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Annual Report of the Coconut Research Board of the Coconut Research Institute for 1953

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ANNUAL REPORT OF THE COCONUT RESEARCH BOARD OF THE COCONUT RESEARCH INSTITUTE FOR 1953

THE present report is the twenty-fifth Annual Report of the Coconut Research Institute which was established by Ordinance No. 29 of 1928, dated December, 1928. Its compilation has again been delayed by the late receipt of the audited accounts which form an integral part of the report under the terms of the Ordinance.

REPORT OF THE CHAIRMAN

Coconut Research Board

On January 1, 1953, the Coconut Research Board consisted of the following members:—

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

Treasury Representative: Mr. W. J. A. Van Langenberg, C.C.S., M.B.E.

Chairman, L. C. P. A.: Mr. S. Pathmanathan (ex-officio).

Senators and Members of the Parliament nominated by the Honourable Minister—

Mr. N. H. Keerthiratne, M.P.
Mr. R. Singleton Salmon, M.P., O.B.E., E.D.

Representative of the Low Country Products' Association of Ceylon—

Mr. A. Gnanapragasam, B.A. (London).
Mr. C. A. Abeyratne, J.P.

Representatives of the Planters' Association of Ceylon—

Mr. R. H. Spencer Schrader, J.P.
Col. W. G. Mack, O.B.E., E.D.

Representatives of the Small-holders nominated by the Honourable Minister—

Mr. C. A. M. de Silva,
Mr. E. Muttukumaru.

Director of the Coconut Research Institute of Ceylon—

Mr. F. C. Cooke, A.R.C.S., B.Sc. (Lond.), A.M.I.Chem. E., E.D. (on furlough).
Dr. M. L. M. Salgado, Ph.D., B.Sc. (Lond.), Dip. in Agric. (Cant.), Acting.

Mr. S. Pathmanathan continued to serve on the Board on his re-election as Chairman of the L. C. P. A. for 1953.

Mr. C. A. Abeyratne, J.P., ceased to be a member of the Board on November 1, 1953. Mr. R. H. de Mel, succeeded Mr. Abeyratne.

Mr. F. C. Cooke, Director, was on overseas leave in the first two months of the year. Dr. M. L. M. Salgado, Acting Director, served on the Board during this period.

Meetings

Seven meetings of the Coconut Research Board were held during the year. On January 27, March 8 (Emergency), May 20, August 1, October 17, November 27 and December 18.

Committees

Administrative Committee—(Personnel at January 1)

(1) Dr. A. W. R. Joachim, O.B.E.
(2) Mr. W. J. A. Van Langenberg, C.C.S., M.B.E.
(3) Mr. S. Pathmanathan
(4) Mr. C. A. M. de Silva
(5) Mr. A. Gnanapragasam
(6) M. F. C. Cooke, E.D., Director, C.R.I.

Four meetings were held.

Research Committee—(Personnel at January 1)

(1) Mr. E. Muttukumaru (Chairman)
(2) Mr. R. H. Spencer Schrader, J.P.
(3) Mr. A. Gnanapragasam
(4) Mr. R. Singleton Salmon, M.P., O.B.E., E.D.
(5) Mr. F. C. Cooke, Director, C.R.I.

Four meetings were held.

Extension Committee—(Personnel at January 1)

(1) Mr. C. A. M. de Silva (Chairman)
(2) Col. W. G. Mack, O.B.E., E.D.
(3) Mr. N. H. Keerthiratne, M.P.
(4) Mr. C. A. Abeyratne, J.P.
(5) Mr. S. Pathmanathan
(6) Mr. E. Muttukumaru
(7) Mr. F. C. Cooke, E.D., Director, C.R.I.

Three meetings were held.

Buildings Committee (Laboratory Extension)—Personnel.

(1) Dr. A. W. R. Joachim, O.B.E.
(2) Mr. W. J. A. Van Langenberg
(3) Mr. C. A. M. de Silva
(4) Mr. F. C. Cooke, E.D., Director, C.R.I.

Welfare Committee—

(1) E. Muttukumaru (Chairman)
(2) Mr. C. A. M. de Silva
(3) Mr. R. H. Spencer Schrader, J.P.
(4) Mr. F. C. Cooke, E.D., Director, C.R.I.

Eastern Province Tour

In a three-day tour the members of the Board accompanied by the technical staff of the Institute visited the coconut areas in the Eastern Province during the first week of July. Public meetings of proprietors of coconut estates and representatives of the Coconut Producers' Societies, Rural Development Societies and a visit to the Gal Oya Valley were included in the programme.

Annual Reports and Accounts

The Director's Report, which embodies the report of the various Divisional Heads and the Balance Sheet, showing the assets and liabilities of the Board, together with its income and expenditure account, duly audited as required under the Ordinance, are attached.

A. W. R. JOACHIM,
Chairman,
Coconut Research Institute of Ceylon.

REPORT OF THE DIRECTOR (1953)

Staff

The Staff of the Coconut Research Institute at the end of 1953 was as follows:—

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

ADMINISTRATION DIVISION

Secretary/Accountant: Mr. S. C. Kahawita, B.Com. (Lond.).
Accounting Assistant: Mr. K. C. de Pinto.

SOIL CHEMIST'S DIVISION

Soil Chemist: Dr. M. L. M. Salgado, B.Sc. (Lond.), Ph.D. (Cantab), Dip. Agric. (Cantab.).
Research Assistant: Mr. D. A. Nethsinghe, B.Sc. (Ceylon).

CHEMIST'S DIVISION

Chemist: Mr. W. R. N. Nathanael, B.Sc. (Lond.). ✓
Research Assistant: Mr. T. S. Balakrishnamurti, B.Sc. (Ceylon).

BOTANIST'S DIVISION

Botanist: Dr. D. V. Liyanage, B.Sc. (Lond.), Ph.D. (Manch.). ✓
Research Assistant: Mr. C. A. Wickramasuriya, B.Sc. (Ceylon).

PLANTING AND ADVISORY DIVISION

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

ANIMAL HUSBANDRY DIVISION

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

ESTATES DIVISION

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

Superintendent, Bandirippuwa Estate: Mr. W. D. Frederick Withana.

MECHANICAL DIVISION

Senior Mechanic: Mr. R. Weerpermall.

Mr. F. C. Cooke resumed duties as Director, Coconut Research Institute on March 1, 1953, relieving Dr. M. L. M. Salgado who acted as Director during Mr. F. C. Cooke's absence.

Dr. D. V. Liyanage, Acting Botanist, resumed duties on June 30, after a post-graduate course in Plant Breeding under Professor Harland at the Manchester University, where he was awarded the Ph.D. degree.

Messrs. H. L. L. Perera, Advisory Field Officer (Negombo) and J. K. F. Kirthisinghe, Field Assistant to the Botanist, underwent a course of 6 months training in Crop Protection under the C-Plan Scheme.

Field Days

Two field days for the members of the Chilaw/Negombo P. A. were held on June 4, 1953, at Bandirippuwa Estate and on August 7, 1953, at Ratmalagara Estate. An artificial rain demonstration in the field was conducted by the British Overhead Irrigation Equipment at Ratmalagara Estate.

The following new appointments were made during the year:—

Mr. S. Jayawickrama, T.A. to Chemist.
Mr. V. Abeywardena, T. A. (Computer).
Mr. M. A. P. P. Manthiriratne, T. A. to Botanist.
Mr. A. D. Piyasena, T. A. to Chemist.
Mr. G. E. R. Dabrera, Field Assistant to Botanist.

Mr. C. W. S. de Silva was promoted as Assistant Planting Officer with effect from February 1, 1953. Mr. R. W. Senaratne succeeded Mr. de Silva as Senior Field Assistant to the Botanist.

The following officers left the service of the Institute during the year:—

Mr. M. N. Jamaldeen, Junior Clerk, Planting Division.
Mr. S. Jayawickrama, T. A. to Chemist.
Mr. O. D. S. Jayawardena, Field Assistant to the Planting Officer.
Mr. C. Marasinghe, Nursery Attendant to the Planting Officer.
Mr. S. Anthony Pillai, Nursery Attendant to the Planting Officer.

Publications

The following articles were published in the Ceylon Coconut Quarterly by officers of the Institute:—

Abeywardena, V.—

Is it statistically significant?

Cooke, F. C.—

Ceylon's greatest industry.
Your Job—Service before Self.
Value of Research.

de Silva, C. W. S.—
Cattle damage to coconuts.

Francis, K. M.—
Watering of coconut nurseries.

Fernando, P. D. L.—
Our Advisory Service.

Frederick, W. D.—
Reverse slope drains.

Ganarajah, T.—
Planting coconuts on old rubber lands.
Why are my palms yellow?

Gooneskera, G. C. M.—
Pastures under coconuts.
Grazing habits of indigenous cattle.

Liyanage, D. V.—
Selection of coconut seed-nuts and seedlings.
An isolated seed garden for coconuts.

Nathanael, W. R. N.—
Exports of coconut products.
Rainfall and crop figures.
Plant nutrients.
Toddy effluents from distilleries.

Rodrigo, R. B.—
Access to remote coconut areas.

Salgado, M. L. M.—
It pays to manure.
Advisory work on manuring and soil management.

Wickramasooriya, C. A. W.—
A ladder for coconuts.
The Black Beetle.

Leaflet Nos. 18 to 21 were issued during the course of the year.

Other publications include—

Salgado, M. L. M.—
Carence potassique du cocotier: Diagnostic par le fruit—Oleagineux (1953) Vol. 8, No. 5.

Salgado, M. L. M. and *Nethsinghe, D. A.*—
Preliminary studies of the transformation of soil nitrogen under coconuts. *Tropical Agriculturist* (1953) Vol. 109.

Lectures and Meetings

Southern Province Planters Association "The Coconut Industry and Research"—F. C. Cooke.

Times of Ceylon Estates and Industries Supplement "Research and the Coconut Industry"—F. C. Cooke.

Chilaw/Negombo Planters Association "Coconut Research Institute and You"—F. C. Cooke.

Low Country Products' Association "Coconut Research Institute of Ceylon"—F. C. Cooke.

Kurunegala Planters' Association "Future of the Coconut Industry of Ceylon"—F. C. Cooke.

Rural Development Rally, Marawila—on "Loyalty"—F. C. Cooke.

Krishikara Magazine of the School of Agriculture "Two Nuts instead of One"—F. C. Cooke.

Radio Ceylon:—Broadcast discussion in Sinhalese "Farmers Hour" on "Manuring and Cultivation of Coconuts"—G. Rajapaksa.

Summary of Annual Report

Botanical Division

The results of the Latin Square experiment designed to compare different methods of seed-nut and seedling selection have shown that there are no significant differences in the yields of nuts and copra from the adult palms whether the original seed-nuts were taken from selected high-yielding palms or from selected high-yielding blocks. Selection of seedlings at the nursery stage, however, leads to earlier flowering and subsequently to markedly higher yields of nuts and copra.

It has been proved that there are no significant differences either in the yield of nuts or copra between monthly and bi-monthly picking.

Arrangements for the establishment of an Isolated Seed Garden for coconuts have been initiated and a survey of possible sites has been carried out. Seventy palms with a consistent record of high yields over a long period of years have been selected for artificial pollination and a team of climbers is being trained in this work.

Hydrocyanic gas has been found to be satisfactory in destroying mites in collected pollen without affecting the pollen viability.

Soil Chemistry Division

Laboratory investigations have shown that at Bandirippuwa the available phosphates in the soil have now been reduced to the low levels at which a response could be expected, yet after 18 years, there is still no significant response to applications of phosphoric acid and potash remains the dominant manurial requirements on this soil. On Ratmalagara Research Station, conversely, the response to phosphoric acid is highly significant, while potash gives no response because ample supplies are already available in the soil. Investigation of this fundamental problem is still proceeding.

The fungus disease, *Helminthosporium incurvatum* on the young palms at Ratmalagara, persists in association with high levels of applied nitrogen and low levels of applied phosphoric acid although leaf analysis has not shown any differences in these elements between healthy and diseased palms.

Manurial trials have shown that, based on four years records, there is no significant difference between the application of manures by broadcasting or their application in circular trenches. The root system of a number of palms have been traced and it has been found that the lateral roots intermingle and reach the manurial circles of adjacent palms.

Technological Chemistry

An investigation of effects of storing nuts in various stages of maturity under different conditions has been carried out in order to ascertain the correct condition for export. The results will be published in due course.

A systematic study of the progress of alcoholic fermentation and of the complete acetification of toddy, obtained from tall palms, has been carried out and this work will be the basis for a new quick-generation process for making high-grade commercial vinegar.

The waste effluents from arrack distilleries have been examined; while it does not appear to be practicable to recover any by-products of commercial value, the total value of the N. P. K. constituents in spent-wash is Rs. 11 per 1,000 gallons.

Animal Husbandry

The herd of indigenous dairy cattle which is being maintained under coconuts on Bandirippuwa Estate, on a diet of rough pasture and coconut poonac only, is now in fine condition, and it has been conclusively proved that rich milk can be produced at a handsome profit with this type of animal under proper conditions of control and management.

The effect on the pastures and on the palms of keeping cattle in different concentrations is being studied. Systematic observations on the grazing habits of the animals when kept in the shade of coconut palms, have shown that they graze mostly during the hours of daylight so that it is wise to take them in at night for the production of farmyard manure in order to avoid unnecessary trampling of the pasture and the fouling of the grass by manure, both of which reduce the available pasture.

Planting Progress

In the course of the year, the Planting Division laid down 581,000 seed-nuts in the Coconut Research Institute nurseries and 67,000 nuts in Co-operative Society Nurseries and in addition supplied 65,000 seed-coconuts making a grand total of 713,000 seed-coconuts which is equivalent to about 7,000 acres planted. The demand for seedlings has been greater than the amount produced.

Small-holders Advisory Service

A Small-holders' Advisory Service has been started with eight officers who have been given a course of training and have now been allotted ranges, based on the D. R. O's Divisions. These officers are working through the D. R. O's and Village Headmen and also through the various Rural Development Societies, Co-operative Societies, Village Committees and other associations in the coconut areas. A " follow-up " and Advisory Service for the benefit of small estates

and small village holdings has been started in support of the Replanting Project. A number of plantations have also been reported upon at the request of the Research Branch. Field days, propaganda meetings and technical lectures to Planting Bodies and at Rural Development Training Centres have also been organised.

F. C. COOKE,
Director.

REPORT OF THE SOIL CHEMIST

Field Experiments

(I) $3 \times 3 \times 3$ *N. P. K. Manurial Experiment* (*Bandirippuwa Estate*). The eighteenth year of this experiment was completed in November, 1953.

The ninth biennial manuring was completed in November. As in the 7th manuring, the potash levels were stepped up. To the K_0 plots which had received no potash since the commencement of the experiment, 0.75 lb. K_2O per palm were added. K_1 plots were similarly stepped up to 1.50 lb. and K_2 to 2.25 lb. K_2O to 2.25 lb. K_2O/palm.

Thus since the manuring in November, 1951—

K_0 is now K_1
K_1 is now K_2
K_2 is now K_3

For the Nitrogen quality comparison (i.e., comparison of Sulphate of Ammonia, Calcium Cyanamide and an oil cake) Mowrah cake was used in 1951 instead of Groundnut cake as the latter was not available. In 1953 a similar oil cake, containing 3.5 per cent. nitrogen was used.

The yield data for the main effects for 1953 are given below—

Nitrogen	*Lb. Copra/Acre*	*Calculated as percentage*	*Difference in lb.*	*Copra out-turn nuts per candy*
N_0	1,569	100	—	1,225
N_1	1,530	98	—39	1,269
N_2	1,460	93	—109	1,311
Phosphoric Acid				
P_0	1,493	100	—	1,245
P_1	1,549	104	+56	1,264
P_2	1,517	102	+24	1,293
Potash				
K_0 (now K_1)	1,267	100	—	1,326
K_1 („ K_2)	1,588	125	+321	1,260
K_2 („ K_3)	1,704	134	+437	1,231

** Significant at P. 01. Significant Difference P. 05 = 121 lb./acre.

Nitrogen at both levels caused a depression of yield. At the higher level N_2 (1 lb. N or 6 lb. Sulphate of Ammonia/palm or its equivalent as Calcium cyanamide or Mowrah cake). This depression in yield is almost significant at P.05,109 lb./acre compared to the significant difference of 121 lb./acre.

