ..	64,514 ..	— 3.8
Total	401,309	166,345	567,654	468,934	−21.0

The crops were disposed of as follows :—

Sold on Contract	..	90,138
Sold to Research	..	4,365
Cured into Copra	..	455,537
Allowance to Staff	..	6,152
Empties and Rejections	..	11,462—2 per cent.
		567,654

The 455,537 nuts cured gave 377 candies 485 lb. of copra, equivalent to an outturn of 1,237 nuts to a candy.

The revenue from Ratmalagara Estate actually accruing in 1955 was :—

Revenue from Estate Management Crops in 1954	Rs. c.	Rs. c.	*Revenue from Research Management Crops in 1954*	Rs. c.	Rs. c.
Sale of Nuts ..	6,770 93		— ..	—	—
Sale of Copra ..	163 97		Sale of Copra ..	5,079 57	
Sale of Sundries ..	264 0		— ..	—	—
		7,198 90			5,079 57
Crops 1955			*Crops 1955*		
Sale of Nuts ..	6,943 30		—	—	
Sale of Copra ..	33,632 56		Sale of Copra ..	12,999 8	
Sale of Sundries	196 29		— ..	—	
Sale of Food Crops	35 13		— ..	—	
Rubber Garden ..	1,279 76		— ..	—	
		42,087 4			12,999 8
		49,285 94			18,078 65

Total revenue for 1955 was thus Rs. 67,364.59.

SUNDRY DEBTORS AND CREDITORS ACCOUNT

Of the income accruing in 1955 and included in the above statement is Rs. 7,198.90 (Estate) and Rs. 5,079.57 (Research) from 1954 crops had been credited to the estate working account for 1954 through sundry debtors account. The estate working account for 1955 does not therefore include this sum.

The following accounts have been credited to the estate working account on account of 1955 crops lying unsold at the end of the year :—

1955 Crops (Estate)	Rs. c.	*1955 Crops (Research)*	Rs. c.
Sale of Nuts	4,923 15	— ..	—
Sale of Copra	407 0	Sale of Copra	4,880 7
Sale of Sunries	2,024 40	Sale of Sundries.. ..	851 96
Rubber Garden	139 26	— ..	—
	7,493 81		5,732 03

The expenditure for the year totalled including depreciation of kilns and animals, Rs. 27,356.05. The cost of production of nuts on the estate area (including depreciation of kiln Rs. 565.14 and animals Rs. 47.25) was Rs. 68.16 per 1,000 nuts.

The Ratmalagara estate working account for 1955 thus shows a balance Rs. 40,955.91.

HENRY J. F. PEIRIS,
Superintendent, Ratmalagara Estate.

Bandirippuwa Estate

Crop harvested during 1955

Crop	*Nuts from Estate Area*	*Nuts from Research Area*	*Total*	*Average 1931 to 1954*	*1954 Average or below Average*
I ..	80,880 ..	14,228 ..	95,108 ..	67,840 ..	+40.2%
II ..	107,850 ..	14,744 ..	122,594 ..	108,371 ..	+13.1%
III ..	107,210 ..	16,157 ..	123,367 ..	131,692 .	— 6.3%
IV ..	108,800 ..	17,599 ..	126,399	117,641 ..	+ 7.4%
V ..	72,959 ..	12,577 ..	85,536 ..	80,951 ..	+ 5.7%
VI ..	49,853 ..	10,823 ..	60,676 ..	63,541 ..	— 4.5%
Total ..	527,552	86,128	613,680	570,036	+ 7.7%

The nuts were disposed of as follows :—

	Nuts	
Sold on contract	83,540	
Sold to Planting Division ..	5,029	
Sold for Research	3,846	
Reserach Nurseries	1,494	
Cured into copra	496,687	
Allowance to staff	17,357	
Empties ..	5,727	0.9%
Total ..	613,680	

The 496,687 nuts cured gave 414 candies 233 lb., of copra and an out-turn of 1,198 nuts to a candy.

The revenue from Bandirippuwa Estate actually accruing in 1955 was—

Revenue from Estate Management Crops in 1954

	Rs. c.	*Rs. c.*
Sale of nuts ..	6,599 44	
Sale of copra ..	4,188 22	
Sale of shells ..	56 0	
		10,843 66

Revenue from Research Management Crops in 1954

	Rs. c.	*Rs. c.*
Sale of nuts ..	72 83	
Sale of copra ..	2,239 62	
— ..	—	
		2,312 45

Crops in 1955

Sale of nuts ..	9,321 92	
Sale of copra ..	43,814 58	
Sale of sundries ..	1,788 68	
		54,925 18
		65,768 84

Crops in 1955

Sale of nuts ..	0 50	
Sale of copra ..	4,638 85	
— ..	—	
		4,639 35
		6,951 80

Total revenue for 1955 was thus Rs. 72,720.64.

