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Annual Report of the Coconut Research Board of the Coconut Research Institute for 1954

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ANNUAL REPORT OF THE COCONUT RESEARCH BOARD OF THE COCONUT RESEARCH INSTITUTE FOR 1954

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

REPORT OF THE CHAIRMAN

Coconut Research Board

On January 1, 1954, the Coconut Research Board consisted of the following members :—

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

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., C.B.E.

Representatives of the Low-Country Products' Association :

Mr. R. H. de Mel, M.A. (Oxon.)
Mr. A. Gnanapragasam, B.A. (London)

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, Coconut Research Institute of Ceylon :

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

Mr. W. J. A. Van Langenberg, C.C.S., ceased to be a member of the Board on his assumption of duties as Government Agent, Central Province. Mr. D. Amarasinghe, C.C.S., of the General Treasury succeeded Mr. W. J. A. Van Langenberg.

Mr. R. H. Spencer Schrader, J.P., resigned from the membership of the Coconut Research Board on being appointed a member of the Ceylon Milk Board. Mr. C. T. Van Geyzel, J.P., succeeded Mr. R. H. Spencer Schrader, J.P.

Col. W. G. Mack, O.B.E., E.D., was re-nominated to serve on the Board for a further period of three years with effect from June 17.

Mr. A. Gnanapragasam, B.A. (Lond.), ceased to be a member of the Board. Mr. Wace de Niese succeeded Mr. A. Gnanapragasam.

Mr. J. E. Rajapakse was appointed to act in place of Mr. R. H. de Mel, representing the L. C. P. A. on the Board during his period of absence from Ceylon.

Mr. D. Amarasinghe, C.C.S., Treasury Representative on the Board, ceased to be a member after his retirement from Government Service. Mr. W. D. Gunaratne, C.C.S., succeeded Mr. Amarasinghe.

Mr. C. N. E. J. de Mel acted as Chairman of the Coconut Research Board, during the absence of Dr. A. W. R. Joachim, for a period of one month to attend the International Rice Conference in Japan.

Mr. F. C. Cooke, Director, was away in India on a two weeks' holiday. He visited the Indian Research Institute at Bangalore, the Indian Food Research Institute at Mysore and Potascheme at Madras.

Important Events

The cess for research was increased in March from 25 cents per 1,000 nuts to Re. 1 per 1,000 nuts (Coconut Research Amendment Act, No. 22 of 1954) with a proportional increase for other coconut products exported. Plans for expanding the research work of the Institute and for extending and improving its advisory services are now being implemented on a 10-year plan.

An annual grant of Rs. 500,000 is also to be given to the Institute for the production of selected coconut seedlings and their distribution to coconut growers under the 10-year plan for the rehabilitation of the coconut industry; 150,000 acres are to be replanted with 9,000,000 seedlings and the programme is already proceeding according to plan.

The 25th Anniversary of the Coconut Research Institute of Ceylon was celebrated on May 15, 1954, by a lunch held in the Jubilee Room at the Galle Face Hotel. The celebrations took the form of a re-union of past and present members of the Board of Management of the Coconut Research Scheme and of the Coconut Research Board and was presided over by the Honourable J. R. Jayewardene, Minister of Agriculture and Food.

Meetings

Eight meetings of the Coconut Research Board were held during the year: on January 22, March 6, May 15 (Emergency), August 21, September 25, November 13, and December 3. A total of 18 meetings, including meetings of committees, have been held during the year.

Committees

Administration Committee (Personnel at January 1):

(1) Dr. A. W. R. Joachim
(2) Mr. C. A. M. de Silva
(3) Mr. Wace de Niese
(4) Mr. S. Pathmanathan
(5) Mr. D. Amarasinghe
(6) Mr. F. C. Cooke

The 11th and 12th meetings were held on July 23, 1954, and November 12, 1954.

Research Committee (Personnel at January 1):

(1) Mr. E. Muttukumaru
(2) Mr. R. H. Spencer Schrader
(3) Dr. A. W. R. Joachim
(4) Mr. R. Singleton-Salmon
(5) Mr. F. C. Cooke

The 9th, 10th, 11th and 12th meetings were held on March 3, July 9, and October 27, respectively.

Welfare Committee (Personnel)

(1) Mr. E. Muttukumaru
(2) Mr. C. A. M. de Silva
(3) Mr. R. H. Spencer Schrader
(4) Mr. F. C. Cooke

One meeting was held on April 29, 1954.

The Coconut Research Board was present at the Joint Conference held in the Ministry of Agriculture and Food on December 14, 1954, to discuss the " Replanting and the Rehabilitation of the Coconut Industry ". Representatives of the Planters' Association of Ceylon, the Low-Country Products' Association, the Ceylon Coconut Board, the Co-operative Union and technical officers of the Coconut Research Institute were present. A keen discussion followed the address by the Minister of Agriculture and Food.

Annual Report 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 (1954)

The Staff of the Coconut Research Institute at the end of 1954 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 CHEMISTRY DIVISION

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

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

CHEMISTRY DIVISION

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

BOTANY DIVISION

Botanist : Dr. D. V. Liyanage, B.Sc. (Lond.), Ph.D. (Manch.)
Research Assistant to Botanist : 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. Goonesekera

ESTATES DIVISION

Superintendent, Bandirippuwa Estate : Mr. D. F. Withana
Superintendent, Ratmalagara Estate : Mr. H. J. F. Peiris

MECHANICAL DIVISION

Senior Mechanic : Mr. R. Weerapermall

Dr. M. L. M. Salgado, Soil Chemist, was away in Australia on a Senior Fellowship awarded under the Colombo Plan for Technical Co-operation to study soil survey techniques and associated research of the Commonwealth Scientific and Industrial Research Organization for a period of six months. Mr. D. A. Nethasinghe was appointed officer-in-charge during Dr. Salgado's absence. Mr. V. Abeywardene, Technical Assistant (Computer), was away in India on a F. A. O. Scholarship for a 3 months' course of training in Experimental Designs. Mr. G. C. M. Goonasekera, Animal Husbandry Officer, underwent a course of one month's training in Dairy Technology arranged at the Food and Agriculture Organization Centre in Bombay.

Mr. J. K. F. Kirthisinghe completed a course of training in Plant Pest Control in England, under the Colombo Plan and returned in March.

Mr. D. F. Withana, Superintendent, Bandirippuwa Estate, was away in India at the invitation by the Indian Central Coconut Committee, Ernakulam, for two weeks to advise on the improvement in operation and design of the Co-operative copra kiln at Badagara in South India.

New appointments

The following new appointments were made during the year :—

Mr. K. C. de Pinto, Accounting Assistant to the Secretary-Accountant
Mr. A. Weerasinghe, Field Attendant to Animal Husbandry Officer
Mr. P. M. Harischandra, Field Attendant to Soil Chemist
Mr. K. J. N. Fernando, Field Attendant to Planting Officer
Mr. D. L. Karunanayake, Field Attendant to Planting Officer
Mr. S. H. M. S. Marikkar, Field Attendant to Planting Officer
Mr. D. L. G. Dharmadasa, Field Attendant to Planting Officer
Mr. B. M. Herathamy, Field Attendant to Planting Officer
Mr. B. N. Jayanayake, Field Attendant to Planting Officer
Mr. H. W. Bandusena, Field Attendant to Planting Officer

The following probationary appointments were confirmed during the year :—

Mr. J. W. Fernando, Field Attendant to Botanist (Pollination)
Mr. A. T. Fernando, Field Attendant to Botanist (Pollination)

The following temporary appointments were made during the year :—

Mr. D. M. Kiribanda, Office Peon with effect from December 22, 1954
Mr. W. M. Kapuru Banda, Field Attendant (Pollination) from November 1, 1954
Mr. I. M. Wijedasa, Field Attendant (Pollination) from November 1, 1954
Mr. G. A. Wijesoma, Field Attendant (Pollination) from November 1, 1954

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

Mr. I. Karunaratne, Field Attendant to Animal Husbandry Officer
Mr. I. A. Haniffa, Field Attendant to Planting Officer

Field Days

Two Field Days for the members of the Chilaw-Negombo and Kurunegala Planters' Association were held, on June 25 at Bandirippuwa Estate and on August 25 at Letchemy Estate, Nattandiya. The Coconut Research Institute was also represented at the following Field Days :—

Hunuwella Field Day and Exhibition on July 3,
Agricultural Field Day and Exhibition at Polgahawela on October 2.

Conferences

The following conferences were held during the year :—

(i) Coconut Conference and Exhibition at Matara on February 27, for the benefit of the coconut growers in the Southern Province.

(ii) Staff Conference of Research, Technical and Field Staff of the Institute on June 4 and 25 and September 2.

(iii) The first Public Technical Conference, presided over by Sir Albert F. Peries, Speaker of the House of Representatives, on November 9, 1954.

Demonstrations

A lecture and demonstration of the " Generator " process of vinegar manufacture was organised at Bandirippuwa by the Chemist for representatives of the All-Ceylon Vinegar Manufacturers' Association on July 16, 1954.