Phosphoric Acid has yet continued to produce no response. The question of P. response will be further discussed under the laboratory investigations.

Potash response continues to be highly significant.

Potash Response

	Year	Lb. Copra per Acre	
		K_1-K_0	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†
	Total for 18 years	5,415	7,260
	Mean per annum	301	403

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

The overall yield figures for 1953, are considerably less than those of the previous year 1952, e.g., in spite of the high level of potash manuring (K_2) which should have produced a larger response in 1953, it is actually smaller, e.g., 1,704 lb./acre. The general mean of 1952 was 1,644; in 1953 it was 1,520 lb./acre, in 1953 compared to 1,994 lb. in 1952.

The climatic factors, rainfall and its distribution in 1952 were ideal for high crop production—in fact it was a peak year for crops in Ceylon.

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	1,405	1,259	1,137	1,267
K_1	1,635	1,656	1,472	1,588
K_2	1,666	1,676	1,771	1,704
N–Total	1,569	1,530	1,460	1,520

	P_0	P_1	P_2	*K–Total*
K_0	1,283	1,275	1,244	1,267
K_1	1,582	1,588	1,593	1,588
K_2	1,614	1,784	1,715	1,704
P–Total	1,493	1,549	1,517	1,520

	P_0	P_1	P_2	*N–Total*
N_0	1,569	1,599	1,539	1,569
N_1	1,484	1,519	1,588	1,530
N_2	1,426	1,528	1,424	1,460
P–Total	1,493	1,549	1,517	1,520

(II) K × P × C *Manurial × Cultivation Experiment (Ratmalagara Estate).*—The fifth biennial application of manures of this experiment was carried out in May, 1953, and the cultivation operations (ploughing) which forms one of the treatment comparisons in July.

This factorial experiment includes all combinations of the following treatments and is of the 3 × 2 × 2 type and consists of 6 blocks of 6 plots each. The interactions PC and KPC 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

× { P_0 — No Phosphoric acid; P — 1 lb. P_2O_5 per palm }

× { 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. of Sulphate of Ammonia per palm. The first biennial application of manure was carried out in June, 1943. The yield data for the main effects from the second year (1944-45) up to the tenth year were summarised below.

(Lb. per Acre)

Treatments	*2nd year 1944–45*	*3rd year 1945–46*	*4th year 1946–47*	*5th year 1947–48*	*6th year 1948–49*	*7th year 1949–50*	*8th year 1950–51*	*9th year 1951–52*	*10th year 1952–53*
K_0	1,771	1,691	1,415	1,841	1,438	1,342	1,631	1,978	1,663
K_1	1,935	1,674	1,395	1,842	1,466	1,327	1,677	1,957	1,684
K_2	1,893	1,738	1,492	1,975	1,589	1,449	1,760	2,167	1,813
Significant difference P. 05	194	152	181	215	161	173	—	—	—
P_0	1,792	1,625	1,276	1,711	1,353	1,095	1,487	1,798	1,434
P_1	1,938	1,777	1,592†	2,061†	1,643*	1,651	1,891	2,270	2,006
C_0	1,783	1,615	1,372	1,851	1,450	1,320	1,654	2,020	1,708
C_1	1,949*	1,787†	1,496	1,921	1,547	1,426	1,725	2,048	1,732
Significant difference P. 05	158	123	149	176	131	145	—	—	—

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

The trends in the responses are shown graphically in Diagram I and II.

In this case the 1952-53 yield figures are lower than those of 1951-52.

As before the phosphate response alone continues to be marked and significant, and reached a record—572 lb./acre, exceeding even a candy (560 lb.) copra per acre per annum.

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

(III) 3 × 3 × NPK *Manurial Experiment on Young Palms (Ratmalagara Estate).*—The fifth annual manuring was carried out in October/November, 1953.

The basic rates of manuring were stepped up as follows:—

Nitrogen (N_1)	..	Sulphate of Ammonia	.. ½ lb. to ¾ lb. per palm
Phosphoric acid (P_1)	..	Saphos phosphate	.. ½ lb. (unchanged)
Potash (K_1)	..	Muriate of potash	.. ½ lb. to ¾ lb. per palm

There were 28 palms in flower at the beginning of the year and at the end of 1953, 58 palms were in flower (inclusive of Guard Row Palms).

(*a*) *Leaf Counts:* The eight leaf counts of the plot palms (54 plots of 18 palms each) were taken in January, 1953. Records of dates of emergence of inflorescences, female flower counts were kept.

Diagram No. 8

MANURIAL x CULTIVATION EXPERIMENT

Ratmalagara Estate

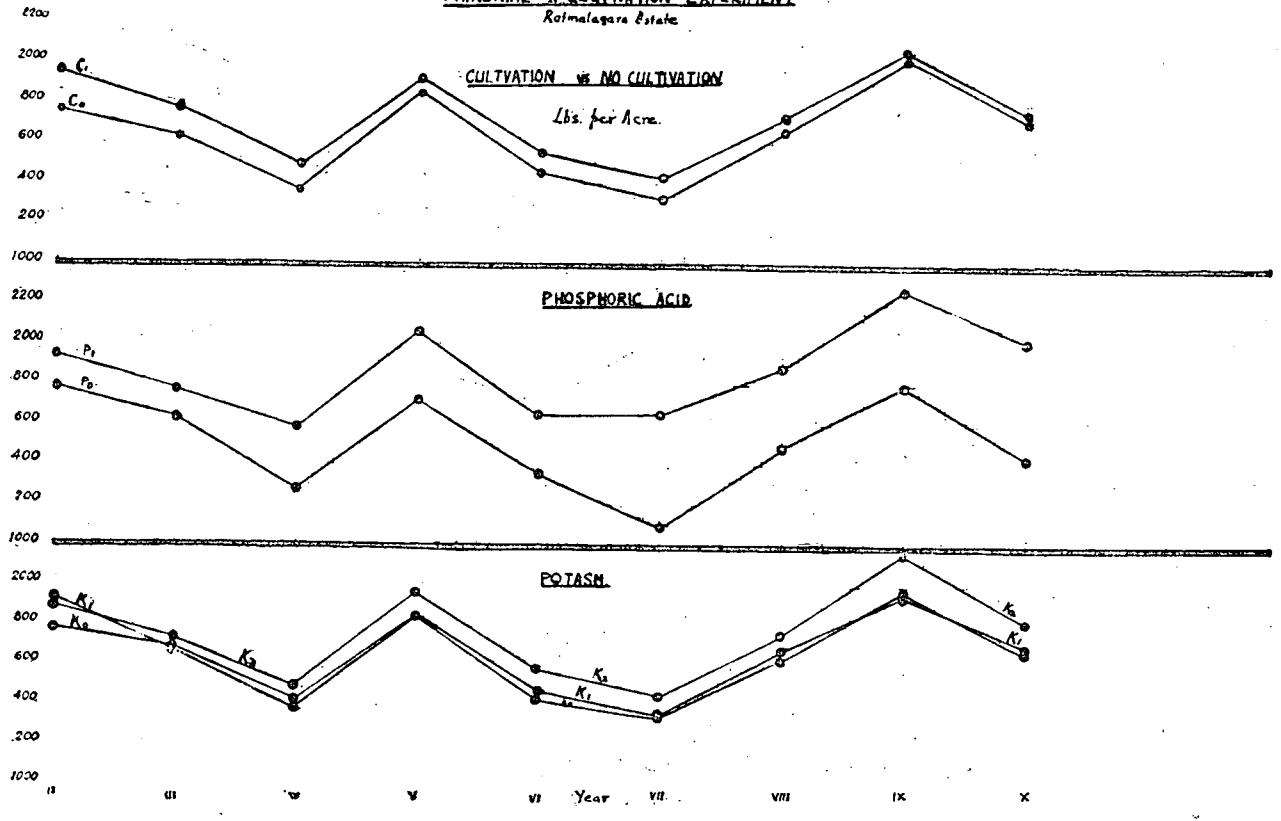
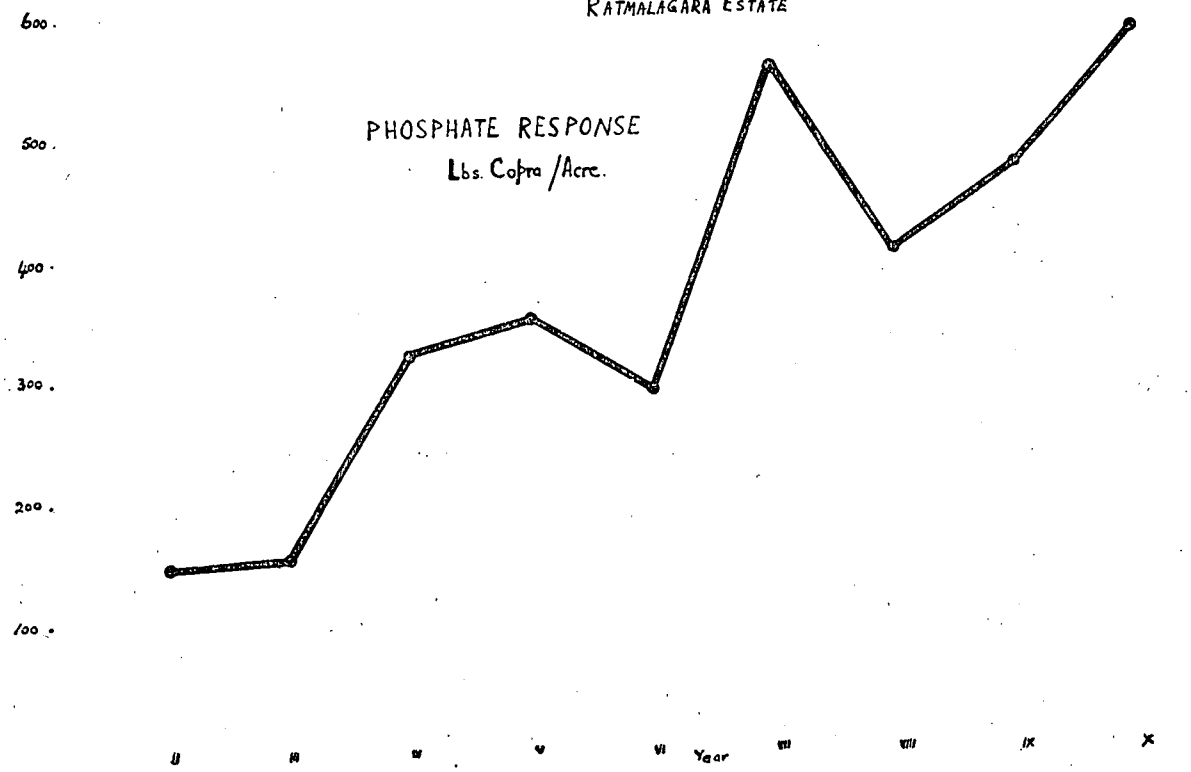


Diagram No. 2

MANURIAL x CULTIVATION EXPERIMENT

RATMALAGARA ESTATE



(*b*) *Helminthosporium Incurvatum.*—Following the application of manures in the previous December, *Helminthosporium* infestation appeared as in previous years and the pattern of infestation was similar.

The main contributory factors, as recorded in last year's report has been confirmed to be (*a*) Nitrogen manuring at the higher level (N_2=1 lb. Sulphate of Ammonia/palm) and (*b*) lack of phosphoric acid (P_0).

How far these manurial interactions are correlated with the chemical composition of the leaflets is discussed under: " Laboratory Investigations (vide (*a*) Leaf Analysis). "

TABLE I

Leaflet Counts of Helminthosporium-affected Palms

	N^0	N_1	N_2	*K–Total*
K_0	18,671	34,553	34,099	87,123
K_1	21,964	37,143	48,275	107,382
K_2	17,582	34,655	41,335	93,572
N–Total	58,217	106,151	123,709	288,077

	P_0	P_1	P_2	*K–Total*
K_0	59,495	21,257	6,371	87,123
K_1	83,619	16,113	7,650	107,382
K_2	71,403	13,723	8,446	93,572
P–Total	214,517	51,093	22,467	288,077

	P_0	P_1	P_2	*N–Total*
N_0	34,720	15,382	8,115	58,217
N_1	80,905	23,214	2,932	106,151
N_2	99,792	12,497	11,420	123,709
P–Total	214,517	51,093	22,467	288,077

It will be seen that while the incidence is much heavier than for the corresponding period last year (in fact almost double as shown by the grand total of 288,077 compared to 113,908) the pattern of distribution depending on the manurial combinations is very similar to and almost identical with that of last year (*vide* page 12, Annual Report for 1952).

(IV) *Co-operative Manurial Experiments:* (i) *Manurial Experiment on Underplanted Young Palms (Letchemy Estate).*—This experiment was commenced on underplanted palms put out in October, 1939.

The treatments are (*a*) Cover vs. no cover, and (*b*) O, NK and NPK in five randomised blocks of six plots each.

The first palm came into bearing in 1945 in the sixth year after planting, and the subsequent distribution of palms in flower according to the manurial treatments is shown below:—

(*a*) *Palms in Flower*

Treatment	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*
O	—	12	43	68	99	119	132	136	148
NK	—	16	49	77	97	120	124	130	136
NPK	1	12	41	75	117	135	146	154	161
Total	1	40	133	220	313	374	402	418	445

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

(*b*) *Yield of Nuts*

Treatments	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*
O	—	92	325	864	976	1,618	2,424	2,661
NK	—	87	668	1,030	1,638	2,559	3,526	4,302
NPK	15	191	656	1,785	2,091	3,379	4,556	5,876
Total	15	370	1,649	4,279	4,705	7,556	10,506	12,839

(c) *Yield of Copra*

Treatment	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*
O	—	44	111	269	501	819	1,117	1,262
NK	—	45	281	497	878	1,417	1,846	2,159
NPK	11	120	272	605	1,158	1,912	2,519	3,030
Total ..	11	209	664	1,371	2,537	4,148	5,482	6,451

(d) *Copra out-turns (nuts/candy)*

Treatments	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*
O	—	1,171	1,175	1,122	1,091	1,106	1,215	1,181
NK	—	1,083	1,158	1,084	1,045	1,011	1,070	1,116
NPK	764	821	945	1,051	1,011	990	1,013	1,086

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

(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:—

N_o = No nitrogen
N_c = Nitrogen applied in circular trenches
N_b = Nitrogen broadcast and ploughed

×

P_o = No Phosphoric acid
P_c = Phosphoric acid applied in circular trenches
P_b = Phosphoric acid broadcast and ploughed

×

K_o = No potash
K_c = Potash applied in circular trenches
K_b = Potash broadcast and ploughed

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

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

(*Yields adjusted by Covariance Analyses*)

	M II 1950–51 Second Year	*M III 1951–52 Third Year*	*M IV 1952–53 Fourth Year*
N_o	1,917	1,493	1,436
N_c	1,929	1,561	1,563
N_b	1,835	1,538	1,500
P_o	1,833	1,416	1,400
P_c	1,907	1,575	1,560
P_b	1,941	1,600	1,539
K_o	1,814	1,482	1,401
K_c	1,938	1,472	1,528
K_b	1,929	1,639	1,570
Significant difference P. 05 ..	83	217	141

Significant Responses

	M II	*M III*	*M IV*
Nitrogen	$N_c > N_b$ ..		Nil
Phosphoric acid	$P_b > P_o$ ..	None of the responses	$P_c > P_o$, $P_b > P_o$
Potash	$K_c > K_o$, $K_b > K_o$ ..	are Significant	$K_c > K_o$, $K_b > K_o$

Based on the data of the fourth year, there is no difference in the response to potash and phosphate, when applied either in circular trenches or broadcast and ploughed in.