SUNDRY DEBTORS AND CREDITORS ACCOUNT

Of the income accruing in 1955, and included in the above statement is Rs. 10,843.06 (Estate) and Rs. 2,312.45 (Research) from 1954 crops had been credited to the Estate working account for 1954 through Sundry debtors account. The Estate working account for 1955 does not therefore include this sum.

The following accounts have been credited to the Estate working account on account of 1955 crops lying unsold at the end of the year :—

1955 Crops—(Estates)	*Rs.*	*c.*	*1955 Crops (Research)*	*Rs.*	*c.*
Sale of nuts	4,762	58	Sale of nuts	232	95
Sale of copra	3,996	36	Sale of copra	5,997	71
Sale of sundries . ..	4,144	79	Sale of sundries . ..	9	35
	12,903	73		6,240	1

The expenditure for the year totalled, including depreciation of kiln and animals to Rs. 30,806.79. The cost of production of nuts in the Estate area (including) the depreciation of Kiln is Rs. 168.12 and animals Rs. 40.81) was Rs. 58.39 per 1,000 nuts.

The Bandirippuwa Estate Working Account for the year 1955 thus shows a balance of Rs. 47,901.48.

D. F. WITHANA,
Superintendent, Bandirippuwa Estate.

ACCOUNTS OF THE COCONUT RESEARCH INSTITUTE FOR THE YEAR ENDED DECEMBER 31, 1955

The Chairman,

Coconut Research Board,

Peradeniya.

No. P-2 (3) 13.

The Accounts of the Coconut Research Institute for the year 1955 were audited under my direction. The Balance Sheet as at December 31, 1955, was rendered for audit in November, 1956, together with the connected financial statements as detailed below :—

(i) Research Account,

(ii) Working Accounts of—

(*a*) Bandirippuwa Estate,
(*b*) Ratmalagara Estate,
(*c*) Nursery,

(*d*) Planting Division,

(*e*) Animal Husbandry,

(*f*) Provident Fund,

(*g*) Medical Aid, and,

(iii) Capital Expenditure Account.

These have been examined and compared with the books kept by the Institute and found to be in order. The Balance Sheet has been certified by me subject to the observations in this report and is returned herewith along with the connected statements.

Revenue Account

2. (*a*) *Cess Collections—Rs. 1,482,001.22.*—The cess revenue for the year under review was Rs. 1,482,001.22 as compared with Rs. 983,269.97 in the previous year. The increase of Rs. 498,731.25 reflects the increase in export volume of Coconut Products in 1955.

(*b*) *Interest on Investments.*—Rs. 40,669.89—This amount has been overstated by Rs. 452.05. The correct figure should be Rs. 40,217.84. The interest on investments for the previous year was 17,719.61. The increase was due to the following additional investments made in December, 1954, and during the year under review :—

		Rs.	*c.*
(i) 3½% National Housing Debentures 1969/79 (1.12.1954)	..	450,000	0
(ii) 3¼% Ceylon Government Loan 1975/80 (15.12.55)	..	750,000	0
(iii) 3% Ceylon State Mortgage Bank Debentures (7.11.55)	..	150,000	0
(iv) 2% Bank of Ceylon Fixed Deposit (8.10.1955)	..	550,000	0

3. *Estate Working Accounts—Profits from Estates: Bandirippuwa, Rs. 47,901, Ratmalagara, Rs. 40,422.24*—The working accounts of the Estates show a profit of Rs. 88,323.72 as compared with the profit of Rs. 98,110.04 for the previous year. The decrease of Rs. 9,786.32 was mainly due to a fall in the average local selling price of coconuts from Rs. 142 per 1,000 nuts in 1954 to Rs. 115 per 1,000 nuts in 1955. Another factor which caused a decrease in profits was a change in the accounting procedure, whereby the Estates' shares of contributions to the Provident Fund were, for the first time, charged to the respective Estates' Working Accounts, included in the item "General Charges", instead of to the Revenue Account of the Institute as in previous years.