The Coconut Research Institute was represented at a demonstration of spraying equipment held at Andigama Estate, Giriulla, on March 4, 1954.

Lectures and Meetings

Kurunegala Planters' Association :

" Food Production on Coconut Estates "—F. C. Cooke
" Put First Things First "—F .C. Cooke
" Hybridisation Work on Coconuts "—D. V. Liyanage

School of Agriculture, Peradeniya :

" Pineapples "—F. C. Cooke

Vinegar Producers' Association of Ceylon :

" Manufacture of Vinegar from Coconut Toddy by the Generator Process "—W. R. N. Nathanael

Southern Province Planters' Association :

" Selection of Planting Material in Coconuts "—D. V. Liyanage

Chilaw-Negombo Planters' Association :

" Selection Work on Coconuts "—D. V. Liyanage
" Replanting of Old Coconut Areas "—D. V. Liyanage

Coconut Research Station, Kasaragod :

" Copra Manufacture "—F. C. Cooke

Coconut Conference, Matara :

" Coconut Replanting Project "—F. C. Cooke
" Importance of Replanting "—P. D. L. Fernando
" Improvement on Coconut Estates "—D. V. Liyanage

St. Thomas' College, Biological Society :—

" Floral Biology "—D. V. Liyanage

Ceylon Association of Science :

" Studies on the Manufacture and Analytical Characteristics of Coconut Toddy Vinegar " —W. R. N. Nathanael

Coconut Exhibition, Hunumulla :

" Coconut Production and the Problem of Population "—F. C. Cooke

Publications

The following original articles were published in the *Ceylon Coconut Quarterly*, Vol. V, by officers of the Institute :—

Abeywardene, V.—

Density of Palms in Triangular and Square Planting
Crop Disposal
Production of Coconuts in Ceylon
Rainfall, Crops and Export Statistics

Cooke, F. C.—

The Future of the Institute
Put First Things First
Synthetic Detergents
Research and Planting Progress in 1954

Fernando, W. V.—

Conference and Field Day in Southern Province

Fernando, P. D. L.—

Smallholders' Advisory Service

Francis, K. M.—

Field Day and Exhibition at Polgahawela

Ganarajah, T.—

Planting Systems

Goonesekera, G. C. M.—

Feeding Trials with Indigenous Cattle
Marawila Livestock Show

Nathanael, W. R. N.—

The Manufacture and Characteristics of Ceylon Arrack

Nethsinghe, D. A.—

Contour Bunds

Salgado—

Soil Management on Coconut Estates

Other publications include :

F. C. Cooke : " Research and the Coconut Industry " ; Times of Ceylon Plantation Industries Supplement.

Nathanael, W. R. N. : " Making Vinegar through the Sour Tower " ; *Ceylon Daily News*—August 16, 1954.

Salgado : The Nutrient Content of Nut Water, in relation to available soil nutrients as a guide to the manuring of coconut palms. 8th International Congress, Paris, 1954.

SUMMARY OF ANNUAL REPORTS

Botanical Division

Replantation is a topical problem as there are many estates where the yields are declining due to senility. A field trial now in its fifth year is showing that stem-formation in the young palms is worst where the old palms are all left standing, and that the largest girth of stem is found where the old stand is completely removed before replanting. In order to maintain the income of estates, and as a compromise, under-planting with the gradual removal of the worst of the old palms is recommended.

A number of crosses of coconut produced by controlled pollination are under observation. A promising hybrid has been obtained by crossing the dwarf (green) and the typical Ceylon tall palm, where the dwarf provides the female parent ; the converse is not so good.

The alienation of 200 acres of forest, together with an isolation barrier of forest vegetation 50 chains wide for the establishment of an Isolated Seed Garden for Coconuts, has been completed. This land will be planted exclusively with selected coconut seedlings produced from selected seednuts obtained by the artificial and controlled pollination of high-yielding mother palms which have been recorded for many years. Subsequently, inter-pollination will be natural and limited to palms planted within the seed-garden.

Crop Protection

Recently some evidence has been advanced that soil fumigation stimulates the growth of plants. Trials with three soil fumigants at various rates of application in a coconut nursery gave negative results and the higher dosages adversely affected the germination and rate of growth.

The effect of certain insecticides in controlling the larvae of the rhinoceros beetle (*Oryctes rhinoceros*) was investigated under laboratory conditions and 100 per cent. mortality was obtained in from 2 to 5 days depending on the treatment.

Two proprietary deer repellants were tried on young coconut leaves as cattle repellants, but although the damage was less than with the control, the protection afforded was not sufficient to warrant the expense.

Soil Chemistry Division

The manurial experiments with nitrogen, phosphorous and potash at three levels have been continued. At Bandirippuwa (19th year) the effect of stepping up the levels of potash in November, 1951, is now visible in that the original K_0 palms, now K_1, are beginning to show a healthier green foliage and the response to potash has again reached a high level. The lack of response to phosphorous was maintained. At Ratmalagara (11th year) the response to phosphorous applications continues. The fungus disease *Helminthosporium incurvatum* again re-appeared on the young palms in the N_2 P_0 plots after the fertilizer applications.

The manurial experiment on underplanted palms at Letchemy (14 years) has strikingly demonstrated the need for the application of a complete NPK mixture to the young palms, whenever an estate is being replanted.

On an estate where the land is more or less level and the soil is a loose sandy loam, manurial trials have not shown any significant difference between the application of manures by ring-manuring or by broadcasting with subsequent harrowing. This important trial, now in its 6th year, is being continued.

The method of measuring the potash status of the soil by analyses of coconut water has been examined. It has been found that there is a slight increase in the potash concentration in the nut water after one month's storage; there are also considerable variations in the potash content in the nut water of individual palms subjected to the same potash applications. The coefficients of variation calculated for different sample sizes however indicate that a 100-nut unit will provide a satisfactory sample.

Analyses of samples of soil have proved that husk mulching conserves soil moisture during long dry spells.

Systematic soil surveys of areas of crown jungle have been carried out to determine the suitability of new lands for coconut cultivation under various Colonization Schemes. A total of 7,000 acres has been approved for planting.

Technological Chemistry

An important achievement during the past year has been the successful application of the " generator " process for the conversion of coconut toddy into high-grade vinegar. This new process, which has been demonstrated to the Vinegar Producers' Association of Ceylon, is quicker, more reliable, more hygienic, more efficient, less laborious and less costly than the now obsolete vat process still used in Ceylon.

The new process has been exhaustively investigated and the overall average of 7·2 per cent. of acid obtained for 25 charges is an almost theoretical recovery. As against 3 to 6 months required for production by the vat process which produces vinegar containing variously between 3·5 and 4·5 per cent. acids, the " generator " process requires only 6 days for complete acetification.

Now that it is possible to produce high-grade vinegar of uniform quality equal in all respects to the best brands of malt vinegar, serious consideration can next be given to the establishment of factories for the production of sauces, chutneys and pickles produced from Ceylon fruits, vegetables and spices, not merely for domestic consumption but more particularly for export.

Following an inquiry regarding the manurial value of coconut poonac, complete analyses of all types of poonac produced in Ceylon have been made.

Other investigations include the routine examination of samples of farmyard manure from pasture-fed and pasture plus poonac fed cattle, which have not revealed any significant difference. The copra produced from a large number of hybrid palms showed the same average oil content as the copra obtained from the tall variety of palm, viz., 68·3 per cent. Finally, although the application of coir dust to the soil has been shown to increase its moisture-retaining powers, it has not been found to check immature nut-fall which was the same as in the adjacent control plot.

Animal Husbandry Division

It has been proved conclusively that milk can be produced in the wet zone (rainfall 70 inches) at a profit from ordinary sinhala village cattle, providing they are improved by selection, good feeding and proper management. The mixed rough pastures, herbs and legumes found growing on most coconut estates, if grazed rotationally, and a supplementary feed of 3 lb. of extracted poonac per day is all that is required. A feeding trial carried out during the year has proved that animals so treated yield more milk, have a higher body weight and a longer lactation period and have less physiological disturbances. There have been no deaths or sickness in the herd, which is in magnificent condition.

New grasses and legumes have been introduced under coconuts to test their resistance to drought and their palatability. *Stylosanthes bojeri* from Australia and *Bracharia brizantha* from Polonnaruwa have given promising results.

Pigs and poultry are being kept for manurial purposes using the portable pen system, and bee-hives are being maintained in the mother palm block to improve the setting of female flowers.

Planting and Advisory Division

An annual grant of Rs. 500,000 for a period of 10 years for the production and sale of seedlings at subsidised prices has been approved by Government, but the demand for our selected seedlings is still greater than the supply.

Thirteen nurseries have been maintained during the year and a total of 843,000 seednuts have been laid down. In 1954, nearly 9,000 acres were planted with C. R. I. seedlings, and under the 10-year plan production is to be gradually stepped up to a peak of 16,000 acres in 1958. The number of nurseries is being increased to meet the growing demand for seedlings.

There are at present only 7 advisory officers ; this is not sufficient and the number is shortly to be increased to 20 so that the whole of the areas under coconuts can be properly served. The service given includes advice to individual small holders, lectures, demonstrations and propaganda, organization of shows, in addition to lining up and survey work.