So far as potash is concerned, determinations of potash in nut water provide further evidence in support of the lack of any difference in yield due to the two methods of the application, as indicated by potash uptake by the palm. The potash uptake of the palm is almost identical as shown below:—

Date of sampling—1953	K_2O/*Litre in Nut Water*	
	Potash applied in circular trenches	*Potash, broadcast and ploughed in*
May	1·97	1·93
July	2·09	2·09
September	1·97	2·06
November	2·14	2·18

It should be noted that the yield data given in the previous year's report have not been adjusted by the method of covariance analysis.

It is yet premature to draw any final and general conclusions based on the limited data of a few years. The lack of response in the third year (1951-52) is due to the unfavourable weather conditions of the previous year.

On the basis of the data of the second and fourth years the only consistent result is the potash response, which in both the second and fourth years is significant but shows no material difference whether potash is applied in circular trenches or broadcast and ploughed. The responses though significant are however not large, amounting to only 120 lb. in the second year and 148 lb./acre in the fourth year, equal to 368 lb. for the two-year period of biennial manuring.

The nitrogen and phosphate responses are however erratic, and it is therefore necessary to await the lapse of a few years until more valid conclusions can be drawn.

Laboratory Investigations

(*a*) *Manurial Experiment on Young Palms (Ratmalagara Estate): Leaf Analysis.*—In the report for last year some preliminary data on the potash content of leaflet samples taken from the young palms of this experiment were summarised, in order to determine to what extent manurial treatments were reflected in the composition of the leaf, particularly in relation to the incidence of *Helminthosporium incurvatum*.

The first set of leaflets sampled on October, 1951, consisted of composite samples from leaflets of the youngest fully-opened frond of each of 18 palms of the plot.

Calcium and Potash/Calcium Ratios

In these samples calcium was determined, particularly with a view to the possibility of Potash/Calcium ratio in the leaflet showing any indications of any possibility of nutrient unbalance that may be the predisposing factor in determining the pattern of *Helminthosporium* infestation associated with the differential manurial treatments previously discussed. The results are shown in Tables II, III and IV.

The following conclusions can be drawn:—

(*a*) Potash manuring reduces the calcium uptake as shown by the rise in the K/Ca ratio. This of course is a general observation, based on Ehrenberg's *Kalk/Kali Gesetzt**.

(*b*) For all the manurial treatments the sum of calcium and potash in the leaflets (expressed as milliequivalents) is remarkably constant, i.e., 89 m.e. per 100 grms. dry matter content of the leaflets.

* Calcium-potash antagonism.

TABLE II

Manurial Experiment on Young Palms (Ratmalagara Estate)

POTASH AND CALCIUM CONTENTS OF LEAFLETS (% D.M.) AND POTASH/CALCIUM RATIOS

	N_0					N_1					N_2				
	Potash		*Calcium*			*Potash*		*Calcium*			*Potash*		*Calcium*		
	K_2O%	*ME* %	*CaO* %	*ME* %	*K/Ca Ratio*	K_2O %	*ME* %	*CaO* %	*ME* %	*K/Ca Ratio*	K_2O %	*ME* %	*CaO* %	*ME* %	*K/Ca Ratio*
K_0	3·18	67·67	0·534	19·07	3·55	2·78	59·16	0·465	16·61	3·56	3·17	67·46	0·638	22·78	2·96
K_1	3·05	64·90	0·517	18·46	3·52	3·24	68·95	0·475	16·96	4·07	3·29	70·01	0·544	19·43	3·60
K_2	3·49	74·27	0·515	18·39	4·04	3·63	77·25	0·564	20·14	3·84	3·63	77·25	0·587	20·96	3·69
Mean															

	P_0					P_1					P_2				
	Potash		*Calcium*			*Potash*		*Calcium*			*Potash*		*Calcium*		
	K_2O%	*ME*%	*CaO*%	*ME*%	*K/Ca Ratio*	K_2O%	*ME*%	*CaO*%	*ME*%	*K/Ca Ratio*	K_2O%	*ME*%	*CaO*%	*ME*%	*K/Ca Ratio*
K_0	3·04	64·69	0·526	18·78	3·44	2·80	59·58	0·533	19·03	3·13	3·29	70·01	0·578	20·64	3·39
K_1	3·20	68·07	0·551	19·68	3·46	3·15	67·03	0·459	16·39	4·09	3·22	68·52	0·527	18·82	3·64
K_2	3·37	71·71	0·498	17·78	4·03	3·79	80·65	0·573	20·46	3·94	3·58	76·18	0·596	21·28	3·58
N_0	3·17	67·46	0·491	17·53	3·85	3·22	68·52	0·524	18·71	3·66	3·32	70·65	0·551	19·68	3·59
N_1	2·96	62·99	0·494	17·64	3·57	3·35	71·29	0·470	16·78	4·25	3·34	71·08	0·541	19·32	3·68
N_2	3·49	74·27	0·589	21·03	3·53	3·17	67·46	0·571	20·39	3·31	3·43	72·99	0·609	21·75	3·36

TABLE III

Manurial Experiment on Young Palms (Ratmalagara Estate)

POTASH AND CALCIUM CONTENTS OF LEAFLETS AND POTASH/CALCIUM PALMS

(Grouped according to Treatments)

	N_0K_0		N_0K_0		N_0K_2			
	K_2O%	CaO	K_2O%	CaO	K_2O%	CaO		
P_0	2·72	0·448	3·03	0·586	3·75	0·440		
P_1	3·06	0·527	2·91	0·457	3·70	0·587	—	—
P_2	3·76	0·626	3·20	0·509	3·01	0·518	—	
Mean								

	N_1K_0		N_1K_1		N_1K_2	
	K_2O	CaO	K_2O	CaO	K_2O	CaO
P_0	2·93	0·467	2·70	0·508	3·25	0·507
P_1	2·71	0·453	3·52	0·394	3·82	0·562
P_2	2·71	0·476	3·49	0·523	3·81	0·624
Mean						

	N_2K_0		N_2K_1		N_2K_2			
	K_2O	CaO	K_2O	CaO	K_2O	CaO	K_2O	CaO
P_1	3·48	0·664	3·88	0·558	3·10	0·546		
P_2	2·64	0·618	3·03	0·525	3·85	0·569		
P_3	3·39	0·632	2·97	0·549	3·93	0·645		
Mean								

TABLE IV

Manurial Experiment on Young Palms (Ratmalagara Estate)

POTASH AND CALCIUM CONTENTS OF LEAFLETS AND POTASH/CALCIUM RATIOS

Mean Values for Main Effects

Treatment	K_0		K_1		K_2	
	K_2O	CaO	K_2O	CaO	K_2O	CaO
Mean	3·04	0·546	3·19	0·512	3·58	0·566
Per cent.						
M/E	64·55	19·47	67·73	18·26	76·01	20·19
K/Ca Ratio (Molecular)	3·32		3·71		3·76	

Treatment	P_0		P_1		P_2	
	K_2O	CaO	K_2O	CaO	K_2O	CaO
Mean						
Per cent.	3·20	0·525	3·25	0·521	3·36	0·567
M/E	67·95	18·73	69·01	18·59	71·34	20·23
K/Ca Ratio (Molecular)	3·63		3·71		3·53	

Treatment	N_0		N_1		N_2	
	K_2O	CaO	K_2O	CaO	K_2O	CaO
Mean						
Per cent.	3·24	0·522	3·22	0·502	3·36	0·590
M/E	68·79	18·62	68·37	17·91	71·34	21·05
K/Ca Ratio (Molecular)	3·69		3·82		3·39	

Milli Equivalent Totals of K plus Ca

Treatment	K_0	K_1	K_2		*Mean/ 100 grm.*
M/E K plus Ca	84·03	85·99	96·20	266·22	88·74
Treatment	P_0	P_1	P_2		
M/E K plus Ca	86·68	87·60	91·57	265·85	88·62
Treatment	N_0	N_1	N_2		
M/E K plus Ca	87·41	86·28	92·39	266·08	88·69

Phosphoric Acid Content of Leaflets as influenced by Manuring. The prosphoric acid content of the leaflets are shown in Table V

TABLE V

(Grouped according to manurial treatments)

P_2O_5 (as % D.M.)

	N_0K_0	N_0K_1	N_0K_2
P_0	0·2844	0·2608	0·2710
P_1	0·3120	0·3094	0·2886
P_2	0·3281	0·3146	0·3471
	N_1K_0	N_1K_1	N_1K_2
P_0	0·2631	0·2882	0·2210
P_1	0·3119	0·3504	0·3483
P_2	0·3641	0·3396	0·3613
	N_2K_0	N_2K_1	N_2K_2
P_0	0·2542	0·2721	0·2406
P_1	0·3487	0·3381	0·3298
P_2	0·3276	0·3651	0·3344

Mean (Main Effects)

P_0—0·262	K_0—0·310	N_0—0·302
P_1—0·326	K_1—0·319	N_1—0·316
P_2—0·343	K_2—0·305	N_2—0·312

In all treatment combinations of N and K there is a consistent increase in the P_2O_5 content of the leaflets with application of phosphate to the young palms.

Potash and Phosphoric Acid contents in leaflets of individual palms

Samples of leaflets from individual palms affected and not affected by *Helminthosporium incurvatum* within the same plot were analysed. The K_2O per cent. and P_2O_5 per cent. are shown below—

Plot No. 2 (Treatment P_0 N_1 K_2)

		$\%K_2O$	$\%P_2O_5$
Good Palm No.	2	2·60	0·268
	4	2·47	0·250
	13	2·37	0·239
	Mean	2·48	0·252
Palms attacked by *Helminthosporium incurvatum*			
Palm No.	6	2·35	0·250
	11	2·22	0·201
	17	2·23	0·237
	Mean	2·26	0·229

The difference in the potash and phosphoric contents of the leaflets of the two sets of palms is not very marked, but those of the affected palm are lower.

(*b*) Soil Phosphate Studies

It has already been mentioned that even after a period of 18 years, application of phosphoric acid produced no response in the manurial experiment on Bandirippuwa Estate. In the early stages of the experiment this was explained by the presence of reserves of available phosphate in the manure circles due to applications before the manurial experiment was commenced. This was indicated by substantial differences in available phosphate between soil in the manure circles and the unmanured rows between palms.

Subsequently periodical soil samples were taken and have shown a progressive reduction in available phosphate in the plots to which phosphate applications were not made (P_0 Plots). The samples taken in October, 1951, before the eight biennial application of manure were analysed during 1953. The phosphate contents have come down to the low level at which marked responses were obtained in the manurial experiments at Ratmalagara Estate, Edunkelle and Kumbaloluwa.

The results are shown in Table VI.

3 × 3 × 3 NPK Manurial Experiment (Bandirippuwa Estate)

Change in Available Phosphate in P_0 Plots (p.p.m.)

Plot No.	*Citric Soluble Phosphate*			*Truog Method*			
	1935 Premanurial	*1940*	*1951*	*1935 Premanurial*	*1940*	*1945*	*1951*
2	133	120	40	90	68	20	30
3	460	53	23	200	36	20	25
8	80	33	20	92	48	20	16
13	84	53	16	80	60	20	10
17	127	22	13	140	34	12	10
18	193	47	20	300	39	20	15
20	—	—	—	—	—	12	—
21	—	—	—	—	—	20	—
23	159	33	16	88	32	20	15
28	120	37	20	106	38	12	20
34	—	—	—	—	—	12	—
35	—	—	—	—	—	12	—
39	—	—	—	—	—	32	—
40	—	—	—	—	—	20	—
45	107	80	20	80	56	12	20
46	127	44	8	112	36	16	20
48	180	80	30	240	56	16	20
54	47	33	15	3	24	12	20

It would appear that in some soils (as at Bandirippuwa) the levels of available phosphate by the Citric Soluble or Truog methods have little prediction value as a basis of the need for phosphate manuring. It may be mentioned that in Malaya, in the case of rubber it has been similarly found that there are soils which, though showing low available phosphate, do not respond to phosphate application. A similar observation has been made by Marel in Java (*Marel: Tropical Soils in Relation to Plant Nutrients, Soil Science. 1947, 64, 445.*)

Phosphate Accumulation

Determinations of available phosphate (Citric Soluble P) from soil samples of the manure circles of the P_1 Plots (1 lb. P_2O_5/palm) and P_2 Plots (2 lb. P_2O_5/palm) taken in 1951 show considerable accumulation of phosphate as shown in Table VII.

TABLE VII

Phosphoros in p.p.m.

	P_1 *plots*			P_2 *plots*		
Plot No.	*1935*	*1951*	*Plot No.*	*1935*	*1951*
1	280	530	5	95	1500
4	133	375	6	213	1800
9	80	650	7	120	1500
11	127	325	15	147	1200
12	120	300	16	77	1200
14	107	265	19	73	1500
36	200	265	27	100	1200
41	87	750	32	293	1300
47	157	700	37	87	1100
49	240	1350	51	33	1800
50	33	1060	52	33	1500
			53	33	1600

HCl—soluble phosphoric acid : The HCl—soluble P_2O_5 in the P_0 and P_1 plots of the 1951 samples were also determined and are given below :—

NPK 3 × 3 × 3 manurial experiment (Bandirippuwa Estate)

Plot No.	*1935 (Premanurial)*	*1940*	*1951*
2	292	94	—
3	417	250	183
8	333	333	267
13	250	268	150
17	270	167	143
18	500	188	167
21	—	—	150
23	292	177	167
28	—	—	117
45	—	—	117
46	—	—	250
48	—	—	250
54	—	—	250

Plot No.	*P_1 Plots (1951)*
1	1000
4	1333
9	1280
11	733
12	933
14	933
36	933
41	1066
47	1533
49	2533
50	1667

Analysis of Clay fraction (Manurial Cultivation experiment—Ratmalagara Estate)

An ultimate analyses of the Clay fraction of three horizons of P 16 of the manurial experiment at Ratmalagara Estate. The results are shown below:—

	Top 0–9″	*Sub 1 9–18″*	*Sub 2 1½–2½″*
K_2O %	0·83	0·75	—
K_2O M.E. %	17·66	15·96	—
SiO_2 %	29·74	26·80	30·02
Fe_2O_3 %	10·78	11·38	10·38
Al_2O_3	25·77	25·27	26·42
SiO_2/Al_2O_3 (Molecular ratio)	1·96	1·80	1·94
$SiO_2/Al_2O_3 + Fe_2O_3$	1·55	1·40	1·53

The Silica/Alumina ratio indicates that the soil is not highly lateritic. The high content of potash indicates ample reserves of potash, as also confirmed by the lack of response to potash manuring on this soil.

The total potash and calcium in the whole soil (in contrast to the clay fraction) was similarly determined by fusion analysis, and are shown below:—

	Top 0–9″	*Sub 9–18″*	*Sub 1½–2½ feet*
K_2O%	0·29	0·42	0·30
K_2O ME/100 grms soil	7·770	8·83	7·90
CaO%	3·45	2·74	3·12

Tabulated below are the percentage of clay in the soil, the potash content of the clay and the calculated value of potash in the soil, assuming that all the potash is in the clay fraction, and the actual value of potash in the soil.

	Top 0–9″	*Sub 9–18″*	*Sub₂*
Clay%	16·02 ..	18·18	
K_2O% in Clay	0·83 ..	0·75	
K_2O % in clay calculated as % of original soil	0·13 ..	0·14	
Actual K_2O % in soil ..	0·29 ..	0·42	

Of the total potash in the soil almost half comes from the coarse fractions of the soil—probably in reserve potash minerals.

These heavy fractions (coarse sand, fine sand and silt) await separation by heavy liquids and subsequent mineralogical examination.

Potash Content of Coconut Water

Since 1953, in addition to the work on the nut water samples of the Ratmalagara and Marandawila manurial experiments, field samples of the estate blocks of Mudukatuwa and Keenakelle Estate, Marawila, were analysed as from April. These are two of the highest yielding estates in the premier coconut district of Ceylon, consisting of a rich deep chocolate loam. The results are given in Table VIII.