4. *Research Nurseries, Rs. 1,711.30*—The practice up to last year had been to show in the Revenue Account of the Institute the net result of the working of these nurseries supported by a separate Nursery Working Account in which was shown the income and expenditure on this activity. A different accounting procedure has been adopted in the year under review, in that while the income of this activity for the year appears in the "Nursery Working Account" as usual, its expenditure is included in the Revenue Account of the Institute, merged in the items of expenditure appearing in the latter account. Consequently the grouping together of the Bandirippuwa and Ratmalagara Estates with Research Nurseries under the heading "Working Accounts" appearing on the credit side of the Revenue Account is misleading, as the amounts shown against the two

estates represent their net working results for the year, i.e., gross income less expenditure, as they should, whereas the amount shows against Research Nurseries represents the gross income without deducting the connected expenditure.

5. *Animal Husbandry Division, Rs. 3,858,86*—The loss in this Division was Rs. 3,858.86 : compared to the loss of Rs. 2,781.09 in the previous year. As this activity is primarily concerned with research and the produce, e.g., milk, is sold to the staff at a nominal rate of 25 cts. per pint losses are not unusual. Additional expenditure had also to be incurred in 1955 on the New Animal Husbandry Division opened in Ratmalagara Estate.

The loss would be increased if the salaries and allowances of the staff together with contributions to the Provident Fund are debited to this account as in the case of the other working accounts, namely, Bandirippuwa and Ratmalagara Estates, and Planting Division. It is desirable to adopt a uniform procedure in the case of all working accounts.

6. *Planting Division Working Account, Rs. 315,788.98*—This account shows as income the grant of Rs. 500,000 given by the Director of Agriculture from the provision under Head 82, Vote 1, Sub-head 15 of 1955-56 Estimates and Rs. 210,125.40 and Rs. 2,473.79 being the proceeds of the sale of seedlings and copra respectively. The expenditure incurred on the Planting Division amounted to Rs. 396,810.21, leaving a balance of Rs. 315,788.98 as at December 31, 1955, which has been transferred to the Surplus Account.

With reference to para 2 (*d*) of the Audit Report on the Accounts for 1954, the fixed assets comprising buildings, plant, machinery, tools, furniture, fittings, &c., which were acquired for this Division from the funds provided by the Director of Agriculture, and whose book value on December 31, 1955 amounted to Rs. 265,385.04, have been treated as assets belonging to the Institute and shown as such in the Balance Sheet. These assets had, however, not been verified by a Board of Survey before they were included in the accounts of the Institute.

The total number of seed nuts planted during the year was 1,303,430 out of which 453,430 were rejected as unsuitable and destroyed. The average cost of raising seedlings by the Institute during the year under review was 69 cts. each as compared with 86 cts. during 1954. The seedlings were sold during the year at a subsidized rate of 30 cts. each. The unsold seedlings at the end of the year 1955 were carried forward to the following year but their value is not shown in the Balance Sheet at December 31, 1955.

It is desirable that the unsold seedlings in stock in the nurseries at the end of each year should be verified and their value shown in the Working Account and the Balance Sheet.

7. *Books and Periodicals—Rs. 10,283.44.* At present the books and periodicals in stock are not shown in the balance sheet as the practice is to charge their cost of purchase in full to the Revenue Account. It is suggested that while continuing to charge the cost of new books to the Revenue Account, the asset may be included in the Balance Sheet at a nominal figure of say Rs. 10.00.

8. *Running expenses of the Electric Plant Rs. 14,028.11.* This sum includes, in addition to the cost of maintenance and operation of the electric plant installed at Bandirippuwa Estate, a sum of Rs. 1,872.58 paid to the Department of Government Electrical Undertakings for the supply of A.C. Current to the office and laboratories. The description of the item might be suitably amended.

9. *Capital Expenditure—Rs. 446,298.57.* Included in the above amount are the following items of expenditure for which there was no provision in the approved estimates of the Board for 1955 :—

	Rs.	*c.*
(*a*) Buildings, Ratmalagara Estate	18,436	73
(*b*) Bungalow for Field Assistant to Soil Chemist	18,134	27
(*c*) Superintendent's bungalow at Ratmalagara Estate ..	17,933	66
(*d*) Laboratory Extensions	128,292	5

10. *Balance Sheet.* This amount represents the interest accrued on Bank of Ceylon Fixed Deposits amounting to Rs. 550,000 and in Savings Certificates of a total cost of Rs. 25,000.00.