F. C. Cooke,
Director.

REPORT OF THE SOIL CHEMIST

Field Experiments

(1) *3 by 3 by 3 N. P. K. Experiment (Bandirippuwa Estate) :*

The nineteenth year of this experiment was completed in November, 1954. The biennial manuring of guard rows was carried out in June, 1954. The yield data for the main effects for 1954 are given below :

TABLE I (a)

Treatment	*Lb. copra/acre*	*Per cent.*	*Difference lb. copra/acre*
N_0	1,731	100	—
N_1	1,762	102	+ 31
N_2	1,711	99	— 20
P_0	1,710	100	—
P_1	1,740	102	+ 30
P_2	1,755	103	+ 45
K_1	1,326	100	—
K_2	1,837	139	+ 511
K_3	2,040	154	+ 714

Significant difference at P.05 = 165 lb. per acre.

Nitrogen.—This year nitrogen shows no depressive effects at level N_1 and at level N_2 the depressive effect is very small.

Phosphoric acid.—The lack of response to phosphoric acid continues in 1954. (See under Laboratory Investigations also.)

Potash.—The response to potash has again reached a high level for 1954. But although the potash levels were stepped up at the manuring in November, 1951, the yield data for the subsequent years do not yet show any improvement over those prior to 1951. In 1951 the original K_0 (no potash), K_2, (0·75 lb. potash as K_2O per palm) and K_2 (1·5 lb. K_2O per palm) levels were stepped up to 0·75, 1·5 and 2·5 lb. K_2O respectively. The second manuring at these levels was carried out in November, 1953. The hitherto lack of response to the increased levels of potash applications is also shown in the potash concentration of nut water (see under Laboratory Investigations). In the earlier no potash palms, however, which showed very yellow crowns, the foliage is now turning green after the application of potash.

Given below are the yield data for the different levels of potash for the period after 1951 and for a period of 6 years prior to 1951.

TABLE I (b)

Year	*Treatment*	*lb. copra/acre*	*Calculated as percentage*	*Difference lb. copra per acre*
1945	K_0	1,387	100	—
	K_1	1,715	124	+328*
	K_2	1,808	130	+421*
1946	K_0	1,186	100	—
	K_1	1,498	126	+312*
	K_2	1,633	138	+447*
1947	K_0	1,333	100	—
	K_1	1,715	129	+382*
	K_2	1,845	138	+512*
1948	K_0	1,383	100	—
	K_1	1,825	132	+442*
	K_2	1,965	142	+582*
1949	K_0	891	100	—
	K_1	1,292	145	+543*
	K_2	1,437	161	+711*
1950	K_0	1,204	100	—
	K_1	1,747	145	+543*
	K_2	1,915	159	+711*

Year	Treatment	lb. copra/acre	Calculated as percentage	Difference lb. copra per acre
1951	K	1,398	100	—
	K	2,062	147	+664*
	K	2,244	161	+846*
1952	K_1	1,195	100	—
	K_2	1,742	146	+547*
	K_3	1,994	167	+799*
1953	K_1	1,267	100	—
	K_2	1,588	125	+321*
	K_3	1,704	134	+437*
1954	K_1	1,326	100	—
	K_2	1,837	139	+511*
	K_3	2,040	154	+714*

* Significant at P·01

The mean yields in 1954 (lb. copra per acre) for the various treatment combinations are given in the two-way tables below :

TABLE I (c)

	N_0	N_1	N_2	K-Total
K_1	1,418	1,330	1,234	1,326
K_2	1,848	(1,921	1,742	1,837
K_3	1,928	2,035)	2,158	2,040
N-total	1,731	1,762	1,711	1,735

	P_0	P_1	P_2	K-Total
K_1	1,291	1,321	1,370	1,326
K_2	1,883	1,821	1,808	1,837
K_3	1,957	2,077	2,087	2,040
P-total	1,710	1,740	1,755	1,735

	P_0	P_1	P_2	N-Total
N_0	1,682	1,827	1,685	1,731
N_1	1,792	1,600	1,895	1,762
N_2	1,658	1,792	1,684	1,711
P-total	1,710	1,740	1,755	1,735

Effect of manuring on copra out-turns

The table below shows the effect of manuring on copra out-turns for 1954.

TABLE I (d)

Treatment	Out-turn nuts/candy	Difference
N_0	1,111	—
N_1	1,143	+ 32
N_2	1,116	+ 55
P_0	1,132	—
P_1	1,134	+ 2
P_2	1,153	+ 21
K_1	1,225	—
K_2	1,123	— 102
K_3	1,100	— 125

The figures show the beneficial effects of potash manuring on the weight of the kernel.

(II) *Manurial × Cultivation Experiment (Ratmalagara Estate) :*

This factorial experiment includes all combinations of the following treatments and is of the 3 by 2 by 2 type consisting of 6 blocks of 6 plots each.

K_0 = no potash
K_1 = 1 lb. K_2O/palm
K_2 = 2 lb. K_2O/palm
} × {
P_0 = no phosphoric acid
P_1 = 1lb. phosphoric acid
} × {
C_0 = no ploughing
C = ploughing once in 2 years at the time of manuring

All plots are given a basic application of 3 lb. sulphate of ammonia per palm. The first biennial application of manure was carried out in June, 1943. The eleventh year of this experiment was concluded in June, 1954.

The yield data for the main effects from the second year onwards are summarized below :

TABLE II (a)

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*
K_0 ..	1,771	1,691	1,415	1,841	1,438	1,342
K_1 ..	1,935	1,674	1,395	1,842	1,466	1,327
K_2 ..	1,893	1,738	1,492	1,975	1,589	1,449
Significant difference P.05 ..	194	152	181	215	161	173
P_0 ..	1,794	1,625	1,276	1,711	1,353	1,095
P_1 ..	1,938	1,777	1,592†	2,061†	1,643*	1,651†
C_0 ..	1,783	1,615	1,372	1,851	1,450	1,320
C_1 ..	1,949*	1,787†	1,496	1,921	1,547	1,426
Significant difference P.05 ..	158	123	149	176	131	145

	8th year 1950–51	*9th year 1951–52*	*10th year 1952–53*	*11th year 1953–54*
K_0 ..	1,631	1,978	1,663	1,827
K_1 ..	1,677	1,957	1,684	1,924
K_2 ..	1,760	2,167	1,813	2,006
Significant difference P.05 ..	—	—	—	—
P_0 ..	1,487	1,798	1,434	1,574
P_1 ..	1,891	2,270	2,006	2,264
C_0 ..	1,654	2,020	1,708	1,942
C_1 ..	1,725	2,048	1,732	1,896
Significant difference P.05 ..	—	—	—	—

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

The high response to phosphate application is maintained and has reached the highest figure for 1954, amounting to well over a candy of copra per acre per annum.

TABLE II (b)

Phosphate response—

Year	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*
Lb. copra/acre ..	144	152	316	350	290	556	404	472	572	690

(III) *3 by 3 by 3 N. P. K. Manurial Experiment on Young Palms (Ratmalagara Estate) :*

(*a*) *Palms in Flower.*—The sixth annual manuring was carried out in October/November, 1954. At the end of 1954 a total of 238 plot palms were in flower, the distribution being as shown in the table below according to main effects.

TABLE III (a)

N_0 ..	52	P_0 ..	10	K_0 ..	63
N_1 ..	87	P_1 ..	118	K_1 ..	87
N_2 ..	99	P_2 ..	110	K_2 ..	88

(*b*) *Mature Nuts.*—During the course of 1954 mature nuts were picked from three plot palms for the first time. The distribution of nuts was as follows :—

TABLE III (b)

N_0	..	—	..	P_0	..	—	..	K_0 .. —
N_1	..	6	..	P_1	..	13	..	K_1 .. 5
N_2	..	7	..	P_2	..	—	..	K_2 .. 8

(*c*) *Leaf Counts.*—Two leaf counts were done during the year in January and July. The extra leaves that emerged during the year are shown below according to main effects :—

TABLE III (c)

	Total leaves	*Cal. as %*	*Leaves per palm*
N_0 ..	3,085 ..	100 ..	9·5
N_1 ..	3,254 ..	105 ..	10·0
N_2 ..	3,161 ..	102 ..	9·8
P_0 ..	2,699 ..	100 ..	8·3
P_1 ..	3,421 ..	127 ..	10·6
P_2 ..	3,380 ..	125 ..	10·4
K_0 ..	3,104 ..	100 ..	9·6
K_1 ..	3,127 ..	101 ..	9·7
K_2 ..	3,269 ..	105 ..	10·1

From the above figures the indications are that in these soils too phosphoric acid is the dominant requirement. But it is yet premature to draw any definite conclusions.

(*d*) *Helminthosporium incurvatum.*—Once again after the manuring in 1954 the symptoms of this disease appeared as in the previous years, particularly in the plots receiving a high level of nitrogen (N_2), no phosphoric acid (P_0), as shown in Table III (*d*).