The unique fertility of these soils (in this case in relation to potash levels) are indicated by the record values for potash, e.g., 2.73 grms. K_2O/litre for Block No. 1.

It should be mentioned that the seasonal fluctuations in potash contents which are not consistent for the different blocks are probably due to (*a*) the small sample of 100 nuts selected for water sampling out of a heap of about 20,000 nuts; (*b*) delays between picking and husking. This period is normally one month and if delayed beyond six weeks, germinations occur, particularly during the wet season and the potash content decreases.

TABLE VIII

Potash Content of Nut Water Samples of Mudukatuwa and Keenakelle Estates, Marawila

(A) MUDUKATUWA ESTATE

K_2O gms. per litre

Block No.	*Date of Sampling April 8, 1953*	*Date of Sampling June 24, 1953*	*Date of Sampling August 26, 1953*	*Date of Sampling October 30, 1953*	*Date of Sampling December 18, 1953*
1 ..	2·612 ..	2·431 ..	2·655 ..	2·588 ..	2·73
	2·610 ..	2·456 ..	2·688 ..	2·522 ..	2·73
2 ..	2·242 ..	1·966 ..	2·240 ..	2·257 ..	2·40
	2·187 ..	1·966 ..	2·157 ..	2·157 ..	2·41
3 ..	2·075 ..	2·174 ..	2·082 ..	2·190 ..	2·37
	2·046 ..	2·215 ..	2·016 ..	2·157 ..	2·39
4 ..	2·285 ..	2·331 ..	1·958 ..	2·198 ..	2·49
	2·185 ..	2·481 ..	1·999 ..	2·091 ..	2·48
5 ..	2·220 ..	2·713 ..	1·601 ..	2·174 ..	2·85
	2·221 ..	2·638 ..	2·497 ..	1·974 ..	2·85
6 ..	2·192 ..	2·041 ..	1·850 ..	2·298 ..	2·17
	2·132 ..	2·215 ..	1·800 ..	1·983 ..	2·20

(B) KEENEKELLE ESTATE

K_2O gms. per litre

Block No.	*Date of Sampling July 16, 1953*	*Date of Sampling September 22, 1953*	*Date of Sampling November 14, 1953*
1	1·452	1·991	1·867
	1·435	1·933	1·825
2	2·115	1·950	1·750
	2·190	1·925	1·742
3	2·273	1·767	1·891
	2·198	1·634	1·858
4	1·734	1·717	1·941
	1·742	1·568	1·925

The potash contents of the nut water sample of the manurial × cultivation experiment are shown in Table IX.

The potash contents are of the same order as in previous years and are parallel with the yield data which show no significant responses to potash manuring.

TABLE IX

Potash contents of nut water (manurial experiment at Ratmalagara)

Year	*M VII*			*M VIII*		
Pick No.	K_0	K_1	K_2	K_0	K_1	K_2
1	—	—	—	2·42	2·63	2·72
2	—	—	—	2·35	2·37	2·54
3	2·17	2·30	2·34	2·31	2·48	2·55
4	2·57	2·70	2·78	2·46	2·58	2·70
5	2·47	2·60	2·67	2·22	2·27	2·45
6	2·35	2·61	2·72	2·22	2·45	2·54
Mean	2·39	2·55	2·63	2·46	2·46	2·58

	M IX			*M X*		
Pick	K_0	K_1	K_2	K_0	K_1	K_2
1	2·27	2·45	2·54	2·37	2·72	2·77
2	2·11	2·30	2·45	2·16	2·47	2·57
3	2·11	2·33	2·47	2·06	2·34	2·44
4	2·39	2·55	2·60	2·29	2·50	2·54
5	2·20	2·46	2·56	1·91	2·18	2·30
6	2·13	2·47	2·60	2·06	2·44	2·53
Mean	2·20	2·43	2·54	2·14	2·44	2·53

Similarly the results of the potash contents of the nut water samples of the manurial experiment at Marandawila on methods of application are shown in Table X.

It will be noticed that here too the potash contents run parallel with the yield data which show little difference due to varying methods of application (see paragraph IV (ii)).

TABLE X

3 × 3 × 3 (NPK × Methods of Application) Manurial Experiment

MARANDAWILA GROUP

Potash Content in Coconut Water (Gms K_2O/Litre (Mean of 9 Plots)

Pick No.	K_0 (*No Potash*)			K_c (*Potash 1 lb. K_2O in Circular Trenches*)			K_b (*Potash 1 lb. K_2O broadcast and ploughed*)		
	Vol. cc 100 Nuts	*Potash gms. K_2O*	*K_2O per Litre*	*Vol. cc 100 Nuts*	*Potash gms. K_2O*	*K_2O per Litre*	*Vol. cc 100 Nuts*	*Potash gms K_2O*	*K_2O per Litre*
M II (1)	12,138	22·79	1·88	12,376	27·35	2·21	12,969	29·05	2·24
II (2)	10,065	18·77	1·88	10,948	23·18	2·12	11,004	26·60	2·20
II (3)	11,080	20·88	1·88	11,269	24·13	2·14	11,960	26·63	2·23
II (4)	9,128	16·13	1·77	9,107	17·96	1·97	9,584	19·72	2·06
II (5)	6,064	8·46	1·39	6,156	9·74	1·58	6,770	11·57	1·71
II (6)	9,443	16·21	1·72	9,608	17·18	1·90	9,252	17·77	1·92
Mean	9,653	17·21	1·75	9,821	19·92	1·99	10,257	21·89	2·06
	K_0			K_c			K_b		
M III (1)	10,157	17·60	1·73	9,468	18·68	1·97	10,248	21·29	2·08
III (2)	10,833	18·03	1·57	11,708	21·06	1·80	13,507	25·12	1·86
III (3)	13,943	27·68	1·99	15,947	34·16	2·14	15,642	35·66	2·28
III (4)	13,517	25·51	1·89	13,940	30·74	2·21	14,613	30·12	2·06
III (5)	14,076	21·94	1·56	14,898	29·99	2·01	15,410	32·16	2·09
III (6)	15,252	26·82	1·76	15,680	34·27	2·19	16,442	36·47	2·22
Mean	12,963	22·76	1·75	13,607	28·15	2·05	14,310	30·14	2·10
M IV (1)	12,036	23·26	1·93	13,022	31·39	2·41	13,992	33·87	2·42
IV (2)	12,001	21·97	1·83	12,222	26·57	2·17	13,369	29·78	2·23
IV (3)	12,904	23·51	1·82	13,182	28·99	2·20	14,196	31·44	2·21
IV (4)	9,610	16·92	1·76	10,749	21·86	2·03	11,511	24·26	2·11
IV (5)	9,277	14·54	1·57	9,081	17·93	1·97	8,793	16·99	1·93
IV (6)	10,406	17·85	1·72	9,771	20·41	2·09	10,630	22·21	2·09
Mean	11,039	19·68	1·77	11,338	24·53	2·15	12,082	26·43	2·17

Studies on the Root System of Young Palms

In order to obtain more concrete data, particularly in regard to the possible interactions involved in broadcasting and ploughing—in manures in contrast to application in circular trenches, root exposure were made on four palms, comprising double guard rows of the manurial experiment on young palms, when in the fifth year at Ratmalagara Estate.

The root systems traced in sectors from the base were carefully exposed without damage by opening up galleries by hand with the aid of copious supplies of water to facilitate root exposures. The following features were noted:—

(*a*) There is a prolific growth of roots widely distributed running horizontally at a depth of 9 inches, the lateral roots running above and below the main roots and crossing the roots of adjacent palms at several points.

(*b*) There is a mat of roots round the base of the palms up to a distance of about 4 feet.

(*c*) At the edge of the planting hole (subsoil being hard lateritic gravel), the roots have turned upwards and then run horizontally thereafter.

(*d*) Roots from the adjacent palm (28 feet away) have even encroached into the manure circles of the other palms.

(*e*) Where the top soil is shallow and the subsoil close to the surface, the roots were found at a depth of 3 inches.

Soil Surveys

The following reconnaisance soil surveys of the following areas of Crown jungle were carried out during the year for purposes of land development, with coconuts as the main crop:—

(i) *Sirambiadi Crown Forest (Puttalam):* This is an excellent Crown jungle suitable for coconuts, along the left of the Puttalam-Anuradhapura Road, a few miles beyond the U. C. limits. The soil is ideal for coconuts and consists in the main of sandy chocolate loam of great depth, except towards the northern boundary bordering the Mee-Oya where the clay subsoil is close to the surface.

On the recommendations of our reports, this land has been released for Middle Class Colonists recently.

(ii) *Sohankulama:* Also in the Puttalam District has not been recommended. Though the top soil is a sandy loam, it is very shallow and overlies a subsoil consisting of a hard lateritic pan, mixed in some localities with concretions of quartz barely 3 feet from the surface.

(iii) *Serukelle Crown Forest:* Except for a small portion at the Andigama end, the whole of the area was recommended as being suitable.

(iv) *Wendakaduwa Crown Forest:* This jungle in the Pottukulama area was found to consist of a light soil, with favourable subsoil water conditions and was recommended as being suitable for coconut cultivation.

M. L. M. Salgado,
Soil Chemist.

REPORT OF THE BOTANIST

1. Mass Selection

METHODS OF SELECTION

A programme of selection work on coconuts (*Cocos nucifera L*) was initiated in 1931 by Mr. W. V. D. Peiris, former Geneticist. Selection was at two levels; seed-nuts and seedlings without controlled pollination. Seed-nuts were collected either from individual high-yielding palms or selected high-yielding blocks. Methods of selection are described in detail in leaflets 1, 2, 11 and 14.

Year by year selected palms were taken for yield recording and in 1952 there were 1,950 palms on record. During the current year 230 palms were retained for further recording and controlled pollination work, and recording of the remaining palms was discontinued.

In 1939 a field trial (Latin Square Experiment) was laid down to test the efficiency of these methods of selection both of seed-nuts and seedlings. In this trial, nuts from " low-yielding " palms were included in addition to those from individual high-yielding palms and high-yielding blocks. The so-called " low yielders " have been selected then purely from a field examination of the palms and not from their yield potentialities. The data collected from this experiment are presented below separately for seed and seedling selections.

RESPONSE TO SEED SELECTION

The average yield of nuts and copra per acre per year during the period 1951-53 are given in Table 1. The yield for three years have been considered to even out the seasonal differences.

TABLE 1

Average Yield per Acre per Year (1951–53) according to Seed-nut Selection

Type of Seednut	*Nuts**	*Copra†* (*Lb.*)
From high-yielding blocks (seedlings selected)	2,689	1,261
From high-yielding palms (seedlings selected)	2,677	1,249
From low-yielding palms (seedlings selected)	2,573	1,309

* Critical difference 246 nuts (P = 0·05)

† Critical difference 221 lb. (P = 0·05)

As the differences between the treatments are not significant, the type of the seed selection on the present methods has no effect on the yield of the progenies.

In this instance only the seed parents have been selected and the pollen parents were from the general population. With a cross-fertilising species like the variety under consideration, it is unlikely that significant differences in yield will be expressed in the progenies unless the pollen parents are controlled.

The relatively unusual performance of the progenies from the so-called " low-yielding " palms, is due to the fact that the character " low yield " of the parent palms has been due to environmental factors rather than to specific genes. This is borne out from the yield curve of these seed parents. Subsequent to their selection for this experiment in 1939, their yield has increased considerably with improved crop husbandry, and are now hardly justified in classifying them as low-yielders.

RESPONSE TO SEEDLING SELECTION

There is a greater response to the selection of seedlings than to the selection of seed-nuts on the basis of the present methods. Data are presented in Table 2.

TABLE 2

Average Yield per Acre per Year (1951–53) according to Seedling Selection

Material	*Nuts*	*Difference**	*Copra Lb.*	*Difference†*
Seedlings selected	2,646	—	1,273	—
Seedlings unselected	2,358	288	1,136	137

* Critical difference 142 nuts (P = 0·05)
† Critical difference 127 lb. (P = 0·05)

The selected seedlings have given significantly higher yield of nuts and copra over un-selected seedlings. Therefore a proper selection of seedlings is very important.

In 1953, the fourteenth year of the plantation, the increase in yield of nuts was 10 per cent. in favour of selected seedlings. Unselected seedlings are not rejected seedlings. They are seedlings taken from a nursery at random without any selection and therefore may include both good and bad ones.

The criteria of selection of seedlings are early germination, vigour and resistance to pests and diseases. Before the seedlings of the above experiment were transplanted a number of characters—period taken for germination of nuts, number of roots and leaves, &c.—were scored. Correlations between these characters and the data collected from the resultant palms are given in Table 3.

TABLE 3

Correlations between Seedlings and Adult Palm Characters

Characters	*Correlation coefficient, R.*	*Significance level, P.*
Germination period and leaf number of seedling	— 0·461	0·03
Germination period and root number of seedling	— 0·531	0·01
Germination and flowering periods	+ 0·437	0·04
Germination period and yield of nuts	— 0·424	0·05
Flowering period and yield of nuts	— 0·622	0·002

Period taken for germination of seed-nuts appears to have a profound influence on the performance of the palms. When seed-nuts germinate early, they give rise to palms that flower in a shorter period and are also more productive than those that arise from late germinations. Thus germination period of a seed coconut appears to be a vital factor in the selection of seedlings.

On the methods of mass selection advocated above, it is immaterial whether seed coconuts are collected from individual high-yielding palms or from high-yielding blocks. The more important factor contributing to increased yields is a vigorous selection of seedlings.

2. Controlled Pollination

SEED GARDEN

It is apparent that only a very limited increase in crop can be gained with mass selection methods where only the seed parents are selected. As the variety that is commonly grown in Ceylon is cross-fertilised, if the pollen source can be controlled, then considerable increase in crop may be expected. With this in view, arrangements to establish a seed garden have been initiated.

From the pool of mother palms that have been recorded during the previous years, 90 palms that have been consistently high-yielding were selected. These palms are to be artificially pollinated and the resultant nuts are to be planted in a block of land surrounded by a screen of forest trees, sufficiently deep to avoid contamination with pollen from unknown palms.

For pollination work, five intelligent young men who can climb palms were selected and are being trained in the techniques of pollination. Possible sites for the situation of the seed garden were surveyed and an application has been made to the Government for alienation of a piece of Crown land in the Chilaw district.

VARIETAL CROSSES

Certain intra-and inter-varietal crosses of coconut (*Cocos nucifera L*) were made in 1949 and 1950. Four parental forms were used, viz., Dwarf, King Coconut, San Ramon, and the commercial " tall " variety. The main purpose of these crosses was to study the expression of hybrid vigour.

During the year, 19 of the hybrids flowered. Some of the crosses show differences in behaviour according to the direction of cross. These differences are shown in Table 4.

TABLE 4

Behaviour of F_1 Plants

Parents	*F_1 of*	*No. of plants*	*Flowering*	*Breeding System*
Tall	—	—	Late	Cross-fertilised
Dwarf	—	—	Early	Self-fertilised
	Dwarf × Tall	20	Early	Self-fertilised
	Tall × Dwarf	20	Late	Not known yet
King Coconut	—	—	Late	Self-fertilised
	King Coconut × Dwarf	5	Early	Self-fertilised

In the above table, when the period taken for the production of the first flower is more than four years, flowering is denoted as " late ", and when less as " early ".

Dwarf × Tall: The average period taken for flowering in the F_1 plants of this cross was 2.8 years from the date of germination of nut. The early flowering character of the female parent is dominant whereas in the reciprocal cross the progenies are late flowering. In the reciprocal crosses the same parental combinations were not used.

Hybrid vigour is not manifest in the progenies with regard to vegetative growth. The palms have been bearing for less than one year and therefore their yield potentialities relative to the parents are not known yet.

In the reciprocal cross (i.e., with the tall variety as the female parent) the plants are more vigorous in growth. None of the palms are yet in flower.