11. *Investments—Rs. 2,458,187.38.* Investments in Government Loan Stocks and State Mortgage Bank Debentures have been shown at cost in the Balance Sheet. Their middle market values as at December 31, 1955, are given below :

Investments	*Cost*	*Face Value*	*Middle Market Rate*	*Middle Market value*
	Rs.	*Rs.*	*Rs.*	*Rs. c.*
3% Sri Lanka Loan 1969/74 ..	2,000 ..	2,000 ..	98 3/16 ...	1,963 75
3½% National Housing Debentures 1969/71	450,000 ..	450,000 ..	108 1/8 ..	473,062 50
2¼% Ceylon Government National Development Loan.. ..	125,000 ..	125,000 ..	92 11/16 ..	115,859 38
Do.	250,000 ..	250,000 ..	92 11/16 ..	231,718 76
3¼% Ceylon Government Loan ..	750,000 ..	750,000 ..	100 ..	750,000 0
3% Ceylon Government Loan ..	150,000 ..	150,000 ..	98 7/8 ..	148,312 50
3% Ceylon State Bank Debentures ..	150,000 ..	150,000 ..	49 5/16* ..	149,812 50
3% Do.	5,000 ..	5,000 ..	49 5/16* ..	4,993 75
Total ..	1,882,000	1,882,000		1,875,623 14

It is desirable to indicate in the Balance Sheet the basis of valuation of the investments shown therein and also to show separately in a foot note the total face value of the holdings and their middle market value. This information is necessary for a proper appreciation of the value of this asset and the suggestion was first made in the Audit Report on the accounts for 1952-53 and repeated in the Audit Report for 1953-54 but does not appear to have received the consideration of the Board.

12. *Unauthorised Expenditure*—The expenditure exceeded the sanctioned estimate in respect of several items as indicated in the statement annexed It has been repeatedly pointed out in audit reports that the practice of incurring expenditure in excess of the approved provisions in the annual estimates without prior approval of the Board is irregular but so far the matter does not seem to have received the consideration of the Board.

13. *Delay in rendering accounts, 1955*—The delay in certification of the accounts for the year is due to the original accounts received on September 3, 1956, having to be returned for amendment on October 25, 1956. The amended acccounts were furnished for audit on November 5, 1956.

The early rendering of the annual accounts for audit should receive the attention of the Board.

D. S. DE SILVA,
Auditor-General.

Audit Office,
Colombo 7, December 15, 1956.

Statement of Excess Expenditure (C. R. I.)

Item	*Estimate*	*Supplementary Provision*	*Total Provision*	*Expenditure*	*Excess*
Capital—	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.
1. Soil Chemist ..	5,120 0..	11,150 0..	16,270 0..	7,557 27	—
Buildings—					
(2) Bandirippuwa ..	75,710 0..	4,000 0..	— ..	— ..	—
		10,485 0..	— ..	— ..	—
		14,495 0..	90,205 0..	89,039 43..	—
Ratmalagara Bungalow ..	17,000 0..	— ..	17,000 0..	18,436 73..	1,436 73
(3) Senior Staff Bungalow Bot. Division ..	— ..	52,635 0..	52,635 0..	26,445 13..	—
Furniture—					
Chemist	975 0..	1,000 0..	1,975 0..	1,225 0..	—
S. Chemist ..	975 0..	500 0..	1,475 0..	1,402 72..	—
Agro's furniture and equipment	— ..	4,000 0..	4,000 0..	3,449 9..	—
Seed Garden Demonstration	37,500 0..	4,100 0..	41,600 0..	41,846 40..	246 40
Centre Mundel ..	— ..	422 21..	422 21..	422 21..	—
Office—					
Stationery ..	8,000 0..	— ..	— ..	9,343 45..	—
Printing and Advertisement	9,000 0..	9,725 0..	30,725 0..	11,499 69..	—
Postage	4,000 0..	— ..	— ..	4,256 80..	—
Incidental ..	— ..	— ..	— ..	1,075 77..	—
	21,000 0				26,175 71
Chemicals and Glassware ..	18,250 0..	4,500 0..	— ..	— ..	—
		6,500 0..	— ..	— ..	—
		11,000 0..	29,250 0..	30,399 82..	1,149 82
Books and Period ..	8,000 0..	3,000 0..	11,000 0..	10,355 59..	—
Res. and Chemicals ..	4,000 0..	1,000 0..	5,000 0..	4,086 84..	—
Entertainment all P.R.O's Photographer ..	400 0..	125 0..	525 0..	455 30..	—

Statement of Excess Expenditure (C. R. I.)—(*contd.*)