TABLE III (d)

	N_0	N_1	N_2	*K–Total*
K_0	1 ..	10 ..	20 ..	31
K_1	5 ..	13 ..	27 ..	45
K_2	7 ..	10 ..	18 ..	35
N–Total ..	13	33	65	111
	P_0	P_1	P_2	*K–Total*
K_0	28 ..	2 ..	1 ..	31
K_1	42 ..	2 ..	1 ..	45
K_2	34 ..	1 ..	0 ..	35
P–Total ..	104	5	2	111
	P_0	P_1	P_2	*N–Total*
N_0	10 ..	2 ..	1 ..	13
N_1	31 ..	2 ..	0 ..	33
N_2	63 ..	1 ..	1 ..	65
P–Total ..	104	5	2	111

Co-operative Manurial Experiments

(i) *Manurial Experiment on underplanted young palms (Letchemy Estate, Nattandiya) :*

This experiment was commenced in 1940 on underplanted palms put out in October, 1939. The treatments are (*a*) Cover *vs.* No cover and (*b*) O, NK and NPK treatments in 5 randomised blocks of 6 plots each.

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

In 1954 there were 458 palms in flower (out of a total of 540). The distribution was as follows :—

TABLE IV (a)

Each Treatment consists of 90 Palms

	O	*NK*	*NPK*	*Total*
No cover	77	73	84	234
Cover	76	68	80	224
	153	141	164	458

The total copra yield for 1954 for 6 picks was 12,088 lb., the distribution being as follows :—

TABLE IV (b)

	O	*NK*	*NPK*	*Total*
No cover	1,236	2,086	3,033	6,355
Cover	1,229	1,685	2,819	5,733
	2,465	3,771	5,852	12,088
Per cent	100	153	237	

It is seen that the complete N. P. K. Mixture continues to give the highest yields. For comparison, the effect of treatments from the time the palms came into flower in 1945 is given below.

TALBE IV (c)

(*a*) *Plams in flower from 1945 to the end of 1954*

	1945	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*
O	—	12	43	68	99	119	132	136	148	153
NK	—	16	49	77	97	120	124	130	136	141
NPK	1	12	41	75	117	135	146	152	161	164
	1	40	133	220	313	374	402	418	445	458

(*b*) *Yield of nuts from 1946 to December, 1954*

O	—	—	92	325	864	976	1,618	2,424	2,661	4,822
NK	—	—	87	668	1,630	1,638	2,559	3,526	4,302	6,976
NPK	—	15	191	650	1,785	2,091	3,379	4,556	5,876	10,345
	—	15	370	1,643	4,279	4,705	7,556	10,506	12,839	22,143

(*c*) *Yield of copra from 1946 to December, 1954 (lb.)*

O	—	—	44	111	269	501	819	1,117	1,262	2,465
NK	—	—	45	281	497	878	1,417	1,846	2,159	3,771
NPK	—	11	120	272	605	1,158	1,912	2,519	3,030	5,852
	—	11	209	664	1,371	2,537	4,148	5,482	6,451	12,088

(*d*) *Copra Out-turns from 1946 to December, 1954 (nuts/candy)*

O	—	1,171	1,175	1,122	1,091	1,106	1,215	1,181	1,096
NK	—	1,083	1,158	1,084	1,045	1,011	1,070	1,116	1,035
NPK	764	821	945	1,051	1,011	990	1,013	1,086	990

Height measurements of the individual palms were carried out in December, 1954, and the average height per palm according to the different treatments is given in the table below.

TABLE IV (d)

Height per Palm in feet

	O	*NK*	*NPK*
No cover ..	14·09	15·92	19·40
Cover ..	13·89	14·52	19·02

Here again it seems that the complete mixture has promoted the best growth.

At the annual manuring which was carried out in July, 1954, the control plots which had received no manure for the last 14 years (1939–53) were given the following mixture at the rate of 4 lb. per palm applied in circular trenches :

Sulphate of ammonia ..	1½ lb.
Saphos phosphate ..	1 lb.
Muriate of potash ..	1½ lb.
Total ..	4

The NK and NPK plots which were being manured according to the above mixture since 1951 (NK plots received no saphos phosphate) in semi-circular trenches annually were given in 1954, in addition, the same treatment broadcast between the rows and disc harrowed.

The " no manure " plots which were in very poor condition had already begun to show effects of manuring by the end of 1954.

(ii) *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 and K applied in the following way :—

N_0 = No nitrogen
Nc = Nitrogen applied in circular trenches
Nb = Nitrogen broadcast and ploughed

×

P_0 = No phosphoric acid
Pc = Phosphoric acid applied in circular trenches
P_b = Phosphoric acid broadcast and ploughed

×

K_0 = No potash
Kc = Potash applied in circular trenches
Kb = Potash broadcast and ploughed

After an year's premanurial recording, the first biennial application of manures was carried out in June, 1949.

Given below are the statistically analysed data from the second to the fifth year of this experiment which ended in June, 1954.

TABLE V (a)

Lbs. Copra per Acre

(*Yields adjusted by covariance analyses*)

	M II 1950–51 2nd Year	*M III 1951–52* 3rd Year	*M IV 1952–53* 4th Year	*M V 1953–54* 5th Year
N_0 ..	1,917	1,493	1,436	1,337
Nc ..	1,929	1,561	1,563	1,496
Nb ..	1,835	1,538	1,500	1,476
P_0 ..	1,833	1,416	1,400	1,343
Pc ..	1,907	1,575	1,560	1,491
P_b ..	1,941	1,600	1,539	1,476
K_0 ..	1,814	1,482	1,401	1,408
Kc ..	1,938	1,472	1,528	1,418
Kb ..	1,929	1,639	1,570	1,484
Sig. Diff. at P·05 ..	83	217	141	403

TABLE V (b)

Significant responses

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

It is seen that even after the fifth year of this experiment no significant difference is shown between the two methods of application.

(iii) *Observation trials on immature nutfall :*

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

(*a*) Every six months broadcasting and harrowing in of—

¾ lb. 60 per cent. muriate of potash
¾ lb. saphos phosphate
¾ lb. sulphate of ammonia
1 lb. dolomite
} per palm

(*b*) Husk burying between palms.

The first manuring was done in December, 1954. Individual palm records of immature nuts fallen and mature nuts picked are being kept.

Laboratory Investigations :

(i) POTASH CONTENT OF COCONUT WATER

(*a*) *N. P. K. Manurial Experiment, Bandirippuwa Estate*

The determination of the potash content of coconut water samples from the N. P. K. manurial experiment at Bandirippuwa Estate, which had been discontinued since 1949 was started again in January, 1954, in order to study the effects of stepping up the levels of potash application to the palms since 1951.

A comparison of the figures for the potash concentration of nut water in 1954 with those of 1947 show that the stepping up of the levels of potash application since 1951 had had no effect so far in increasing the potash uptake by the palms.

TABLE VI (a)

Concentration of potash in nut water in gms K_2O/Litre

	Year : M XIX–1954			*M XII–1947*		
Mick No.	K_o	K_1	K_2	K_o	K	K_2
1 ..	0·97 ..	1·55 ..	1·93 ..	1·06 ..	1·56 ..	1·95
2 ..	0·98 ..	1·51 ..	1·94 ..	1·08 ..	1·64 ..	2·07
3 ..	1·00 ..	1·55 ..	1·90 ..	0·99 ..	1·47 ..	1·82
4 ..	1·02 ..	1·53 ..	1·92 ..	0·92 ..	1·51 ..	1·90
5 ..	1·06 ..	1·55 ..	1·89 ..	1·06 ..	1·59 ..	1·98
6 ..	1·09 ..	1·61 ..	1·98 ..	1·04 ..	1·59 ..	2·05
Mean ..	1·02 ..	1·55 ..	1·93 ..	1·03 ..	1·56 ..	1·96

(*b*) *Manurial × cultivation experiment, Ratmalagara Estate :*

The table below gives the concentration of potash in nut water, samples from the above manurial experiment in which potash has shown no significant response according to the different levels of potash application.

TABLE VI (b)

Pick No.	*Year : M. IX. 1954* K_2O *in gms/litre*		
	K_0	K_1	K_2
1	2·10	2·41	2·60
2	1·98	2·33	2·47
3	2·04	2·27	2·48
4	2·11	2·43	2·57
5	—	—	—
6	2·05	2·45	2·61
Mean of 5 picks	2·06	2·38	2·55

(*c*) *Methods of Application Experiment, Marandawila :*

The absence of any significant difference between broadcasting and circular trench manuring for 1954 is also reflected in the potash concentration of the nut water.

TABLE VI (c)

Year : MV — 1953–54 : K_2O in gms/litre

Pick No.	K_0	K_b	K_c
1	1·64	1·97	2·06
2	1·74	2·14	2·18
3	1·77	2·13	2·16
4	1·78	2·26	2·28
5	1·53	2·03	2·01
6	1·67	2·19	2·20
Mean	1·69	2·12	2·15

(*d*) *Effect of storage on the potash content of nut water :*

In order to study the effect of storage on the potash content of nut water, sampling was carried out on every 10th day after the date of picking up to the 60th day on nuts from the Manurial × Cultivation Experiment at Ratmalagara Estate. The unhusked nuts were allowed to remain in the plots and husked just before the water sampling.