King Coconut × Dwarf: The five F_1 plants of a single cross flowered early, the average period being 3.4 years from the date of germination of nut. They carry heavy bunches with medium sized nuts. Heterosis is expressed both in vegetative growth and yield. One conspicuous disadvantage is the periodicity in bearing nuts.

When these crosses were made in 1949, they were largely of an exploratory nature. Since then the work had to be suspended as the writer was on overseas leave. In the ensuing year an extensive programme of hybridisation work is to be launched.

3. Harvesting of Nuts

The common practice on coconut estates is to harvest nuts bimonthly. Under average conditions an inflorescence is produced every four weeks, so that at each pick at least two bunches can be harvested. A few planters persistently insist on monthly picking and they claim that an increase in crop can be gained thereby.

A simple field trial with monthly and bimonthly picking was carried out between 1950 and 1953, to test the efficacy of this claim. There were no significant differences either in the yield of nuts or copra for any year whether harvesting was monthly or bimonthly. If monthly harvesting had any cumulative effects, then that should be expressed at least in the third year of the trial. In the absence of any such differences the trial was abandoned.

Considering the fact that monthly picking nearly doubles harvesting costs and that there is no distinct advantage, bimonthly picking is to be preferred to monthly picking.

4. Pests and Diseases

Inquiries relating to pests and diseases have been attended to in collaboration with the Department of Agriculture, Peradeniya. Owing to the lack of a well-defined policy, trained staff and facilities, this work remained static and so far only some empirical work has been done.

POLLEN MITES

In the course of hybridisation work referred to above, it was found that mites infested pollen during certain seasons. They presumably fed on the pollen and also clumped together the pollen grains which affected the free flow of the grains during pollination. Satisfactory control methods had to be worked out.

Use of insecticides—" Chlorodane ", " Intox 8 ", Lindane, " Derriphytan ", hydrogen sulphide gas, coal gas, ammonium hydroxide vapour, &c., gave negative results. Most of these were found to kill the mites, some not ovicidal in action, but affected the viability of the pollen.

Hydrocyanic acid gas was found to be satisfactory. Exposure for 90 seconds killed the mites and did not affect the pollen viability. Samples of pollen exposed to HCN for 90 seconds showed 92 per cent. germination in gelatine-sugar medium which compares favourably with control samples.

RAT DAMAGE

A number of inquiries pertaining to damage done by rats on the crowns of palms were received. The damage particularly the developing fruits.

Besides the use of various patent rat poisons and traps, banding of the palms with two foot wide aluminium sheets about six feet above ground prevented the rats from reaching the crowns. It is necessary that the leaves of the treated palms do not overlap those of the adjoining palms.

MISCELLANEOUS

Routine observations and yield-recording of (*a*) 300 palms in Botanist's Block " B " at Bandirippuwa, (*b*) replantation trials at Bandirippuwa and Olaboduwa, (*c*) progeny trial at Marandawila, and (*d*) variety palms at Bandirippuwa and Ratmalagara were continued.

The progeny trial at Walpita was discontinued owing to difficulties in management.

D. V. LIYANAGE,
Botanist.

REPORT OF THE CHEMIST

(I) Studies on the Macro-nutrient Composition of Coconut Toddy

The major investigations on toddy during the year were on the determination of its macro-nutrient composition. Two sets of analyses for nitrogen, phosphoric acid, potash, calcium and magnesium were done on ten bulked samples and six individual samples of toddy respectively.

The results were remarkably consistent and showed that for the normal healthy palms from which the toddy samples were drawn the range of macro-nutrient composition was not very wide. Potassium however, which is outstanding among the nutrient elements for its mobility and solubility within the plant tissues showed greater fluctuations than the other major elements in the sap.

Tables I and II below give the analytical figures obtained, and it will be seen that the ranges of composition of the various nutrients are as follows:—

	Gm/100 ml
Nitrogen (as N)	0·033 to 0·038
Phosphoric Acid (as P_2O_5)	0·015 to 0·023
Potassium (as K_2O)	0·144 to 0·203
Calcium (as CaO)	0·0017 to 0·0021
Magnesium (as MgO)	0·0060 to 0·0085

TABLE I

Bulked Toddy from Six Tall Palms at Bandirippuwa which flowed between 4 p.m. and 6 a.m.

Sample No.	*Time of Analysis*	*Nitrogen as N Gm/100 ml*	*Phosphoric Acid as P_2O_5 Gm/100 ml*	*Potash as as K_2O Gm/100 ml*	*Calcium as CaO Gm/100 ml*	*Magnesium as MgO Gm/100 ml*
	a.m.					
1	10·00	0·034	0·019	0·192	0·0017	0·0066
2	10·00	0·036	0·018	0·178	0·0019	0·0068
3	10·00	0·036	0·019	0·153	0·0018	0·0076
4	10·00	0·037	0·018	0·162	0·0019	0·0072
5	10·00	0·038	0·018	0·169	0·0018	0·0076
6	10·00	0·035	0·019	0·154	0·0020	0·0068
7	10·00	0·034	0·020	0·155	0·0021	0·0078
8	10·00	0·035	0·023	0·162	0·0021	0·0060
9	10·00	0·035	0·018	0·189	0·0018	0·0085
10	10·00	0·034	0·020	0·203	0·0017	0·0068
Average	10·00	0·035	0·019	0·172	0·0019	0·0072

TABLE II

Toddy from Six Individual Tall Palms which flowed between 4 p.m. and 6 a.m.

Sample No.	*Time of Analysis*	*Nitrogen as N Gm/100 ml*	*Phosphoric Acid as P_2O_5 (Gm/100 ml)*	*Potash as K_2O (Gm/100 ml*	*Calcium as CaO (Gm/100 ml)*	*Magnesium as MgO (Gm/100 ml*
	a.m.					
1	10·00	0·036	0·018	0·192	0·0018	0·0076
2	10·00	0·033	0·018	0·179	0·0020	0·0078
3	10·00	0·038	0·016	0·161	0·0021	0·0078
4	10·00	0·034	0·015	0·178	0·0021	0·0068
5	10·00	0·037	0·019	0·185	0·0018	0·0085
6	10·00	0·037	0·023	0·144	0·0017	0·0068
Average	10·00	0·036	0·018	0·173	0·0019	0·0075

The toddy samples used for the above estimations had the following average composition at the time of analysis:—

Total solids—14.2 gms/100 ml.
Acidity (as acetic)—0.64 gm/100 ml. and
Alcohol (v/v)—2.12 per cent.

The sulphated ash representing the total mineral matter in the sap, amounted on an average to 0.46 gm. per 100 ml. of the original toddy. The silica content of the ash was about 3.6 per cent. equivalent to 0.02 per cent. on the toddy.

(II) **Studies on the Micro-nutrient Composition of Coconut Toddy**

As the special digestion and distillation apparatus ordered for " trace element " work had not been received during the year, it was possible to estimate manganese alone of the micro-nutrients.

Very satisfactory and concordant results were obtained using the periodate oxidation method, after wet digestion of solids in toddy with sulphuric, nitric and perchloric acids. The permanganate colour produced was estimated with an Officine Galileo (Duboscq type) colorimeter.

As with the macro-nutrients, two sets of analyses were done on ten bulked samples and six individual samples of toddy respectively. The results charted in Table III show that the manganese content of toddy from healthy palms ranges between 44 and 66 micrograms per 100 ml. (1 microgram = 0.000001 gm.)

TABLE III

Bulked Toddy from Six Palms		*Toddy from Six Individual Palms*	
Sample No.	*Manganese as Mn (Micrograms/100ml)*	*Sample No.*	*Manganese as Mn (Micrograms/100ml)*
1	53	1	46
2	51	2	54
3	58	3	44
4	46	4	66
5	50	5	56
6	56	6	58
7	44	—	—
8	46	—	—
9	51	—	—
10	56	—	—
Average	51	Average	54

The samples for the above estimations were drawn at 10 a.m. and were in a state of fermentation comparable with the samples used for the major element analyses quoted above.

(III) **Toddy Effluents**

In response to requests from arrack distillers, three samples of toddy spent wash were examined in order to determine methods of disposal and possible utilization.

Though the analytical characteristics of the samples given in Table IV do not reveal the practicability of recovering anything commercially profitable, yet the mineral constituents of the waste liquor certainly impart to it some manurial value.

TABLE IV

Analytical Data on Three Samples of Toddy Spent Wash

Constituents Gms/100ml	*Sample I*	*Sample II*	*Sample III*	*Mean*	*Mean % on Total Dried Solids*	*Mean Percentage on Ash*
Solids in suspension	0·609	0·362	0·373	0·45	—	—
Solids in solution	1·99	2·04	2·18	2·07	—	—
Total solids	2·60	2·40	2·55	2·52	—	—
Total acidity (as acetic)	0·37	0·57	0·71	0·55	—	—
Total sulphated ash	0·67	0·64	0·65	0·65	25·8	—
Percentage water soluble ash	85·05	84·89	91·38	87·11	—	—
Percentage water insoluble ash	14·95	15·11	8·62	12·89	—	—
Potash as K_2O	0·171	0·163	0·178	0·171	6·79	26·3
Nitrogen	0·059	0·053	0·046	0·053	2·10	—
Protein (N × 6·25)	0·369	0·331	0·288	0·329	13·06	—
Phosphate (as P_2O_5)	0·023	0·021	0·019	0·021	0·83	3·23

Computing on the basis of the above results it will be found that 1,000 gallons of spent wash would contain 5.3 lb. nitrogen, 17.1 lb. potash (as K_2O) and 2.1 lb. phosphorus (as P_2O_5). Based on current prices of fertilizers the total value of the manurial constituents present in every 1,000 gallons will be approximately eleven rupees.

The standard 3: 2: 2 (N: P: K) fertilizer mixture prescribed for biennial application to coconut palms could be equated with gallons spent wash as follows:—

Three lb. Sulphate of Ammonia (20·6% N) = 116·4 gallons of liquor
Two lb. Muriate of Potash (50 % K_2O) = 70·0 gallons of liquor
Two lb. Saphos Phosphate (29·5% P_2O_5) = 279·7 gallons of liquor

In round figures if the liquor could be applied to palms preferably after neutralizing with lime at the rate of approximately 60 gallons per palm per year, this would cover all the nitrogen requirements, besides providing almost a luxury double dose of potash which is well known to be the dominant fertilizer requirement of the coconut. The palms treated this way should require to be supplemented only with phosphoric acid to the extent of about 0.5 lb. saphos phosphate per year.

The analytical figures quoted above, show that the spent wash of arrack distilleries contains a considerable amount of organic matter indicated by the concentration of total solids and nitrogen. A separate experiment has also shown that this organic matter could be readily decomposed by biological action. In other words, if the streams or rivers into whiich these effluents are normally discharged do not permit of requisite dilution then severe deoxygenation of the water could result giving rise to anaerobic conditions with concomitant danger to the survival of any living organisms (including fish) in the water.

Based on these observations a paper on "Toddy Effluents" has been published indicating its possible uses and satisfactory disposal, for the benefit of those interested in Ceylon's arrack industry.

(IV) Studies on the keeping qualities and the rate of dryage of water from husked Coconuts

Studies which were commenced last year on five lots of nuts of graded sizes were completed during the year. The five lots were comprised of I. Green Nuts. II. Nuts withered for a month (*a*) in the field, (*b*) under cover and III. Nuts withered for two months (*a*) in the field and (*b*) under cover.

The complete results will be published elsewhere but in broad outline, the following observations were made:—

(1) The maximum number of germinations were evident in nuts over 14" diameter, withered for one month in the field.

(2) The minimum number of germinations were evident in the Fresh Green nuts 12-14" in diameter.

(3) The maximum number of spoiled nuts were in the group over 14" in diameter, withered for two months under cover.

(4) The minimum number of spoiled nuts were in the group of nuts 12"—14" in diameter withered for one month under cover.

(5) The maximum number of dry nuts were in the group withered for 2 months under cover.

(6) The minimum number of dry nuts were in the group Mature Fresh Green Nuts.

(7) The water from the smaller nuts had a tendency to dry out more quickly than that from the larger ones.

The above was an *ad-hoc* investigation following up an inquiry from a firm handling the export of fresh coconuts. The results are of some importance because they give indications of the type of husked nuts which have the best keeping qualities, and consequently most suited for export.

In order to ensure the arrival of fresh husked coconuts in a sound undeteriorated condition fit for sale in overseas markets, three possible sources of trouble have to be contended with, viz.:—

(1) Direct spoilage, (2) Dryage of water, and (3) Germination of the nuts.

Unhusked fresh coconuts do germinate on long storage, but as a rule they keep very well for protracted periods of time and rarely go " rotten " unless they are immature. On husking however, they are very susceptible to spoilage especially in the region of the " soft eye " where the shell is very thin and below which the embryo is situated. In usual practice, during husking the fibrous " tuft " is left intact, and this to a certain extent protects the delicate " eye " from attack by fungi and other putrefactive organisms especially under damp conditions.

As nuts are handled in the husked form for export the present experiment shows that keeping the " tuft " intact is not by itself a sufficient guarantee of their keeping qualities. Nuts which have been in long storage (in the field or under cover) before husking, will not prove suitable for export as they germinate quickly and are apt to go " rotten " easily. Small nuts are also not suitable because the water in them tends to dry out more quickly than from the larger ones. Large size nuts sorted from Mature Green nuts (husked fresh) should be the best suited for export purposes.

(V) Coconut Water Effluents from D. C. Mills

Two typical samples of coconut water effluents drawn from a Co-operative Mill were analysed with the following results:—

TABLE V

Analytical Data on Coconut Water Effluents from D. C. Mills

Sample No.	Specific Gravity (filtered water) 30°C/30C°	30°C/4°C	pH	%Oil Gms/100 ml.	% Acidity as acetic) Gms./100 ml.	% Alcohol w/w	w/v	v/v	% Total Solids Gms/100 ml.	% Sulphated Ash Gms/100 ml.	As % of Total Solids	% Nitrogen Gms/100 ml.	% Protein (N×6·25) Gms/100 ml.	% Phosphorus as P_2O_5 Gm/100 ml.	% Potassium (as K_2O) Gms/100 ml.	As % Ash
I	1·0045	1·0000	4·1	0·32	0·58	0·28	0·28	0·36	1·05	0·42	30·4	0·024	0·150	0·017	0·094	22·4
II	1·0046	1·0000	3·9	0·63	0·60	0·28	0·28	0·36	1·27	0·36	21·2	0·037	0·231	0·021	0·083	23·1
Mean	1·0046	1·0000	4·0	0·48	0·59	0·28	0·28	0·36	1·16	0·39	25·8	0·030	0·190	0·019	0·088	22·8

Sugars: % Reducing Sugars (as Invert Sug. Gms/100 ml.	% Non-Red. Sug. (as Sucrose) Gms/100 ml.	% Total Sugars Gm/100 ml.	As % Total Solids	% Non-Fermentable Solids Gm/100 ml.	% Suspended Solids Gm/100 ml.	% Solids in Solution Gms/100 ml.	Sample No.
0·0	Trace	Trace	Trace	1·05	0·10	0·95	I
0·0	Trace	Trace	Trace	1·27	0·25	1·02	II
0·0	Trace	Trace	Trace	1·16	0·18	0·98	Mean

The data show that the effluents as run out are of not much value, as a source of alcohol or acetic acid, because there are no residual fermentable solids. About 0.4 per cent. (v/v) of alcohol and 0.6 per cent. of acid could possibly be regarded as maximum yields. The cost of fuel would certainly not justify the recovery of these small amounts.

The liquor has a certain amount of manurial value which however is less than that of nut water itself or toddy effluents. This could well be explained by the fact that the nut water from the coconuts used for DCN manufacture is appreciably diluted by the wash water used in the factories.

The possibility of using these effluents for the propagation of yeasts, and bacteria which are employed in the manufacture of antibiotics is an interesting speculation and appears to warrant investigation.

The 0.03 per cent. of total nitrogen in the effluents would doubtless be enough to sustain the growth of these organisms to some degree, but certainly inadequate for productive fermentation. About 4 g/100 ml. of total nitrogen, with amino nitrogen 0.8 g/100 ml. is usually reckoned as an optimum concentration.