Item	*Estimate*		*Supplementary Provision*		*Total Provision*		*Expenditure*		*Excess*	
Capital—	*Rs.*	*c.*	*Rs.*	*c.*	*Rs.*	*c.*	*Rs.*	*c.*	*Rs.*	*c.*
Equipment and materials	2,100	0	2,100	0	4,200	0	4,327	43	127	43
Meteor Equipment	—		5,000	0	5,000	0	1,875	47	—	
Library Shelves	3,000	0	3,000	0	6,000	0	4,281	0	—	
Lab. Furniture and Equipment	—		30,250	0	30,250	0	1,850	0	—	
Director's Furniture	—		800	0	800	0	800	0	—	
Agro's Furniture	—		11,000	0	11,000	0	4,798	5	—	
P.R.O's Exhibitions and Field Days	500	0	500	0	1,000	0	985	14	—	
Royal Agricultural Show	500	0	500	0	1,000	0	530	22	—	
Agro's Bungalow Furniture	—		4,000	0	4,000	0	4,767	86	767	86
Agro's Expts.	—		200	0	—		—		—	
	—		800	0	—		—		—	
	—		720	0	1,720	0	1,471	30	—	
Chemist's Lab. Fitting and Furniture	—		30,250	0	30,250	0	16,252	86	—	
Venetian Blinds	—		650	0	650	0	404	66	—	
F. A. to S/Chemists Bungalow R/E	—		—		—		18,134	27	—	
Superintendent's Bungalow R/E	—		—		—		17,933	66	—	
Lab. Expenses	—		—		—		128,292	5	—	
Research Reserve Fund	250,000	0	—		250,000	0	365,000	0	115,000	0
Passage	1,000	0	—		1,000	0	2,000	0	1,000	0

COCONUT RESEARCH INSTITUTE

Balance Sheet as at December 31, 1955

LIABILITIES	Rs. c.	Rs. c.
1. *Capital Outlay :*		
Institute's at December 31, 1954 ..	1,238,400 70	
In 1955 ..	446,298 57	
		1,684,699 27
Planting Livision at December 31, 1954 ..	265,385 4	
In 1955 ..	32,628 18	
		298,013 22
2. *Reserves :*		
Depreciation at December 31, 1954 ..	175,605 81	
In 1955 Institute's ..	15,279 83	
In 1955 Planting Division ..	17,783 34	
		208,668 98
Passage at December 31, 1954 ..	6,000 0	
In 1955 ..	2,000 0	
		8,000 0
Research at December 31, 1954 ..	365,000 0	
In 1955 ..	350,000 0	
		715,000 0
Medical Aid Reserve under Rule 14 at		
December 31, 1954 ..	10 0	
In 1955 ..	77 0	
		87 0
3. *Provident Fund :*		
Officers' contribution and interest ..	180,353 4	
Institute's Bonus and Interest ..	179,360 15	
		359,713 19
4. *Medical Aid Fund :*	7,901 19	7,901 19
5. *Current Provisions and Liabilities :*		
Sundry Creditors	64,898 11	

ASSETS	Rs. c.	Rs. c.
1. *Fixed Assets :*		
Buildings ..	1,045,926 37	
Estates ..	393,285 13	
Estate Kilns ..	15,604 96	
Animal Husbandry Equipment ..	7,783 57	
Laboratory Equipment ..	206,763 39	
Power Plant ..	88,043 38	
Fences and Wells ..	3,367 20	
Gas Plant ..	8,221 77	
Museum ..	3,276 20	
Furniture—Bungalow ..	51,452 1	
Furniture—Office ..	441,133 89	
Machinery ..	43,551 90	
Tools ..	3,538 37	
Vehicles ..	70,764 35	
		1,982,712 49
2. *Current Assets :*		
Cess collections due in 1955 ..	133,094 4	
Sundry debtors ..	140,980 10	
Accrued Interest on Investments ..	4,082 5	
Transport Loans ..	40,147 75	
General Stores Advance ..	1,126 44	
Travelling Advance ..	1,944 15	
		321,374 53
3. *Investment at Cost :*		
Government Stock ..	1,727,000 0	
Savings Banks ..	1,187 38	
Savings Certificates ..	25,000 0	

Furniture Advance Account	..	895 99	65,794 19	Fixed Deposit	..	.. 550,000 0	
6. *Surplus Account :*				Debentures—State Mortgage Bank		.. 155,000 0	
Institute's	..	.. 980,118 34					2,458,187 38
Planting Division	..	.. 722,732 92		4. *Cash Balance :*			
			1,702,851 26	Bank of Ceylon No. 1 account		.. 178,897 51	
				Bank of Ceylon No. 2 account		.. 24,997 40	
				Bank of Ceylon Imprest account		.. 74,557 0	
				Cash in hand	..	.. 10,001 90	
							288,453 81
			5,050,728 21				5,050,728 21

Certified Correct :
S, C. KAHAWITA,
Secretary-Accountant,
Coconut Research Institute.