Composite samples for each plot were obtained by taking one nut from each plot palm (18 palms in each plot). The mean values for the potash content of nut water for the K_0, K_1 and K_2 plots are given below.

TABLE VI (d)

K_2O in gms/litre

Pick No. M. XI. 5.—Date : April 23, 1954

Date of Sampling	K_0	K_1	K_2
3rd May	2·07	2·37	2·54
13th May	1·96	2·22	2·39
24th May	1·88	2·04	2·33
2nd June	1·90	2·21	2·33
11th June	1·82	2·19	2·32
22nd June	1·77	2·09	2·27

Pick No. M. XII. (I)—Date : August 23, 1954

3rd September	2·22	2·55	2·73
14th September	2·18	2·51	2·66
23rd September	2·15	2·46	2·61
4th October	2·13	2·44	2·72
13th October	2·31	2·47	2·67
22nd October	2·00	2·33	2·58

The above figures indicate a slight but definite decrease in the potash concentration of the nut water with storage.

(e) *Effect of size of sample on potash content of nut water.*

As a preliminary investigation a simple trial on the variability of the potash content of nut water with the size of sample unit was carried out on nuts taken from a uniform block (Block No. 2) of Mudukatuwa Estate, Marawila, in the following manner : Units of 10, 20, 50, 100, 200, 300 and 500 nuts in triplicate were picked at random from the heap of nuts from Block 2. The nut water from these different units were analysed for potash and the figures are given below :—

TABLE VI (e)

Sample Size		*K_2O in gms/litre*
10	(*a*)	2·198
	(*b*)	2·190
	(*c*)	2·149
20	(*a*)	2·165
	(*b*)	2·364
	(*c*)	2·049
50	(*a*)	2·215
	(*b*)	2·115
	(*c*)	2·356
100	(*a*)	2·223
	(*b*)	2·232
	(*c*)	2·265
200	(*a*)	2·232
	(*b*)	2·190
	(*c*)	2·248
300	(*a*)	2·257
	(*b*)	2·323
	(*c*)	2·339
500	(*a*)	2·240
	(*b*)	2·174
	(*c*)	2·257

The coefficients of variation calculated for the different sample sizes indicate that the 100 nut unit is the best, giving the minimum variation. The results however are not conclusive and further trials are to be carried out.

TABLE VI (f)

Sample Size	*Coefficients of Variation*
10	1·207
20	7·267
50	5·432
100	0·987
200	1·347
300	1·885
500	1·972

(f) Potash content of nut water from individual palms :

This experiment was commenced on palms in the N. P. K. manurial experiment to investigate the variation of the potash content in nut water of individual palms subject to the same treatment. The palms of the two K_0 (0·75 lb. K_2O/palm) plots which received no potash from 1935–51, and one K_2 plot (now receiving 2·25 lb. K_2O/palm) which received 1·5 lb. K_2O/palm from 1935–51, were chosen for sampling. All nuts picked from the individual palms were taken for sampling one month after the date of pick. There is a considerable variation between palms within the same plot, particularly in the K_0 plots, as shown by the colour of the crowns as well as yields.

The figures tabulated below also indicate quite a variation in the potash concentration of nut water of individual palms within the same plot. Analysis of the data show that the potash concentration in the nut water of individual palms is negatively correlated with yield within the same plot. But the variation of the mean potash concentrations of nut water between different plots such as K_0 and K_2 plots has been earlier shown to be parallel to the yields. Given below are the figures for two picks, and these too show that between plots the variation in nut water potash is parallel to yields.

TABLE VII (a)

Potash Concentration of Nut water from individual palms

K0 PLOT NO. 53

	Pick No. M. XIX (5)			*Pick No. M. XIX (6)*		
Tree No.	*Appearance*	*Yield good nuts (nuts sampled)*	*Rejections*	*K_2O gms per litre*	*Yield good nuts (nuts sampled)*	*Rejections*	*K_2O gms/litre*
229	Good	7	—	1·012	2	1	0·705
230	,,	3	1	0·772	7	1	0·780
231	,,	7	—	0·680	7	—	0·920
232	,,	9	—	0·622	6	—	0·804
233	,,	5	—	0·481	5	—	0·581
234	,,	4	1	0·440	5	—	0·606
245	,,	4	1	1·352	11	—	0·987
246	,,	3	—	0·274	5	—	0·390
310	,,	8	—	0·697	8	—	0·382
311	,,	3	—	0·846	9	—	0·846
244	Fair	2	—	0·531	3	—	0·451
248	,,	1	—	0·124	2	—	0·282
313	,,	5	—	1·161	2	—	0·888
314	,,	6	—	0·572	7	—	0·622
312	,,	0	—	—	1	—	1·278
243	Poor	0	—	—	—	—	—
247	,,	1	—	0·705	1	—	0·913
315	,,	0	—	—	—	—	—
	Total	68	Plot mean	0·751	Total 81	—	0·715

K0 PLOT NO. 54

Tree No.	Appearance	Pick No. M. XIX (5) Yield good nuts (nuts sampled)	Rejections	K_2O gms per litre	Pick No. M. XIX (6) Yield good nuts (nuts sampled)	Rejections	K_2O gms /litre
70	Good	4	—	1·211	9	—	1·128
73	,,	2	—	1·717	11	—	1·941
74	,,	1	—	1·344	4	—	1·269
83	,,	3	—	0·639	5	—	0·796
84	,,	—	2	—	9	1	0·929
85	,,	4	—	1·078	11	—	1·153
86	,,	1	—	1·203	8	—	0·713
71	Fair	3	—	1·095	1	—	1·286
72	,,	1	—	2·115	1	—	1·817
69	,,	3	1	0·589	1	4	0·423
87	,,	3	—	0·971	5	1	0·929
148	,,	1	—	1·460	—	—	—
149	,,	—	—	—	—	—	—
150	,,	—	—	—	2	—	0·730
152	,,	5	—	1·112	10	—	1·037
153	,,	—	—	—	1	—	1·178
88	Poor	3	—	1·161	—	—	—
151	,,	1	—	0·191	2	1	0·506
	Total	35	Plot mean	1·135	Total 80	Plot Mean	1·055

K2 PLOT NO. 52

Tree No.	Appearance	Pick No. M. XIX (5) Yield good nuts (nuts sampled)	Rejections	K_2O gms per litre	Pick No. M XIX (6) Yield good nuts (nuts sampled)	Rejections	K_2O gms-litre
488	Good	4	—	2·182	6	—	2·298
408	,,	6	—	2·057	3	—	1·651
399	,,	7	—	2·149	9	—	2·605
398	,,	10	—	1·891	17	1	2·041
409	,,	2	—	2·124	3	—	2·472
487	,,	9	—	2·066	6	—	1·784
397	,,	7	1	1·634	11	—	1·966
410	,,	4	—	1·709	10	—	1·518
486	,,	10	—	1·809	6	—	1·911
485	,,	18	—	1·991	10	1	1·883
411	,,	1	2	3·194	1	—	4·77
396	,,	8	—	1·742	4	—	1·435
395	,,	4	—	2·265	3	—	2·165
412	,,	15	—	2·215	5	—	2·240
484	,,	6	—	1·833	14	1	2·082
483	,,	10	—	1·012	10	—	1·294
413	,,	6	—	1·344	9	—	1·070
394	,,	10	—	1·775	6	—	1·734
	Total	137	Plot mean	1·940	Total 133	Plot mean	2·050

(ii) TRANSFORMATION OF SOIL NITROGEN UNDER COCONUTS*

In order to study the depth and catenary fluctuations of ammoniacal (NH_4) and nitrate (NO_3) nitrogen, soil samples were taken to a depth of 30 inches at the following points on Bandirippuwa Estate :—(1) lower end of Botanist's replanting block, (ii) upper end of Botanist's replanting block, (iii) NPK manurial experiment plot No. 18, (iv) NPK plot No. 42, and (v) cover crop demonstration plot.

* See also *Annual Report*, 1952, page 16 and " *Tropical Agriculturist* ", Vol. C IX, page (iii).

The soil samples were taken at depths of 0–9 ", 9–18 " and 18–30 " from the centres of squares. Composite samples of 3 borings were taken for each area.

Immediately after sampling, half the sample was put into a tin, closed, and shaken up with a few c.c. of toluene. The other half was taken without the addition of toluene. The latter samples were subject to immediate analysis for NH_4 nitrogen and their moisture contents were also determined simultaneously.

The results tabulated below show the NH_4-nitrogen on the fresh and toluene treated samples, and the nitrate and total nitrogen on the latter samples. All figures refer to moisture free samples (oven dried at 110°C).