The problem of fortification with extra nitrogen hinges on the question of availability of suitable nitrogenous material (containing amino-acids, peptides, &c., in the correct proportions) at an economic price.

(VI) **Examination of Farmyard Manure**

In continuation of the work reported last year two more half yearly samples of Farmyard Manure were examined. Table VI summarises all the results obtained up till now, for the major manurial constituents, nitrogen, phosphoric acid and potash.

TABLE VI

(*a*) **Farmyard Manure from Pasture-fed Cattle**

Sample No.	*Date of Sampling*	% *Moisture*	% *Nitrogen*		% *Phosphoric Acid (as P_2O_5)*		% *Potash as K_2O*	
			Wet Basis	*Dry Basis*	*Wet Basis*	*Dry Basis*	*Wet Basis*	*Dry Basis*
Ia	Dec. 51	—	—	—	—	—	—	—
II a	Jan. 52	6·31	1·50	1·60	0·67	0·72	1·25	1·33
III a	June 52	8·15	1·84	2·00	0·68	0·74	1·55	1·69
IV a	Dec. 52	7·94	1·21	1·32	0·48	0·52	1·75	1·90
V a	June 53	7·81	1·52	1·65	0·65	0·70	2·12	2·30
VI a	Dec. 53	3·78	0·79	0·83	0·63	0·66	0·87	0·91
	Five Samples	6·80	1·37	1·48	0·62	0·67	1·51	1·63

(*b*) **Farmyard Manure from Concentrate Fed Cattle**

I b	Dec. 51	5·44	1·22	1·29	0·58	0·61	1·30	1·38
IIb	Jan. 52	5·35	1·33	1·39	0·80	0·85	1·28	1·38
III b	June 52	5·41	1·52	1·61	0·63	0·67	1·07	1·14
IV b	Dec. 52	6·36	1·09	1·16	0·58	0·62	2·12	2·27
V b	June 53	4·80	1·09	1·15	0·41	0·43	0·87	0·92
VI b	Dec. 53	5·26	1·11	1·17	0·74	0·78	—	—
	Six Samples	5·44	1·23	1·30	0·62	0·66	1·33	1·42

The average figures still indicate that the manure from pasture-fed cattle is a trifle superior to that from the concentrate fed animals.

As the composition of the individual samples shows wide fluctuations, the present average figures could not be regarded as being strictly representative.

(VII) Investigations on Tapering Palms

The various monthly and bimonthly treatments of the palms and seedlings under observation have been continued during the year.

Empirical trials on young palms have confirmed the observations on mature palms, regarding the beneficial effects of magnesium applied in the form of dolomite or epsom salts. As dolomite even in excess is not harmful, annual applications both to young and old palms are now being recommended at the rate of 2 pounds per palm.

(VIII) Miscellaneous Work

This included analyses and reports on various samples of copra, poonac and coconut oil sent mostly by mill-owners seeking advice. Some of the copra examined included samples from hybrid palms sent by the Botanist.

W. R. N. NATHANAEL,
Chemist.

REPORT OF THE ANIMAL HUSBANDRY OFFICER

This new division is for the purpose of studying the inter-relationship between coconuts and livestock, i.e., the effect of keeping dairy cattle, pigs and poultry on the economic conditions of the coconut grower.

Cattle

The herd of indigenous Sinhala-type cattle which is now maintained at Bandirippuwa Research Station on a diet of mixed rough pasture and coconut poonac is in fine condition and it has been proved that rich milk can be produced at a profit with this type of animal under proper conditions of control and management, in spite of the low yields of milk per animal.

Adult herd strength was maintained at 20, but it was decided to increase the herd strength to 30 with heifers born on the Research Station. The two original stud bulls have sired all the progeny. It is interesting to note that all heifers born have been raised to maturity in less than 2 years, and that Cow No. 20 born on November 9, 1951, calved on July 19, 1953—i.e., in less than 2 years. Lactation figures, weight records and history sheets are being maintained for the whole herd.

Systematic observations on the grazing habits of the animals, when kept in the shade of coconut palms, have shown that they mostly graze during the hours of daylight, so that it is wise to take them in at night for the production of farmyard manure and in order to avoid unnecessary trampling and fouling of the pasture. The results have been published.

A feeding trial with different levels of poonac was started in May and is being continued. Farmyard manure is being prepared separately from those animals receiving poonac in addition to grazing and those only pasture fed. The Chemist has examined the samples of the manures (see his report).

Napier and Guinea grass and *Bracharia miliformis* are being planted under the coconuts as fodder and pasture grasses.

Animals were sent for the All-Ceylon Cattle Show in Colombo and the District Livestock Show in Negombo. Milk is being supplied to the Staff at concession rates and excess milk is turned into ghee. Cow No. 4 was the best milker giving 130 gallons for the lactation. The whole herd was T. T. tested in January.

Poultry

Flock strength at the beginning of the year was 80 birds, all Australorps, bought from the Government Farm, Ambepussa. These birds were trap-nested and it was found that the highest yield for any hen for the year was only 125 eggs. The Australorps were all sold off.

Poultry are maintained in the free range and also on the portable pen system. Eggs are sold to the staff, and to a hatchery in Colombo. The yield of coconuts in the one acre block where the poultry are maintained was 5,263 for 1953.

Pigs

One boar and 3 sows of the middle white breed were purchased in December and are housed in portable pens, which are moved progressively from square to square along the rows of palms.

GAMINI C. M. GOONESEKERA,
Animal Husbandry Officer.

REPORT OF THE PLANTING OFFICER

Nurseries

The following Planting Division Nurseries were maintained during the year:—

Name of Nursery	*Capacity*		
Ratmalagara	113,000		
Carmel	41,000		
Walpita	40,000		
Hettipola	47,900		
St. Anne's	46,945		
Labuduwa	18,500		
Palugaswewa	16,000		
Killinochchi	40,000		
Kalawewa	29,000		
Bedigama	56,750		
Wilpotha	131,350		
		580,545	
Co-operative Nurseries—			
Veyangoda	10,000		
Dunagaha	20,000		
Nattandiya	16,000		
Puttalam	6,000		
Sandalankawa	15,000		
		67,000	
			647,545 nuts

In addition to seed-nuts planted in Planting Division & Co-operative Nurseries, 65,000 seed-coconuts were supplied on orders during the year.

In practically all our nurseries, seedlings available for issue during the North East Monsoon planting in 1952 were not taken delivery in full and as such our estimated seed-nut programme for 1953 had to be curtailed for want of nursery space. With the reduction in the price of seedlings and favourable weather conditions experienced during the latter part of 1953, the demand for planting materials increased considerably and could not be met. Anticipating the present demand to continue, arrangements are being made to replenish the nurseries to full capacity.

A New Nursery established at Wilpotha Middle Class Colony on a 10 acre block of land obtained from the Land Commissioner and 130,000 seed-nuts were planted in 1953 and it is proposed to increase the quantity to about 200,000 in 1954.

The demand for seedlings in Kurunegala District is very heavy, but unfortunately we are unable to make arrangements even in the coming year to meet the demand by opening new nurseries. The only nursery we have now in Kurunegala is Carmel Nursery at Ibbaganiuwa which can accommodate only 30,000 seed-nuts which is quite insufficient to meet the requirements of this area.

So far we have not been able to obtain a suitable plot of land sufficiently large enough to establish a Nursery. We have contacted Revenue Officers, Forest Department, Co-operative Societies and other private individuals but so far we have not been able to obtain a suitable land for a Nursery.

Though Crown land was available in one or two Colonization Schemes, the situation of the lands was very unsuitable from the point of view of accessibility and transport and moreover scarcity of water in these areas prevented us from selecting a site in these Schemes.

Co-operative Nurseries

Only 6 Co-operative Nurseries are being maintained now—namely—Nattandiya, Dunagaha, Sandalankawa, Veyangoda, Puttalam and Kurunegala Co-operative Societies.

Kurunegala Society will not be having a Nursery in 1954 for want of land for a Nursery. The demand for seedlings from Puttalam Co-operative Nursery being poor, the Society has decided not to replenish the Nursery in 1954. A New Nursery is to be established for Wennappuwa Coconut Producers' Co-operative Society. The land has already been selected and the work of clearing the site is proceeding.

Advisory Services

New Ranges for Advisory Field Officers were approved by the Board and the Officers were stationed in the new Ranges from October 1, 1953, as follows:—

Range	*Province*	*District*	*Acreage*	*Name of Officer*	*Station*
1	Northern Province	Jaffna, Vavuniya and Mannar	24,000	Vacant	—
2	Eastern Province	Batticaloa and Trincomalee	24,000	Victor Vennayagam	Batticaloa
3	N.-W. Province	Puttalam	61,000	Wilson Senanayake	Left
4	N.-W. Province	Chilaw	55,000	Dunstan Fernando	H.Q.
5	N.-W. Province	Kurunegala	129,000	T. Ganarajah	Kurunegala
6	N.-W. Province	Kurunegala	117,000	Bede Fernando	Kuliyapitiya
7	N.-W. Province and Sabaragamuwa	Kurunegala and Kegalla	115,000	K. M. Francis	Polgahawela
8	Western Province	Colombo	144,000	H. L. L. Perera	Divulapitiya
9	Western Province	Colombo	84,000	H. L. L. Perera	
10	Southern Province	Galle Matara and Hambantota	—	W. V. Fernando	Matara

Advisory Field Officers are now working to a set programme of work. During the three months, from October 1, 1953, on which date they were posted to new stations, the work carried out is satisfactory. As could be seen from the Chart, the ranges marked out covers all coconut growing areas of Ceylon, but the ranges areas are fairly large for one Officer to deal effectively but due to lack of funds, extra staff could not be recruited. For 10 ranges there are only 8 Officers. Northern Province range remains vacant. Ranges 8 and 9 are worked by one Officer.

The New Ranges are based on the D. R. O's Divisions to obtain clearly defined Range boundaries. The Officers are now working through the D. R. O's to get in touch with all the Village Headmen, who will be of great assistance to these Officers in their work. They have now met most of the Village Headmen and are drawing up programmes of work for each of the Divisions. As it is not possible to contact land owners individually, these Officers are working through Rural Development Societies, Co-operative Agricultural Production and Sales Societies, Coconut Producers' Co-operative Societies, Village Committees and other Associations connected with the Coconut Industry.

Lists of all Societies in each of the D. R. O's Divisions are prepared and a large number of Societies have already been contacted and visits paid to a considerable number of holdings.

Visits to properties are to give general advice and provide a " follow-up " Service. A fair number of requests for advice on lining for new and under-planting, contour draining, &c., have been received from different areas and have all been attended to by the Officers in charge of respective ranges. Follow-up Service work is being done on Advisory Visits. A large number of plantations have been visited and reports submitted.

The equilateral triangular planting system is becoming popular and is being adopted by a large number of land owners.

Propaganda and Education

Three Field Days and Mass Propaganda Meetings were held in Southern Province in Talpepattu D. R. O's Division and these were well attended. Advisory Field Officer, Southern Province, was responsible for bringing a large number of estate owners from Southern Province on a tour to the Institute. Advisory Field Officers attend the Rural Development Training Centres, whenever requested to give talks on Coconut Cultivation to trainees, who are normally brought to the Institute on a tour after the training course, to show the practical side of the work.

Model Plantations

It is proposed to have Model Plantations wherever possible, at least one for each D. R. O's Division. Ten sites in Southern Province and 2 in Chilaw District have already been selected. Ten plots in Southern Province cover all aspects of Coconut Plantation work, namely, triangular and equilateral systems of planting, draining of water-logged lands, new and under-planting, contour draining, water conservation methods, manuring and cultivation. Two plots in Chilaw District demonstrates under-planting on the equilateral triangular system.

Expenditure

The following Statement gives details of expenditure for the financial year 1952-53:—

Items	*Total* Rs. c.
Office	17,622 56
Transport	9,397 61
Vehicles	31,011 68
Travelling	19,277 48
General stores	24,405 90
Incidental expenses	6,137 64
Salaries	78,898 59
Buildings	33,774 60
Up-keep of nurseries	79,362 59
Seed-nuts	149,698 27
Propaganda	3,636 33
Land utilization	38 50
Demonstration plots	15,000 0
Refund to Department of Agriculture	188 25
	468,450 0

LAURENCE FERNANDO,
Planting Officer.

REPORT ON THE ESTATES

Bandirippuwa Estate

Crop harvested during 1953 was—

Crop	*Nuts from Estate Area*	*Nuts from Research Area*	*Total*	*Average 1931 to 1952*	*1953 above or below Average (%)*
I	37,066	12,043	49,109	67,468	— 27·2
II	53,308	13,103	66,411	111,677	— 40·5
III	101,140	21,144	122,284	132,969	— 8·0
IV	89,619	20,067	109,686	118,424	— 7·4
V	80,963	17,591	98,554	79,984	+ 23·2
VI	56,788	17,556	74,344	62,248	+ 19·4
Total	418,884	101,504	520,388	572,770	— 9·1

The nuts were disposed of as follows :—

Sold on contract	100,666	
Sold to planting division	31,325	
Sold to research section	5,518	
Supplies to nurseries	200	
Cured for copra	363,615	
Allowance to staff	13,610	
Empties	5,454	1·0%
	520,388	

The 363,615 nuts cured gave 282 candies 178 lb. of copra and an out-turn of 1,288 nuts to a candy.

The revenue from Bandiruppuwa Estate actually accruing in 1953 was—

Revenue from Estate Management

	Rs.	*c.*	*Rs.*	*c.*
Crops, 1952—				
Sale of nuts	10,651	92		
Sale of copra	4,072	53		
Sale of sundries	191	0		
			14,915	45
Crops, 1953—				
Sale of nuts	20,135	76		
Sale of copra	29,350	16		
Sale of sundries	873	80		
Sale of cadjans	111	58		
			50,471	30
			65,386	75

Revenue from Research Management

	Rs.	*c.*	*Rs.*	*c.*
Crops, 1952—				
Sale of nuts	52	43		
Sale of copra	5,108	16		
Sale of sundries	1	80		
			5,162	39
Crops, 1953—				
Sale of nuts	91	87		
Sale of copra	10,261	76		
Sale of sundries	12	75		
			10,366	38
			15,528	77

Total revenue for 1953 was thus Rs. 80,915.52.

Expenditure for the year totalled Rs. 28,219.18. Receipts therefore exceeded expenditure for the year by Rs. 52,696.34.

Cost of production of nuts on the estate area (including copra curing, transport expenses and depreciation of kiln) was Rs. 67.36 per 1000 nuts.

Sundry Debtors and Creditors Account. Of the income accruing in 1953 and included in the above statement is Rs. 14,915.45 (Estate) and Rs. 5,162.39 (Research) from 1952 crops had been credited to the Estate Working Account for 1952 through Sundry Debtors Account. The Estate Working Account for 1953, does not therefore include this sum.

The following amounts have been credited to the Estate Working Account on account of 1953 crops lying unsold at the end of the year:—

1953 Crops (Estate)	Rs.	c.	*1953 Crops (Research)*	Rs.	c.
Sale of nuts	7,628	32	Sale of nuts	—	
Sale of copra	11,144	38	Sale of copra	6,629	22
Sale of sundries	80	10	Sale of sundries	9	15
Sale of cadjans	27	99			
	18,880	79		6,638	37

The Bandirippuwa Estate Working Account for 1953 thus shows a balance of Rs. 58,018.72, carried forward to revenue.

D. F. WITHANA,
Superintendent,
Bandirippuwa Estate.

Ratmalagara Estate

Crops harvested during 1953 were—

Crop No.	*1953* Estate Nuts	*1953* Research Nuts	*Total 1953*	*Total 1952*	*Total 1951*	*Average 1938–52*
I	40,460	13,954	54,414	52,598	51,983	50,794
II	48,757	17,543	66,300	75,294	62,371	62,029
III	74,920	22,469	97,389	111,761	78,539	90,879
IV	66,217	20,069	86,286	90,331	85,688	85,822
V	60,256	20,284	80,540	81,658	68,594	79,140
VI	45,815	17,495	63,310	68,373	56,652	63,430
Total	336,425	111,814	448,239	480,015	335,233	432,094

Crops were disposed of as follows:—

Cured into copra	335,343
Sold on contract	101,150
Rejections	8,354
Issues to staff	3,380
Issued for research	12
	448,239

The 335,343 nuts cured into copra gave 266 candies 253 lb. of copra equivalent to an out-turn of 1,259 nuts per candy.