The accounts of the Coconut Research Institute for the year ended December 31, 1955, have been audited under my direction. Subject to the observations contained in my report No. P 2 (3)—13 dated December 15, 1956, made to the Chairman, Board of Management of the Coconut Research Institute, I am of opinion that the Balance Sheet and Financial Statements above set forth have been drawn up so as to present fairly the financial position of the Institute as at December 31, 1955, and the results of its operations for the year ended on that date.

Audit Office,
Colombo 7, December 15, 1956.

D. S. DE SILVA,
Auditor-General.

Revenue Account (1955)

EXPENDITURE	Rs. c.	Rs. c.
1. *Personal Emoluments :*		
Institute salaries	188,128 17	
Living allowance	91,553 78	
Rent allowance	6,474 67	
Provident Fund bonus and interest	37,388 38	
Medical Aid Fund	2,796 0	
Coconut allowance to staff	2,458 47	
Recreation	500 0	
		329,299 47
2. *Other Charges :*		
Travelling—Board Members	3,645 60	
Staff	40,483 6	
		44,128 66
3. *Office :*		
Stationery	8,276 31	
Postage	3,032 89	
Printing and advertising	6,043 51	
Cost of Audit	3,000 0	
Telephone rental	295 0	
Entertainment allowance	455 30	
Workmen's Compensation Insurance	427 86	
Office upkeep	524 31	
Ceylon coconut, quarterly	4,515 93	
Incidental Expenses	604 51	
Coconut Conference, &c.	6,285 48	
		33,461 10
4. *Building and Machinery :*		
Upkeep	15,796 30	
Insurance	2,880 13	
Running Expenses of Electric Plant	14,028 11	
Upkeep of vehicles	1,924 62	
		34,629 16
5. *Laboratories and Library :*		
Books and periodicals	10,283 44	
Laboratory upkeep	30,523 66	
		40,807 10
		482,325 49

REVENUE	Rs. c.	Rs. c.
1. Government Grant under section 6-1 (*b*)		30,000 0
2. Cess collection		1,482,001 22
2. Interest on investments		40,669 89
4. Sale of coconut, quarterly		2,168 39
5. Sale of publications		187 22
6. Charges to staff for electricity		1,921 50
7. Sundry receipts		19,530 75
8. *Working Accounts :*		
Bandirippuwa Estate	47,901 48	
Ratmalagara Estate	40,422 24	
Research nurseries	1,711 30	
	90,035 2	
Less loss—		
Working account, Animal Husbandry	3,858 86	
		86,176 16
		1,662,655 13

6. *Research :*			
Chemist	4,086 80		
Botanist	20,632 8		
Soil Chemist	8,789 78		
Pasture	22,114 66		
Industrial Research	642 88		
Agronomist	6,269 35		
		62,535 55	
7. *Reserves :*			
Depreciation	14,129 85		
Passage	2,000 0		
Overseas training	119 0		
Research Fund	350,000 0		
		366,248 85	
		911,109 89	
Excess Revenue over Expenditure in 1955 ..		751,545 24	
		1,662,655 13	1,662,655 13

Medical Aid Fund Working Account, 1955

	Rs. c.	*Rs.* c.		*Rs.* c.	*Rs.* c.
Medical Aid Bills paid	3,865 53		*Medical Aid Fund Contribution :*		
Less refunds	36 95		By Staff	3,697 0	
		3,828 58	Board	3,697 0	
Transfer of Reserve Fund (1954 Account) ..	5 0				7,394 0
Transfer to Reserve Fund	72 0				
Refund to members leaving	72 0				
		149 0			
Balance	..	3,416 42			
		7,394 0			7,394 0

Research Nursery Working Account, 1955

	Rs. c.	Rs. c.		Rs. c.	Rs. c.
Transferred to Revenue Account ..		1,711 30	By sale of seedlings	1,321 70	
			sale of seednuts	250 90	
			transport charges	138 70	
					1,711 30
		1,711 30			1,711 30