TABLE VIII (a)

Date of sampling : August 6, 1954

Sample		*Fresh*	*Toluene treated*		
		ppm. NH_4 Nitrogen	*ppm. NH_4 Nitrogen*	*ppm. NO_3 Nitrogen*	*ppm. Total Nitrogen*
Botanist I.	Top 0–9 "	14·5	8·5	2·2	34
	Sub_1 9–18 "	15·8	8·4	2·0	224
	Sub_2 18–30 "	15·3	11·5	1·6	207
Botanist II.	Top	16·1	14·5	2·0	347
	Sub_1	11·7	11·6	1·4	185
	Sub_2	14·9	14·0	2·0	180
NPK 18	Top	15·3	11·0	2·2	403
	Sub_1	15·5	11·6	2·4	286
	Sub_2	15·5	7·2	1·6	347
Cover —	Top	20·1	17·0	2·2	532
	Sub_1	11·9	13·0	2·4	460
	Sub_2	15·1	10·0	2·0	362
NPK 42	Top	14·8	11·1	2·4	280
	Sub_1	15·4	8·7	1·0	320
	Sub_2	14·3	11·1	1·2	341

The date of sampling was preceded by a period of wet weather. The results indicate a fair concentration of ammoniacal nitrogen at all points even at depths of $2\frac{1}{2}$ ft., and a remarkably low concentration of nitrate nitrogen both in the top and sub soils in all cases.

As is to be expected, the concentration of total nitrogen in the soils under the leguminous cover crop is of a higher order than in the others.

The figures for ammoniacal nitrogen obtained for the toluene treated samples are lower than those obtained for the fresh samples, indicating that toluene is not acting as a perfect steriliser.

The p_H, total exchangeable bases and clay fractions in the samples are tabulated below—

TABLE VIII (b)

Total exchangeable bases

Sample		*m.e./100 gms*	*% Clay*	*ph.*
Botanist I	Top	1·28	5·2	6·0
	Sub_1	1·18	1·3	5·5
	Sub_2	0·93	1·6	5·5
Botanist II	Top	0·80	1·8	6·5
	Sub_1	0·98	2·6	5·8
	Sub_2	1·38	2·7	5·5
NPK I8	Top	1·53	6·6	5·9
	Sub_1	2·08	1·5	6·5
	Sub_2	2·15	9·7	6·0
Cover	Top	1·88	9·2	5·0
	Sub_1	1·90	11·4	5·2
	Sub_2	1·53	7·7	5·0
NPK 42	Top	2·25	6·3	5·2
	Sub_1	1·28	12·7	5·2
	Sub_2	1·38	1·1	5·2

(iii) SOIL PHOSPHATE STUDIES

The Truog and citrate soluble methods for the estimation of available phosphoric acid in soils have proved to be of no value in explaining the lack of response to phosphate manuring even after 19 years of the N. P. K. manurial experiment at Bandirippuwa Estate. The values for available phosphoric acid obtained by these methods for the soils sampled in 1951 from the no phosphate (P_o) plots of the NPK experiment have been quite low (20–30 ppm), at which level responses to phosphate manuring have been obtained at Ratmalagara, Kumbaloluwa and Edunkelle Estates (see annual report of the C. R. I. 1953). It appears, therefore, that in the case of the Bandirippuwa soils there is some phosphoric acid fraction available to the coconut palm other than that indicated by the Truog or citrate soluble methods.

In an attempt to identify this fraction, two series of soils—one sampled in 1935 (before the N. P. K. experiment was commenced) and the other in 1951 from the no phosphate (P_o) plots of the NPK manurial experiment at Bandirippuwa were subject to phosphate fractionation according to the method of Colin Williams (J. Agri. Sc. Vol. XC, 1950). The samples were all taken from the manure circles (top 0–9 ″). The phosphate fractions soluble in dilute acid (2·5 per cent. acetic acid in 1 per cent. 8-hydroxy quinoline) and dilute alkali (0·1 N-sodium hydroxide) were estimated colorimetrically. For comparison two series of soil samples from the no phosphate (P_o) plots of the Manurial × Cultivation Experiment at Ratmalagara Estate in which a marked response to phosphate manuring has been obtained were also subject to phosphate fractionation. The results are shown in Table IX (*a*).

It is interesting to note that both in the case of the Bandirippuwa and the Ratmalagara soils, the phosphate fraction soluble in dilute acid has been more or less constant at 30–40 ppm for the two series (premanurial and later). In the case of the total alkali soluble phosphates however the Bandirippuwa soils show an increase in the 1951 series (300 ppm) over the 1935 series (140 ppm), whereas the Ratmalagara soils show a decrease from 300 ppm in the 1943 series to 60–100 ppm in the 1954 series.

TABLE IX (a)

Fractionations of Soil Phosphorus

MCT Samples from P_0 plots of N. P. K. Experiment at Bandirippu Estate

Plot No.	p.p.m. P_2O_5 soluble in dilute acid		p.p.m. Total P_2O_5 soluble in dilute alkali		p.p.m. Inorganic P_2O_5 soluble in diltue alkali		p.p.m. Organic P_2O_5 soluble in dilute alkali	
	1935 Series (pre-manurial)	1951 Series	1935	1951	1935	1951	1935	1951
3	—	25	—	320	—	192	24	128
8	30	30	140	384	116	192	—	192
13	—	80	—	300	—	128	—	172
18	—	40	—	280	—	104	36	176
23	25	25	140	360	104	112	—	188
28	—	23	—	260	—	112	—	148
45	15	15	140	300	80	104	60	196
54	17	35	140	300	120	136	60	164

MCT Samples from P_0 plots of Manurial × Cultivation Experiment at Ratmalagara Estate

Plot No.	p.p.m. P_2O_5 soluble in dilute acid		p.p.m. Total P_2O_5 soluble in dilute alkali		p.p.m. Inorganic P_2O_5 soluble in dilute alkali		p.p.m. Organic P_2O_5 soluble in dilute alkali	
	1943 Sereies (pre-manurial)	1954	1943	1954	1943	1954	1943	1954
7	25	30	280	60	176	55	104	5
8	35	25	240	60	150	55	84	5
15	200	35	300	60	120	32	180	28
17	10	20	260	60	136	32	124	28
19	10	35	200	120	120	32	80	88
21	66	40	300	100	160	32	140	68
32	40	30	200	100	150	32	46	68

MCT = Manure circle top.

The high content of alkali soluble phosphate in the 1951 series of the Bandirippuwa soils is probably due to the residual effects of the heavy dressings of bone meal these plots are reputed to have received at the hands of the previous owners. Although this residual effect has not been reflected in the figures obtained for available phosphate by the usual Truog or citrate soluble methods, yet it has been shown in the lack of response to phosphate manuring.

In the case of the Ratmalagara soils, the decrease in the total alkali soluble phosphate has been accompanied by a corresponding increase in the response to phosphate manuring during the period 1943–54.

It is apparent then, that at least some part of this alkali soluble phosphate, both organic and inorganic, is in an available form and plays an important role in the phosphate nutrition of the coconut palm.

The free iron content of the above soils were also estimated and the results are shown in Table IX (*b*). The free iron extractions were carried out according to the method of Mackenzie (Journal of Soil Science, Vol. V., No. 1, 1954) and the iron determined by Scott's colorimetric method (Analyst, Vol. 66, 1941). The percentage of free iron in the Ratmalagara soils is seen to be of a slightly higher order than in the Bandirippuwa soils.

TABLE IX (b)

Free iron

MCT samples from P_0 plots of NPK experiments at Bandiruppwa Estate

PER CENT FREE IRON

Plot No.	*1935 series*	*1951 series*
3	0·31	0·36
8	1·04	1·10
13	0·31	0·42
18	0·38	0·36
23	0·46	0·35
28	0·31	0·35
45	0 40	0 45
54	0·94	0·91

MCT samples from P_0 plots of manurial and cultivation experiment at Ratmalagara Estate

PER CENT FREE IRON

Plot No.	*1943 series*
7	0·72
8	0·50
15	0·44
17	0·88
19	1·00
21	0 88
32	0·69

MCT = Manure circle top

(iv) SOIL MOISTURE STUDIES

In order to investigate the extent of moisture conservation brought about by husk mulching the following simple experiment was commenced :—

Soil samples to a depth of 18 inches were taken from the manure circles round each palm from two sets of guard row palms on either side of the road in the manurial experiment on young palms at Ratmalagara Estate. Each set consisted of ten palms. At the first sampling, all the soils were under husk mulch, and analysis of the results showed no significant difference between the different samples. After the first sampling, the husk mulch round every alternate palm was removed, and

a second sampling carried out a month later. Moisture determinations on these showed that the moisture content of the soils under husk mulch was significantly higher than in those without the mulch. This sampling was preceded by a long period of dry weather (over 30 days).

Moisture determinations carried out on a further three series of soil samples during the course of the year showed no difference between the mulched and unmulched soils, probably a result of the light rains in the days preceding the dates of sampling. Further work is being continued.