Revenue actually accruing during the year was—

Revenue from Estate Management	Rs.	c.	Rs.	c.	*Revenue from Research Management*	Rs.	c.
Crops, 1953—					Crops, 1953—		
Estate copra	55,207	41			Research copra	17,432	92
Estate sundries	528	12					
			55,735	53			

The expenditure for the year on the Estate Section amounted to Rs. 23,389.35.

The cost of production of nuts on the Estate Section (including copra curing, transport and the upkeep of the young plantation) was Rs. 69.52 per 1,000 nuts.

Ratmalagara Estate Working Account for 1953 shows a balance of Rs. 49,779.10 carried forward to revenue.

HENRY J. F. PEIRIS,
Superintendent
Ratmalagara Estate.

REPORT OF THE AUDITOR-GENERAL.

No. M 2 (3) 13,
Audit Office,
Colombo 7, March 16, 1955.

The Chairman,
Board of Management,
Coconut Research Institute,
Peradeniya.

The accounts of the Coconut Research Institute for the year 1953 were audited under my direction and the General Balance Sheet as at December 31, 1953, is forwarded herewith, duly certified, together with the following statements:—

(i) Statement of Receipts and Disbursements,

(ii) Statements of the Working Accounts of the Bandirippuwa, Ratmalagara Estates, Nursery and Animal Husbandry Division

(iii) Capital Expenditure Account,

(iv) Revenue Account, and

(v) Expenditure on Special Recurrent Vote.

Revenue Account

2. (*a*) *Cess Collections—Rs. 333,415.09.* This figure includes a sum of Rs. 31,727.47 being Cess Collections of September, 1952, the recovery of which was overlooked till the matter was pointed out in Audit. As reported in paragraph 3 of my Report on the accounts for 1952, necessary action was taken by the Director and the amount has since been recovered and credited to the funds of the Board in January, 1954. Taking the cess collections due for September, 1952, as income for 1952, the Cess Revenue for the year was Rs. 301,687.62 as compared with Rs. 349,799.32 for the previous year.

(*b*) *Profits from Estates—Bandirippuwa: Rs. 58,018.72. Ratmalagara—Rs. 49,779.10.* The working accounts of the Bandirippuwa and the Ratmalagara Estates show a profit of Rs. 107,797.82 as compared with the profit of Rs. 83,532.72 for the previous year. The increase of Rs. 24,265.10 was mainly due to a rise in prices of copra and to the transfer to the Estate Account of a sum of Rs. 2,788.46 being the cost of nuts issued free to the Institute's Staff and to the labourers. This is the first time that the cost of the free issue authorised by the Board has been treated as a charge to the Revenue Account.

Although an income of Rs. 2,600 was estimated from the sale of husks, shells, &c., only a sum of Rs. 975.80 was derived from this source. The shortfall was explained to be due to the husks and shells being utilized for other purposes such as mauring and curing copra.

An income of Rs. 400 was estimated for from food crops at Ratmalagara Estate. No income, however, accrued from this source as experiments with food crops were abandoned during the year.

(*c*) *Nursery—Rs. 6,741.75.* As compared to the loss of Rs. 1,172.47 in 1952, there has been a profit of Rs. 6,741.75 in 1953. This was due to the following factors:—

(i) The salary and allowances of the Nursery Attendant was not charged to this account as was done in previous years on the ground that the Nursery was maintained for research work and not for the supply of seedlings, and

(ii) Seednuts purchased and sold during the year brought in a profit of over Rs. 4,000.

(*d*) *Animal Husbandry—Loss Rs. 3,242.41.* The loss in this Division was Rs. 3,242.41 compared to the loss of Rs. 12,937.06 in the previous year. It was explained that the loss is inevitable in this Division as the products of cattle such as milk is issued to the staff at a price of 25 cents per pint and the Division itself was set up purely for research purposes and not with a view to making profits. The question of charging the Animal Husbandry Officer's salary and allowances to this account may be considered by the Board as it would help to assess correctly the working results of this Division.

(*e*) *Books and Periodicals—Rs 8,929.58.* The expenditure on books and periodicals for the Board's Library during the year amounted to Rs. 8,929.58. The total expenditure on this account since the opening of the Library in 1932, was in the neighbourhood of Rs. 54,000. A proper system regarding the issue and receipt of books from the Library does not exist and an annual survey of the books has not been carried out to verify the physical existence of the books.

Balance Sheet

3. (*a*) *Capital Outlay—Rs. 1,167,938.53.* The Capital Assets shown in the Balance Sheet amount to only Rs. 1,166,505.62. The difference of Rs. 1,432.91 represents the cost of a Copra Kiln which was demolished in 1947, and was written off in the Revenue Account. The question of transferring a like sum to the Surplus Account from the Capital Outlay Account should be considered.

(*b*) *Animal Husbandry Division—Rs. 7,783.57.* This sum includes Rs. 3,040 being the cost of animals originally purchased for the use of the estate, but does not include the cost of livestock (dairy cattle, pigs and poultry), purchased for the Animal Husbandry Division. A proper register of livestock showing dates of purchase, value, disposition, disposal, &c., has not been maintained. The matter is under reference to the Director.

(*c*) *Co-operative Nurseries—Rs. 35,093.65.* As the expenditure on these nurseries was not of a Capital nature and as the nurseries do not actually belong to the Coconut Research Institute, it would not be correct to show this as an asset in the Balance Sheet.

(*d*) *Superintendent's ,Bungalow—Rs. 1,197.45: Junior Staff Bungalow—Rs. 3,947.81.* These represent the purchase price of building materials such as bricks. The work of construction was not undertaken during the year.

(*e*) *Investments.* The basis of valuation has not been indicated in the Balance Sheet. It is suggested that investments be shown at cost price and their Middle Market Value shown as a foot-note in the future Balance Sheets.

General

4. (*a*) *Unauthorised Expenditure.* The expenditure exceeded the sanctioned estimates in respect of several items as indicated in the statement annexed. The covering approval of the Board should be obtained for the excesses. It should also be noted that it is not correct in principle to incur expenditure in excess of the amounts provided for in the estimates without the prior approval of the Board.

(*b*) *Expenditure from the Special Grant.* The expenditure charged to this Grant amounted to Rs. 175,765.18 as shown below, although the balance available was only Rs. 72,377.16—

	Rs.	*c.*
On Capital Works	146,952	85
On Recurrent expenditure	28,812	33
	175,765	18

Unless it is proposed to obtain a reimbursement of the amount spent in excess of the Grant from the Central Government, the purpose of charging further expenditure to the Grant would be meaningless.

(*c*) *Leave.* Although the Board had decided that leave conditions of the Institute's Staff should be the same as for the New Entrants in the Government Service, it was observed that 2 weeks' casual and 4 weeks' vacation leave have been allowed whereas new entrants in the Government Service are entitled to only 1 week's casual and 4 weeks' vacation leave. When this was pointed out in Audit, the Board decided to allow 2 weeks' casual leave to its staff. Minor employees too are allowed the same privileges, while in terms of the Government Financial Regulations, they are allowed only 14 days sick and 14 days casual leave.

(*d*) *Missing Vouchers.* Ten vouchers amounting to Rs. 6,370.56 have not been furnished for audit. I am in communication with the Director regarding this matter.

(*e*) *Delay in the rendition of Accounts 1953.* A major portion of the monthly accounts of the Institute were rendered to audit in August, 1954.

The Statements in respect of the Final Accounts of the Institute for 1953, were received in Audit only on October 11, 1954, and due to the numerous errors observed in the accounts, this report could not be issued earlier.

March 21, 1955.

A. WEERASINGHE,
Auditor-General.

COCONUT RESEARCH INSTITUTE—COCONUT RESEARCH BOARD

Statement of Receipts and Disbursements for the Year ended December 31, 1953

(In compliance of Section 8/2/ of Ordinance No. 29 of 1928)

	RECEIPTS	Amount Rs. c.	Estimate Rs.
BALANCE AS AT JANUARY 1, 1953		332,948 33	
A.	*Revenue Account :*		
	Government grant under Ordinance	30,000 0	30,000
	Cess collection	333,415 9	250,000
	Interest on investments	15,357 93	14,952
B.	*Income Bandirippuwa :*		
	Estate area	43,738 78	43,625
	Research area	11,558 31	11,187
C.	*Income Ratmalagara :*		
	Estate area	41,496 71	29,550
	Research area	12,542 3	8,475
	Rubber seed garden	284 25	—
D.	*Other income :*		
	Sale of planting materials	23,355 56	14,000
	Charges to staff for electricity	1,377 95	1,200
	Sale of publications	402 45	1,500
	Sale of Ceylon Coconut Quarterly	3,405 83	1,700
	Sale of Pol Sangharawa	62 75	—
	Sundry receipts	1,153 84	2,500
	A. H. O. Division	5,272 87	8,490
E.	*Advance account :*		
	Provident fund contributed by staff	21,525 20	
	Office extension refund	2,645 0	
	Genl. stores account	556 90	
	Loans to staff (29442/50)	29,442 50	
	Fertiliser adv/B/E/ and R/E	2,327 2	
	Provident fund bonus	21,202 15	
	Travelling advances	107 0	
F.	*Investments :* Interest	4,059 68	
		938,238 13	

DISBURSEMENTS

		Rs. c.	Rs.
A.	*Capital expenditure :*		
	Laboratory equipment	10,533 7	51,100
	Junior staff bungalows and garage	1,608 10	12,000
	Senior staff bungalows	1,049 59	3,090
	Nursery stores	1,096 2	1,000
	R/E superintendent's bungalow	972 45	12,000
	R/E labour cottage	1,934 70	2,000
	G. C. B/E new labour lines	7,235 59	4,000
	Office equipment	1,621 20	3,350
	Varieties block S/C	4,330 84	5,125
	Overseas training	654 60	1,200
	House for power plant and line shaft	3,573 93	8,600
	Furniture	9,019 42	22,550
	Library chairs	2,250 0	4,500
	Laboratory furniture	11,486 64	14,050
	A. H. O. attendant's bungalow water service	1,091 75	850
	B/E new well	9,426 83	10,000
	Laboratory extension	84,739 44	89,505
	Office garage	1,666 34	1,500
	Junior staff drainage	305 34	2,000
	Electricity and water supply B/E	3,937 12	18,550

		Amount Rs. c.	Estimate Rs.
B.	*Personal emoluments :*		
	Senior staff salaries	68,482 50	68,515
	Senior staff dearness allowance	11,802 60	11,731
	Rent allowance	4,192 69	4,334
	Junior staff salaries	60,472 79	60,544
	Junior staff dearness allowance	49,555 35	47,932
	Co-op. advances account	27,017 77	33,036
	Travelling board members	3,433 0	4,500
	Travelling staff	15,994 3	17,000
C.	*Office :*		
	Stationery	2,367 96	4,000
	Postage	1,314 61	1,200
	Printing and advertising	1,585 75	2,000
	Incidental expenses	1,597 92	2,000
	Cost of audit	1,297 10	1,200
	Entertainment allowance	202 73	250
	Workmen's compensation insurance	549 88	250
	Office upkeep	546 65	600
	Ceylon Coconut Quarterly	4,376 43	5,000
	Telephone rental	600 0	520
D.	*Laboratory :*		
	Upkeep and chemicals	18,154 12	7,700
	Scientific books and periodicals	8,929 58	4,000
E.	*Buildings :*		
	Upkeep	10,970 80	7,800
	Insurance	2,880 13	2,980
	Running expenses of electrical plant	10,389 67	14,000
	Tractor upkeep	2,182 96	—
F.	*Bandirippuwa Estate :*		
	General charges	8,636 5	22,141
	Upkeep	6,205 24	6,315
	Cultivation	4,122 11	4,744
	Collection	3,959 19	4,438
	Replanting	564 74	
	Cadjan	84 0	
	Food crops	57 67	
G.	*Ratmalagara :*		
	General charges	6,510 89	11,668
	Upkeep	2,382 38	2,940
	Cultivation	5,729 57	6,400
	Collection	3,196 66	4,410
	Varieties block	451 81	
	Food crops—estate	265 62	200
	Food crops—research	44 88	
	Copra kiln	2,886 13	3,000
H.	*Research :*		
	General I	3,761 12	2,000
	Botanist II	13,075 82	19,500
	Soil Chemist III	10,205 34	18,000
	Purchase of planting material	12,625 86	12,000
	A. H. O. pasture cattle and poultry	14,621 39	10,140
I.	*Investments :*		
	5-year savings certificates	665 4	
	12-year saving certificates	360 0	
	Ceylon Savings Bank	9 0	
	Post Office Savings Bank	0 20	

J. *Advance accounts :*	*Amount* Rs. c.
Loans to staff	28,122 0
Sundry creditors	1,271 33
Sundry debtors	24,643 46
P. D. imprest	90,751 77
R/E F. A's bungalow repairs	1,583 95
Revenue account	27,476 48
	762,705 38
Cash at Bank No. 1 account	190,172 21
No. 2 account	3,376 23
Cash	3,000 0
	938,238 13

SUNDRY DEBTORS, 1953

Bandirippuwa Estate nuts	98 76
B/E estate copra	1,159 67
B/E estate sundries	40 10
Ratmalagara Estate nuts	9,939 68
R/E estate copra	2,981 43
R/E sundries	300 0
B/E research copra	1,328 89
B/E research	9 15
R/E research copra	3,614 32
Nursery working account	1,375 0
Rubber seed garden	95 43
Provident fund bonus and interest	5,900 71
Ceylon Coconut Quarterly	172 50
B/E fertilizer	3 31
A. H. O. poultry	325 60
A. H. O. cattle	540 26
Cadjans	3 0
Interest	843 6
Cess collections	57,008 2
	85,738 89
Recoveries in 1952	61,095 43
Balance as per statement	24,643 46

SUNDRY CREDITORS, 1953

Payments on 1952 account in 1953		7,547 43
Ceylon Coconut Quarterly	9 0	
B/E cultivation	8 40	
B/E collection	30 61	
G. C. B/E N. cottage	14 0	
G. C. R/E	3 65	
R/E. copra kiln	12 95	
R/E watchers cottage	80 0	
R/E collection	5 65	
Buildings upkeep	22 34	
Lab. upkeep	194 1	
Office upkeep	25 0	
Nursery working account	29 0	
R. I.	8 49	
R. II	70 92	
R III	36 71	
Lab. equipment	912 71	
Senior stff salaries	403 0	
Staff travelling	13 4	
Running expenses elec. plant	68 80	
Sc. books and periodicals	3,253 77	
Postage	24 5	
		5,226 10
Balance as per statement		2,321 33

BANK RECONCILIATION STATEMENT AS AT DECEMBER 31, 1953

	No. 1 Account Rs. c.	*No. 2 Account* Rs. c.
Balance as per Cash Book	.. 190,172 21	.. 3,376 23
Add cheques not cashed	.. 68,663 24	.. 13,584 6
	258,835 45	16,960 29
Less credits not gone into bank	.. 8,543 68	.. 15,793 75
	250,291 77	1,166 54

INVESTMENTS

	Rs. c.	Rs. c.
Ceylon Government Loan ..	525,000 0	
12-year Saving Certificates ..	9,360 0	
Ceylon Savings Bank ..	373 19	
Sri Lanka Loan ..	2,000 0	
Mortgage Bank Debentures ..	5,000 0	
5-year Savings Certificates ..	17,354 0	
Post Office Savings Bank ..	447 87	
Ceylon Government Defence Loan ..	5,000 0	
		564,535 6