Animal Husbandry Division Working Account, 1955

Expenditure	Rs. c.	Rs. c.	Income	Rs. c.	Rs. c.
1. *Cattle :*	3,199 45		1. *Cattle :*		
Food	2,791 50		By sale of milk	4,999 47	
Medicine and ropes	1,213 7		sale of curd and ghee ..	331 15	
Sheds	846 18		sale of animals	1,021 0	
		8,050 20	sale of manure	127 50	
2. *Poultry :*			sale of grass	33 60	
Labour	857 18				6,512 72
Food	1,259 7		2. *Poultry :*		
Troughs	734 63		By sale of eggs	662 95	
		2,850 88	sale of birds	180 48	
3. *Pigs :*					843 43
Expenditure	825 27		3. *Pigs :*		
		825 27	By sale of piglings	840 0	
4. *Depreciation :*					840 0
Equipment for cattle	259 70		4. Revenue Account (transferred) ..	..	3,858 86
Equipment for poultry	68 96				
		328 66			
		12,055 1			12,055 1

Estate Working Accounts for 1955

Bandirippuwa Estate

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
General charges	13,415 98		By sale of nuts	14,084 50	
Upkeep	7,803 87		sale of copra	47,810 94	
Collection	6,404 66		sale of sundries	5,933 47	
Cultivation	2,973 35				67,828 91
		30,597 86	2. *Research Area :*		
2. *Depreciation :*			By sale of nuts	233 45	
Kilns	168 12		sale of copra	10,636 56	
Animals	40 81		sale of sundries	9 35	
		208 93			10,879 36
3. Revenue Account (transferred) ..		47,901 48			
		78,708 27			78,708 27

Ratmalagara Estate

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
General charges	12,925 26		By sale of nuts	11,866 45	
Upkeep	4,772 7		sale of copra	34,039 56	
Collection	4,096 31		sale of sundries	2,148 89	
Cultivation	4,587 26				48,054 90
		26,380 90	2. *Research Area :*		
2. *Food Crops :*			By sale of copra	17,879 15	
Expenditure	100 2		sale of sundries	851 95	
		100 2			18,731 10
3. *Depreciation :*			3. *Rubber Seed Garden :*		
Kiln	565 14		Income..	1,419 2	
Animals	47 25		*Less* Expenditure	796 40	
		612 39			622 62
4. Revenue Account (transferred) ..		40,422 24	4. *Food Crops*	..	106 93
		67,515 55			67,515 55

Planting Division Working Account, 1955

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Seed-nuts Account :*			Planting Division Grant	..	500,000 0
Cost of seed nuts	149,837 61		Sale of seedlings	..	210,125 40
2. *Transport :*		149,837 61	Copra from rejected seedlings ..	2,496 90	
Selection and transport	28,378 33		*Less* Cess	23 11	
Less recoveries	2,342 45				2,473 79
		26,035 88			
3. *Vehicles and Buildings :*					
Depreciation	17,783 34				
Vehicle Insurance	773 5				
Vehicle upkeep	1,518 48				
		20,074 87			
4. *Nurseries :*					
Maintenance	89,543 43				
Workmen's Compensation Insurance ..	393 50				
		89,936 93			
5. *Personal Emoluments :*					
Salaries	38,466 57				
Rent allowance	3,356 22				
Living allowance	29,532 78				
Contribution to Medical Aid Fund ..	901 0				
Providend Fund Bonus and Interest ..	7,963 72				
		80,200 29			
6. *Travelling :*					
Staff	20,059 58				
Board	1,500 0				
		21,559 58			
7. *Office :*					
Postage	1,239 64				
Printing and advertising ..	5,749 10				
Stationery	1,067 14				
Books and periodicals	72 15				
Office upkeep	38 65				
Incidental Expenses	465 26				
Surveying and legal fee ..	532 91				
		9,165 5			
		396,810 21			
8. *Surplus :*					
Transferred to Surplus Account		315,788 98			
		712,599 19			712,599 19

Capital Expenditure Account, 1955

Capital Expenditure on Revenue Account

		Rs.	c.	Rs.	c.		Rs.	c.
1.	*Laboratory :*					Transferred to Surplus Account ..	446,298	57
	Equipment		..	58,040	6			
2.	*Buildings*		..	178,275	10			
3.	*Laboratory extension*		..	128,292	5			
4.	*Furniture and Fittings :*	Rs.	c.					
	Bungalows	11,421	11					
	Office	15,918	89					
				27,340	0			
5.	*Improvements to Estates :*							
		Rs.	c.					
	Bandirippuwa ..	6,960	78					
	Ratmalagara ..	5,134	13					
	Isolated seed garden ..	41,864	40					
				53,959	31			
6.	*Electricity and Water Supply :*							
	Tools	303	75					
	Machinery and Vehicles	88	30					
				392	5			
				54,351	36			
				446,298	57		446,298	57