(v) MISCELLANEOUS ANALYSIS

The following analyses were carried out during the course of the year for advisory purposes :—

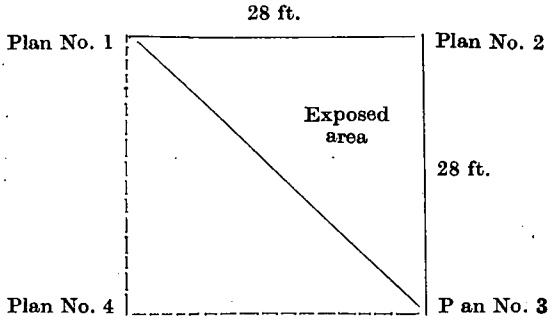
	% *N*	% P_2O_5	% K_2O	
(*a*) Rice bran	0·61	1·08	0·17	on air dry samples
(*b*) Pulverised manure	0·83	0·48	0·17	

	% K_2O	% *MgO*	% *Moisture*
(*c*) Agricultural salt	0·06	traces	8·08

	Sample No. 1	% *Moisture*	% *Sand*	
(*d*) Goat manure	No. 1	11·20	42·76	on air dry samples
	No. 2	15·22	10·50	
	No. 3	14·71	21·18	

Studies on the Root System of young palms (Ratmalagara Estate)

This is a continuation of the work carried out in 1953. Root exposures were made on three of the guard row palms of the manurial experiment on young palms (six years old) on which studies were carried out last year. The technique employed was similar to that described in the Annual Report of the C. R. I. for 1953. A triangular area touching the three palms was exposed to a depth of 1 foot as shown in the diagram below.



The following observations were made :—

(*a*) Most of the roots which had been exposed last year for about a month were decayed and some of the new roots were found to be growing through them.

(*b*) Some of the main roots damaged during the previous exposure had their lateral roots well developed. Damaged roots at the base of the palm were found to have given rise to 3 to 5 branches from the damaged point.

(*c*) In palm No. 3 which was on loamy soil almost all the roots were below a depth of 6 inches and had a uniform horizontal spread. The lateral roots of this palm were quite long and gave rise to a number of well developed rootlets running above and below the main roots.

(*d*) In palms No. 1 and 2 which were on gravelly soil most of the roots were below 6 inches, but they showed a restricted growth and did not spread evenly. The roots were seen to follow the path of least resistance, avoiding the hard gravel wherever possible.

(*e*) Roots from palm No. 4 were also observed in the exposed area, and one root from this palm had almost reached palm No. 2, covering a distance of over 40 ft.

(*f*) Measurements on the lengths, distribution, and thickness of the exposed roots are given in Table X (*a*).

TABLE X (a)

Root Distribution

PALM NO. 1

(1/8 circle exposed ; gravelly soil)

Distance	*No. of roots*
0—3 ft.	11
3—6 ft.	6
6—9 ft.	6
9—12 ft.	6
12—15 ft.	3
15—18 ft.	1

PALM NO. 2

(1/4 circle exposed ; gravelly soil)

Distance	*No. of roots*
0—3 ft.	23
3—6 ft.	10
6—9 ft.	10
9—12 ft.	8
12—15 ft.	2
15—18 ft.	1

PALM NO. 3

(1/8 circle exposed ; sandy loam)

Distance	*No. of roots*
0—3 ft.	54
3—6 ft.	22
6—9 ft.	14
9—12 ft.	12
12—15 ft.	7
15—30 ft.	1

Longest main and lateral roots

Palm No. 1	Main	19 ft. 8 inches
	Lateral	7 ft. 2 inches
Palm No. 2	Main	19 ft. 7 inches
	Lateral	7 ft. 9 inches
Palm No. 3	Main	28 ft. 8 inches
	Lateral	13 ft. 5 inches

(Points of Intersection (distance from one palm)

1 × 2	17 ft. 10 inches
1 × 3	15 ft. 5 inches
2 × 3	12 ft. 10 inches
2 × 4	10 ft. 9 inches
3 × 4	13 ft. 2 inches

Average diameter of main roots

Palm No. 2	root 1	8· 5 mm.
	root 2	8· 0 mm.
	root 3	6· 0 mm.
Palm No. 3	root 1	9· 5 mm.
	root 2	8· 0 mm.
	root 3	8· 0 mm.
	root 4	8· 5 mm.
	root 5	7· 5 mm.
	root 6	8· 0 mm.
	root 7	8· 0 mm.

Miscellaneous

SOIL SURVEYS FOR COLONISATION SCHEMES

Soil surveys of crown jungle were carried out during the course of the year in the following areas to be alienated under colonisation schemes for planting coconuts :—

(*a*) *Mankerni* (Eastern Province): 1,900 acres. The soils here were of a deep sandy loam. The entire area was recommended as suitable for coconut cultivation.

(*b*) *Nikaweratiya* (North-Western Province): 1,060 acres. The soils in this area were mostly gravel, cabook and clay. The lands were condemned as unsuitable for coconuts.

(*c*) *Siyambalagaswewa* (North-Western Province): 500 acres. This area was recommended for coconuts, the soils consisting of a deep sandy loam.

(*d*) *Mullaittivu* (Northern Province): 5,000 acres. The soils were uniform and consisted of deep chocolate and sandy loams. Almost the whole of the area was recommended.

D. A. Nethisingha,
Officer-in-Charge,
Soil Chemist's Division.

REPORT OF THE BOTANIST

REPLANTATION

Replantation is a topical problem as there are many coconut estates where the yield is declining due to senility of the palms. A field trial was initiated in 1950 to study different systems of replantation and the following is a preliminary report. Three systems have been tried out :—

(1) *New clearing type.*—Planting after the complete removal of the old stand of palms.

(2) *Gradual thinning.*—Underplanting and removing the old stand *gradually.* In this instance 20 per cent. of the old stand was removed during the first year and thereafter 10 per cent. every year.

(3) *No thinning.*—Underplanting and removing the old palms during the initial stages of flowering of the young palms, *i.e.*, eight years after transplantation.

Selected seedlings were planted in May, 1950, with 25 seedlings per plot and each treatment was replicated seven times. The density of the old stand was approximately 64 palms per acre.

Leaf Production

The number of leaves produced per palm was scored in October each year and the data for the treatments separately are tabulated below—

Mean number of leaves produced per 100 young palms

Treatment	*1951–52*	*1952–53*	*1953–54*
New clearing ..	659	722	878
Gradual thinning	607	652	755
No thinning ..	594	628	693

Critical difference between two treatments = 47 (P = 0·05)

The pattern of leaf production is related to treatment during the early periods of growth of the young palms. During the first year (1950–51) after planting, leaf production was practically the same for all the treatments. This was to be expected as the effect of the different systems of thinning of the old palms would not have been felt then.

In the second (1951–52), third and fourth years, the young palms in the new clearing method have produced more leaves than in either of the other treatments and the differences were highly significant. Although the differences in leaf production between gradual thinning *vs.* no thinning were in favour of the former, the differences were not statistically significant during the second (1951–52) and third years, but they were growing every year (13 to 24 to 62) and in the fourth year reached a significant level.

Stem Formation

The girth of the stem of each young palm was measured six inches above ground level in December, 1954, and the data are presented below—

Mean girth of stem per palm

	New Clearing	*Gradual thinning*	*No thinning*
Mean girth (inches) ..	50·1	45·0	40·3
Per cent. ..	124·3	111·7	100·0

Critical difference between treatments = 5·3 inches (P = 0·05)

The differences between the treatments are statistically significant. The young palms in the new clearing system have shown relatively the largest development of stem with an increase of 24 per cent. over the no thinning treatment. Although, the difference in girth of stem between gradual thinning and no thinning was marked, nearly five inches, it just failed to reach the significant level.

The above analysis shows that as far as the two characters, leaf production and stem girth which express to a certain degree the vigour of a young palm, are concerned, the three systems of replanting can be placed in the following order of preference : (i) new clearing, (ii) gradual thinning, (iii) no thinning.

The main purpose of this trial is to find out an economic method of replanting whereby the bearing age of the young palm is not unduly delayed, and its potential yield not permanently retarded due to the presence of the old stand. The new clearing system would be practicable only if early maturity and subsequent yield of the young palms compensate for loss in crop caused by the removal of the old stand of palms completely. It is yet premature to answer these questions as this experiment is only four years old.

CONTROLLED POLLINATION

Two programmes on controlled pollination were in progress, *viz.* (*a*) production of seed-nuts for a seed garden, and (*b*) study of inter-varietal hybridization.

Further studies on techniques of pollination were completed and the following schedule is now generally adapted in crossing the *typica* variety of coconut palms grown on a commercial scale in Ceylon. Seventeen days after the opening of the spathe, the inflorescence is emasculated and the female flowers are thinned out to about 20 for convenience of working. The inflorescence is then bagged, and the female flowers are pollinated when they are receptive with pollen collected from the required parent. Receptivity is normally attained between the 22nd and 24th day after the opening of the spathe. Pollen samples are stored over 43·4 per cent. sulphuric acid in a desiccator at room temperature.

Pollination on tall palms is done by a band of young men who can climb trees skilfully and who have been trained in the technique involved. A detailed description of the technique of pollination has been published in *Ceylon Coconut Quarterly, Vol. 5, No. 3, 1954.*

The Seed Garden

The alienation of 200 acres of land for a seed garden in the *Ambakalle* forest reserve in the *Chilaw* district was finalised after considerable difficulty. The site selected has an isolation barrier composed of forest vegetation at least 40 chains wide all round.