EXCESS EXPENDITURE, 1953

REVENUE ACCOUNT	*Estimate*	*Supplementary Estimate*	*Total Provisions*	*Expenditure*	*Excess Expenditure not approved by the Board*
1. *Personal emoluments :*					
Provident fund schemes—					
Bonus and interest ..	25,797 0..	— ..	25,797 0..	27,476 48..	1,679 48
Other allowances ..	— ..	— ..	— ..	1,810 56..	1,810 56
3. *Office :*					
Postage ..	1,200 0..	— ..	1,200 0..	1,314 61..	114 61
Telephone rental ..	520 0..	— ..	520 0..	600 0..	80 0
Workmen's Compensation Insurance ..	250 0..	— ..	250 0..	549 88..	299 88
Audit fee ..	1,200 0..	— ..	1,200 0..	1,747 10..	547 10
4. *Building and machinery :*					
Upkeep ..	7,800 0..	— ..	7,800 0..	12,826 50..	5,026 50
Tractor upkeep ..	— ..	— ..	— ..	2,182 96..	2,182 96
5. *Library and laboratory :*					
Books and periodicals ..	4,000 0..	— ..	4,000 0..	8,929 58..	4,929 58
Lab. upkeep ..	7,700 0..	4,500 0..	12,200 0..	18,289 24..	6,089 24
6. *Research :*					
Research (i) (General) ..	2,200 0..	— ..	2,200 0..	3,816 73..	1,616 73
(ii) (Botanist) ..	8,500 0..	— ..	8,500 0..	13,053 54..	4,553 54
7. *Reserve fund :*					
Depreciation ..	11,252 0..	— ..	11,252 0..	14,644 43..	3,392 43
Training staff ..	1,200 0..	— ..	1,200 0..	1,321 9..	121 9
Capital expenditure—					
A. (1) Buildings—					
Office garage ..	— ..	1,500 0..	1,500 0..	1,666 34..	166 34
Nursery store ..	— ..	1,000 0..	1,000 0..	1,096 2..	96 02
(2) Furniture and equipment ..	— ..	— ..	— ..	— ..	—
(3) A. H. O. ..	— ..	1,250 0	2,100 0..	4,743 57..	2,643 57
(4) *Improvements to estates—*		850 0			
B. E. Labourers' cottage ..	5,000 0..	— ..	5,000 0..	6,472 94..	1,472 94
A. H. O. Division—Working account—					
Expenditure ..	— ..	5,525 0 1,200 0	6,725 0..	8,599 7..	1,874 7
	76,619 0	15,825 0	92,444 0	131,140 64	38,696 64

Bandirippuwa Estate Working Account, 1953

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
Superintendent and watchers	7,067 81		By sale of nuts ..	27,764 8	
General charges ..	6,244 57		By sale of copra ..	40,494 54	
Upkeep	6,205 24		By sale of sundries ..	953 90	
Collection	4,263 83				
Cultivation	4,122 11		By sale of Cadjans Rs. c. 139 57		
			Less expenses .. 118 94		
		27,903 56		20 63	
					69,233 15
2. *Other expenses :*			2. *Research Area :*		
Food crops	57 67		By sale of nuts ..	91 87	
		57 67	By sale of copra ..	16,890 98	
3. *Depreciation :*			By sale of sundries ..	21 90	
Kiln	207 56				17,004 75
Animals	50 39				
		257 95			
4. *Revenue account* ..	..	58,018 72			
		86,237 90			86,237 90

Lunuwila, March 21, 1955.

Ratmalagara Estate Working Account, 1953

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
Superintendent and watcher ..	5,975 49		By sale of nuts ..	18,442 90	
General charges ..	4,567 62		By sale of copra ..	36,090 63	
Up-keep ..	2,382 38		By sale of sundries ..	673 88	
Collection	3,544 67				55,207 41
Cultivation	5,729 57		2. *Research Area :*		
		22,199 73	By sale of copra ..	17,414 71	
2. *Other expenses :*			By sale of sundries ..	18 21	
Food crops—Estate ..	265 62				17,432 92
Research ..	167 96		3. *Food Crops :*		
		433 58	By sale, estate area ..	485 82	
3. *Depreciation :*			By sale, research area ..	42 30	
Kiln	697 71				528 12
Animals	58 33				
		756 4			
4. *Revenue account* ..	..	49,779 10			
		73,168 45			73,168 45

Lunuwila, March 21, 1955.

Nursery Working Account, 1953

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. Travelling of N. attendants	437 35		1. *Sale of seed material :*		
Less Refund ..	60 0		Seedlings ..	1,054 40	
		377 35	Seed-nuts ..	20,495 25	
2. *Cost of labour* ..	..	931 8		21,549 65	
3. *Cost of seed-nuts* ..	..	16,382 45	*Less* Refund ..	119 0	
4. Revenue account ..	..	6,741 75			21,430 65
			2. *Other income :*		
			Sale of copra from rejected seedlings ..	1,823 52	
			On brokerage ..	16 58	
					1,806 94
			3. *Transport :*		
			Payment for transport ..	1,512 39	
			Less expenses ..	317 35	
					1,195 4
		24,432 63			24,432 63

Expenditure on Special Recurrent Vote, 1953

	Rs. c.	Rs. c.		Rs. c.
1. *Co-op. advisory division personal emoluments :*			Adjusted in Balance Sheet	28,812 33
Salaries	14,097 88			
Dearness allowance ..	10,901 17			
Rent allowance ..	1,262 53			
		26,261 58		
2. *Other charges :*				
Travelling	869 64			
		869 64		
3. *Publications :*				
Printing C.C.Q. ..	6,286 80			
Less subscription ..	4,542 94			
	1,743 86			
Less sale of Pol Sangarawa ..	62 75			
		1,681 11		
		28,812 33		28,812 33

Animal Husbandry Division working Account, 1953

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.
1. *Bees and rabbits* ..		24 0	1. *Cattle :*	
2. *Cattle :*			By sale of produce	3,657 31
Labour	2,128 66		2. *Poultry :*	
Food	1,853 27		By sale of produce	1,699 35
Medicine	279 92		By revenue account	3,242 41
Association fees, &c. ..	120 80			
Sheds	290 15			
Incidentals	575 89			
		5,248 69		
3. *Poultry :*				
Labour	789 77			
Food	1,423 95			
Medicine	98 97			
Chickens	258 65			
Associations and shows ..	28 80			
Incidentals	106 56			
		2,706 70		
4. *Pigs :*				
Cost of animals ..	182 5			
Food	6 50			
Stys	341 13			
		529 68		
		8,599 7		8,599 7

Capital Expenditure Account, 1953

		Rs. c.	Rs. c.	Rs. c.
A.	*On Revenue account :*			
	1. *Buildings :*			
	Senior staff bungalows ..	1,049 59		
	Junior staff bungalows ..	1,608 10		
	Junior staff drainage	305 34		
	Office garage	1,666 34		
	Nursery store	1,096 2		
			5,725 39	
	2. *Furniture :*			
	Bungalows	8,581 1		
	Office	4,181 20		
			12,762 21	
	3. *Animal Husbandry Division :*			
	Water service	1,091 75		
	Equipment for cattle	2,885 58		
	Equipment for poultry	766 24		
			4,743 57	
	4. *Improvement to estate :*			
	(*a*) *Bandirippuwa Estate—*			
	Replanting estate block ..	564 74		
	New labour lines ..	6,472 94		
			7,037 68	
	(*b*) *Ratmalagara Estate—*			
	S-C's young plantation ..	4,330 84		
	Replanting estate block ..	451 81		
	Watcher's cottage ..	1,934 70		
	Copra kiln	2,886 13		
			9,603 48	
				39,872 33
B.	*On special capital grant account—*			
	1. *New power house plant :*			
	House for gas plant	3,473 93		
	B/E new well	9,476 83		
	Electric and water supply ..	3,937 12		
	Line shaft/power house ..	100 0		
			16,987 88	
	2. *Laboratory :*			
	New extension	88,057 91		
	Equipment	13,714 78		
	Fittings and furniture	28,192 28		
			129,964 97	
				146,952 85
				186,825 18

	Rs. c.
By Adjustment in Balance Sheet Revenue Account	39,872 33
By Adjustment in Balance Sheet Capital Grant	146,952 85
	186,825 18

Revenue Account, 1953

EXPENDITURE

	Rs. c.	Rs. c.
1. *Personal emoluments :*		
Salaries	124,463 83	
Dearness allowance	58,114 55	
Rent allowance	4,192 53	
Provident Fund bonus and interest	27,476 48	
Other allowances	1,810 56	
		216,057 95
2. *Other charges :*		
Staff travelling	16,068 48	
Board travelling	3,433 0	
		19,501 48
3. *Office :*		
Stationery	2,367 96	
Postage	1,314 61	
Printing and advertising	1,585 75	
Incidental expenses	1,597 92	
Telephone rental	600 0	
Entertainment allowance	209 73	
Maintenance of office equipment	546 65	
Workmen's Compensation insurance	549 88	
Cost of audit	1,747 10	
		10,519 60
4. *Buildings and machinery :*		
Upkeep	12,826 50	
Insurance	2,880 13	
Running expenses of electrical plant	10,189 67	
Tractor upkeep	2,182 96	
		28,079 26
5. *Laboratory and library :*		
Books and periodicals	8,929 58	
Laboratory upkeep	18,289 24	
		27,218 82
6. *Research (Field) :*		
Research I (General)	3,816 73	
Research II (Botanist)	13,053 54	
Research III (Soil chemist)	10,414 99	
A. H. O. pasture (Experiment)	2,389 97	
		29,675 23
7. *Reserve funds :*		
Depreciation	14,644 43	
Passage	2,500 0	
Research	25,000 0	
Training of staff	1,321 9	
		43,465 52
8. Excess revenue over expenditure transferred to Balance Sheet		118,633 61
		493,151 47

REVENUE

	Rs. c.	Rs. c.
1. *Government grant :*		
Annual Government grant under 6 (i) (*b*) of Ordinance		30,000 0
2. Cess collections		333,415 9
3. Interest on investments		15,243 55
4. Sale of publications		356 29
5. Charges for electricity		1,395 95
6. Sundry receipts		1,159 18
7. *Working accounts :*		
Profits—		
B/E	58,018 72	
R/E	49,779 10	
Rub. S. Gr.	284 25	
Nursery	6,741 75	
	114,823 82	
Less losses—		
Animal husbandry	3,242 41	
		111,581 41
		493,151 47

Lunuwila, January 10, 1955.

COCONUT RESEARCH INSTITUTE OF CEYLON

Balance Sheet as at December 31, 1953

LIABILITIES	Rs. c.	Rs. c.	Rs. c.
1. *Capital outlay :*			
At December 31, 1952		981,113 35	
In 1953		186,825 18	
			1,167,938 53
2. *Provident Fund :*			
Contribution and interest at December 31, 1952 ..		86,202 5	
	Rs. c.		
In 1953	30,296 52		
Less refunds in 1953	8,771 32		
		21,525 20	
			107,727 25
Bonus and interest at December 31, 1952		86,735 85	
In 1953	33,446 52		
Less refunds in 1953	12,244 37		
		21,202 15	
			107,938 0
3. *Reserve funds :*			
Depreciation at December 31, 1952		149,766 16	
In 1953		15,658 42	
			165,424 58
Passage at December 31, 1952		1,500 0	
In 1953		2,500 0	
			4,000 0
Research at December 31, 1952		25,000 0	
In 1953		25,000 0	
			50,000 0
4. *Sundry creditors :*			
S/A's security		2,000 0	
P. D. well		79 50	
Fertilisers, 1953		4,430 94	
1953 sundries		39,149 90	
			45,660 34
5. *Surplus account :*			
Excess of income over expenditure as per Revenue Account, 1953 ..	118,633 61		
Rs. c.			
Surplus in 1952 Balance Sheet 394,690 37			
Less revenue .. 226 15			
	394,464 22		
		513,097 83	
Adjustment 1952—			
Capital expenditure in 1953 ..	186,825 18		
Recurrent expenditure on Sp. Gr. in 1953	28,812 33		
	215,637 51		
Less Balance of Sp. Gr. in 1953 ..	72,377 16		
		143,260 35	
			369,837 48

ASSETS	Rs. c.	Rs. c.	Rs. c.
1. *Buildings at December 31, 1952*		373,068 29	
In 1953		5,725 39	
			378,793 68
2. *Estates :*			
Bandirippuwa		187,554 68	
Ratmalagara		73,138 0	
			260,692 68
3. *Improvements to estates :*	Rs. c.		
Previously		50,578 86	
In 1953 : Bandirippuwa ..	7,037 68		
Ratmalagara ..	9,603 48		
		16,641 16	
			67,220 2
4. *A. H. D. :*			
Previously		3,040 0	
In 1953		4,743 57	
			7,783 57
5. *Estate kiln :*		—	
Previously			
Bandirippuwa		4,946 75	
Ratmalagara		10,658 21	
			15,604 96
6. *Laboratory equipment*		67,623 85	
Previously		41,907 6	
In 1953			
			109,530 91
7. *Laboratory buildings :*			
Previously		64,427 31	
In 1953		88,057 91	
			152,485 22
8. *Gas plant :*			
Previously		3,808 71	
In 1953		3,473 93	
			7,282 64
9. *Furniture :*			
Bungalows—Previously ..		22,795 56	
In 1953		8,581 1	
			31,376 57
10. *Office—previously—*		6,275 95	
In 1953		4,181 20	
			10,457 15
10. *Power plant :*			
Previously		73,394 40	
In 1953		13,513 95	
			86,908 35
11. *Museum :*			
Previously			3,276 20
12. *Co-op. nurseries*			35,093 67
13. *Sundry debtors :*			
Cess collections ..	57,008 2		
Interest accrued ..	841 37		
B/E Working Account ..	25,454 2		
R/E Working Account ..	35,101 7		
Animal Husbandry Working Account ..	945 86		

Nursery Working Account	2,905 0			
Rubber seed garden	95 43			
Cadjan account	27 99			
Fertiliser advance account	3 31			
Running expenses of electrical plant	200 0			
Electricity charges	3 0			
Laboratory upkeep	191 13			
P. F. bonus and interest	5,900 71			
Rent allowance	71 71			
C.C.Q.	1,325 90			
P. O. attendant's bungalow	1,499 88			
			..	131,574 40
14. *Advance Accounts :*				
Transport loan to staff	45,181 50			
Bulbs	80 64			
General stores	2,971 81			
Travelling	318 0			
Furniture	4,264 3			
Superintendent's bungalow R.E.	1,197 45			
J. S. bungalow B/E	3,947 81			
			..	57,961 24
15. *Investments :*				
Ceylon Government 2½ per cent. National Development Loan	375,000 0			
Ceylon Government Stock	150,000 0			
Sri Lanka Government Loan	2,000 0			
Ceylon Government 3 per cent. Defence Loan	5,000 0			
State Mortgage Bank debentures	5,000 0			
5-Year Savings Certificates	17,321 94			
12-Year Savings Certificates	9,360 0			
Ceylon Savings Bank	373 19			
P. O. Savings Bank	465 47			
			..	564,520 60
16. *Cash balance at December 31, 1953 :*				
Bank No. 1 Account	190,172 21			
Bank No. 2 Account	3,376 23			
Petty Cash Imprest	3,000 0			
		196,548 44		
Less amount due to P. D.		98,584 12		
				97,964 32
	2,018,526 18			2,018,526 18

Certified correct.

S. C. KAHAWITA,
Secretary-Accountant.

The accounts of the Coconut Research Institute for the year ended December 31, 1953, have been audited under my direction. Subject to observations contained in my report No. M-2 (3)—13 dated March 16, 1955, made to the Chairman of the Board of Management of the Coconut Research Institute, as a result of this Audit, I am of opinion that the Balance Sheet has been drawn up, so as to present fairly the financial position of the Institute as at December 31, 1953, and the results of its operations for the year ended on that date.

Audit Office,
Colombo 7, March 16, 1955.

A. WEERASINGHE,
Auditor-General.