Capital Adjustments

	Rs.	c.		Rs.	c.
Capital outlay as at December 31, 1954 ..	1,274,927	28	*Amount written off in 1955 :*		
			Value of copra kiln dismantled ..	1,432	91
			Co-operative nurseries	35,093	67
			Adjusted capital outlay as at December 31, 1954	1,238,400	70
	1,274,927	28		1,274,927	28

Planting Division Capital Account, 1955

		Rs. c.	Rs. c.	Rs. c.		Rs. c.
1.	*Assets acquired prior to 1955 taken over in 1955 :*				1. Transferred to Balance Sheet Capital Outlay ..	265,385 4
	Buildings ..	165,609 86			2. Transferred to Surplus Account	32,628 18
	Less depreciation ..	7,236 99				
			158,372 87			
	Bungalow furniture ..	7,334 52				
	Less depreciation ..	521 99				
			6,812 53			
	Office equipment ..	11,782 26				
	Less depreciation ..	1,134 41				
			10,647 85			
	Vehicles ..	75,401 59				
	Less depreciation ..	31,456 12				
			43,945 47			
	Tools	4,677 47				
	Less depreciation. ..	2,830 20				
			1,847 27			
	Machinery ..	46,840 35				
	Less depreciation ..	6,448 50				
			40,391 85			
	Fencing and wells ..	3,828 20				
	Less depreciation ..	461 0				
			3,367 20			
				265,385 4		
2.	*In 1955 :*					
	Buildings ..	17,120 26				
	Improvements to estates	217 82				
	Vehicles ..	13,599 0				
	Tools	1,691 10				
			32,628 18			
				32,628 18		
				298,013 22		298,013 22

Planting Division Surplus Account as at December 31, 1955

	Rs. c.		Rs. c.
Revenue Adjustments :			
Repayment of Advance from Institute	35,135 50	Sale of seedlings, 1954	30,257 80
Refunds for seedlings, 1954	308 40	Transport charges, 1954	37 50
Capital Expenditure in 1955	32,628 18	Surplus on 1955 working account	315,788 98
Net surplus in 1955	278,012 20		346,084 28
	346,084 28		
		Net surplus in 1955	278,012 20
		Surplus previously from Balance Sheet	444,720 72
		Surplus as at December 31, 1955, transferred to Balance Sheet .	722,732 92

Coconut Research Institute Surplus Account as at December 31, 1955

	Rs. c.		Rs. c.
Revenue Adjustments :			
Revenue adjustments (General stores)	64 62	Air Passage—Animal Husbandry Officer	230 0
Electricity charges	1 0	Wreaths, 1954	50 0
Sale of seedlings	9 0	Sundry creditors purchase control in 1953	50 0
Travelling advance	75 0	Chemist's glassware, 1954	112 0
	149 62	Botanist seedlings, 1954	115 0
Capital Expenditure, 1955	446,298 57	Ratmalagara Estate Copra Kiln written off	1,432 91
			1,989 91
	446,448 19	Revenue Account Surplus, 1955	751,545 24
Net surplus in 1955	307,086 96		
	753,535 15		753,535 15
		Net surplus in 1955	307,086 96
		Previously from Balance Sheet	673,031 38
		Surplus as at December 31, 1955, transferred to Balance Sheet ..	980,118 34

Provident Fund Account for the Year 1955

	Rs. c.	Rs. c.	Rs. c.
1. *Officers' Contribution and Interest :*			
Balance as at December 31, 1954 ..	..	140,185 98	
Contributions in 1955 ..	33,674 81		
Interest in 1955 ..	6,958 28		
		40,633 9	
		180,819 7	
Less refunds in 1955—			
A. D. Piyasena	374 53		
H. M. N. de Silva	54 0		
S. Sivarajasingham	37 50		
		466 3	
			180,353 4
2. *Institute's Bonus and Interest :*			
Balance as at December 31, 1954 ..	..	139,855 63	
Bonus in 1955	33,437 81		
Interest in 1955	6,283 42		
		39,721 23	
		179,576 86	
Less refunds in 1955	..	216 71	
			179,360 15
Total Fund as at December 31, 1955 ..	..	..	359,713 19