The seed garden is to be planted exclusively with planting material derived through artificial pollination. Subsequently, natural crossing of palms is limited to those within the seed garden as the isolation barrier would considerably minimise the chances of contamination with pollen from unknown palms in the neighbourhood.

From the pool of mother palms that have been recorded previously, 90 palms were selected for pollination work. In their selection morphological characters consistent with high-yield, out-turn, quality of copra, drought resistance, &c., have been considered. Each of these palms has given more than 100 nuts per year, each nut giving at least half a pound of copra.

During the year nearly 12,000 female flowers borne on 636 inflorescences were artificially pollinated. These nuts would be ready for harvesting in 1955.

In connection with this project, a simple trial was carried out to study the wind buoyancy of coconut pollen through a jungle barrier. Slides (area of each $8\frac{3}{4}$ sq.in.) smeared with glycerine were mounted on wind vanes and were placed at four stations within a thick jungle at a height of about 30 feet above ground. The stations were 10, 100, 200 and 350 yards from the nearest coconut plantation. The slides were left exposed at their respective stations for eight hours each day and the coconut pollen grains on the slides were scored. The trial was continued for five days and the velocity of the wind during the observation periods varied between 2 to 20 m.p.h. (Beaufort scale). The maximum number of pollen grains scored at each station was as follows :—

	A (10 yards)	*B (100 yards)*	*C (200 yards)*	*D (350 yards)*
No. of pollen grains	76	13	6	nil
Per cent.	100	17	8	0

Inter-varietal Crosses

268 first generation progenies from certain inter- and intra-varietal crosses are under observation ; out of these 144 progenies were planted in 1950 and the remainder in 1952. Four forms of coconut palms have been used in these crosses ; *Dwarf* (green), *King-coconut, San Ramon* and the Ceylon *typica* type, i.e., the tall palms grown on

a commercial scale in Ceylon. The first three varieties although not of much economic importance have certain desirable characters, e.g., the *Dwarf* is early flowering and short in habit, the *King-coconut* has a heavy setting of female flowers and the *San Ramon* has large nuts each giving about 0·8 lb. of copra.

The initial crosses were largely exploratory in nature. It was necessary to study the crossability between the varieties, the genetic expression of certain qualitative characters, and the hybrid vigour, if any, in the F1 progenies.

The four varieties listed above are easily crossable. They carry the same chromosome complement 2n = 32. Chromosome counts were done on a number of palms by preparing Feulgen root squashes and the results are recorded below :—

Variety or form	*Chromosome number*
Dwarf (green)	2n = 32
Dwarf (*red*)	2n = 32
Dwarf (yellow)	2n = 32
King-coconut	2n = 32
Ceylon *typica*	2n = 32
San Ramon	2n = 32

Out of the crosses made so far, the first generation (F1) palms between Ceylon *typica* and *dwarf*, appear to be the most promising. The palms are vigorous and early flowering. Their yield of nuts and copra have to be tested.

Two types of palms are apparent in the F1 progenies of *dwarf* (female) × *typica* (male). One type is like the dwarf palm with slender stems, short internodes and small sized nuts (vide Annual Report for 1953, page 29), and the other type is more vigorous and the *typica* characters predominate. Judging by the appearance and breeding system of the palms, it is very likely that the former type is purely a dwarf palm and not a hybrid between the two varieties. Two explanations are possible for this behaviour ; either this was an instance of apomixis, or there has been contamination of pollen during pollination. The latter explanation is more probable.

King Coconut × *Dwarf*.—Eight progenies are available, all the palms have flowered the mean period taken for flowering being 43·9 months from the date of sprouting of seed-nuts. Five of the palms were in full bearing during 1954, the fifth year after planting and the mean yield per palm for that year was 142 nuts with a husked nut weight of 1.51 lb. The copra was thin and leathery. Since the nuts are small, and copra generally of poor quality, this cross is of little commercial value in the first generation at least. However the short habit of the palms, with reddish brown nuts and a crown heavily packed with large bunches, make them ideal to grow in the garden for beverage purposes.

King-coconut × Ceylon *typica*.—The palms are vegetatively more vigorous, than either of the parents. A few flowered during the year. The progenies have to be tested further for their yield.

NURSERY TRIALS

Soil Fumigation

Soil fumigation is a common agricultural practice where eelworms or nematodes are present in the soil. Recently some eviedence has been advanced to show that soil fumigation stimulates the growth of plants, besides its nemocidal properties. A simple trial was carried out to study the efficacy of this claim in relation to coconut nursery beds.

Three soil fumigants were used, *viz.*, Ethylene dibromide (E.D.B.), Ethylene chlorobromide (E.C.B.) and Shell D-D soil fumigant. Rates of application were 200 lb./acre (single dose), 400 lb./acre (double dose) and 800 lb./acre (quadruple dose) for E.D.B. and E.C.B. ; and for D.D 300, 600 and 900 lb./acre. The two bromide compounds were diluted to 10 per cent. using light Diesel oil, and were applied 10, 18 and 24 weeks after planting. D-D was applied two weeks before planting and subsequently the soil was well turned over. Fumigants were applied with a " Fumigun ". For each treatment 100 seed-nuts were planted.

All applications of the two bromide compounds during the 10th week and the double and quadruple doses during the 18th week generally retarded sprouting and growth of the seedlings. In many instances, there were over 80 per cent. non-sprouting ; the control plots showed 90 per cent. sprouting. Three dosages of D-D fumigant produced no differences between them and the seedlings were of the same type as those from the control beds, except that germinations were slightly less.

The results were negative. The different applications either affected adversely the germination of seed-nuts and subsequent growth or else there was no marked stimulation of vegetative growth in relation to the control plants.

Storage of Seed-nuts

The current practice is to transplant eight-month old seedlings during the two main planting seasons, May—June and October—November depending on the locality. Consequently, seed-nuts collected during certain months do not fit into the planting programme either because harvesting may coinicde with unfavourable periods for planting nuts in the nursery or else the seedlings may be too old for transplantation during the correct planting season. Therefore, a trial was carried out in order to ascertain whether seed coconuts can be stored under practicable conditions without severely affecting their viability and quality of seedlings.

800 seed-nuts of more or less uniform size and shape were selected from a high-yielding block, 400 nuts were heaped up in an open space under the shade of old palms and were covered with cadjans and the remaining nuts were stored in a room. At intervals of 4, 6, 8, 10, 12 14, 16, and 18 weeks from date of pick, 50 nuts were drawn at random from each lot and were planted in the nursery. The dates of sprouting and quality of seedlings were noted.

There were no appreciable differences in the seedlings due to the two methods of storage. In each case about 90 per cent, of the seed-nuts sprouted utlimately ; 5 per cent sprouting was observed about the 12th week after planting irrespective of the period of storage, but to get the maximum sprouting it took nearly 24 weeks for the lots stored up to 8 weeks, whereas for the other lots it was not more than 19 weeks from the date of planting. The only apparent difference was a gradual decrease in height of seedlings with storage, obviously due to the shorter growing periods. There were 40 to 50 per cent. good seedlings in each treatment.

Thus storage of seed-nuts under the above conditions up to 18 weeks had no bad effects either on the viability of seed-nuts or the quality of seedlings.

CROP PROTECTION

It was the intention of the Institute to create a separate division for Crop-Protection work and as no appointment has been made hitherto, the research assistant to the Botanist continued to work on relative problems. Mainly advisory work was attended to with the collaboration of the Department of Agriculture, Peradeniya. From the voluminuous correspondence received two problems seem to be of paramount importance, *viz.*, the control of Red Weevil (*Rhynchophorus ferrugineus*) and the Rhinoceros beetle (*Oryctes rhinoceros*) and it is necessary to appoint a full time officer to study these problems and work out both-biological and insecticidal methods of control. In the absence of any modern methods of control, estate sanitation and destroying the breeding grounds of the Rhinoceros beetle were recommended.

The Rhinoceros Beetle

The effect of certain insecticides in controlling the Rhinoceros larvae was investigated under laboratory conditions. The insecticides used were: D.D.T. dust and wettable powder; Hexidole 805 dust, Agrocide wettable powder and Gammalin (Benzene Hexachloride products); Intox 8 (Chlorodane product); Dieldrex (Dieldrin product); Aldrex (Aldrin product); and D-D Shell fumigant. Concentrations varying from 0·013 to 1·0 per cent. of the active ingredients were used and in all thirty treatments were tried out.

Earthen-ware posts were filled with 8200 c.c. of well decomposed farm yard manure in each, and nine uniformly sized large larvae were introduced into each pot. The chemicals were uniformly applied to all the pots and untreated ones were used as the control. Every third day the pots were sprayed with water to keep them moist. The larvae that were normal, moribund and dead were noted daily for 17 days.

The results indicated a 100 per cent. mortality of larvae within 48 hours with the applications of 2·5 c.c. Shell D-D, 0·5 per cent. active ingredient of Dieldrex 15 and Gammalin. Intox 8 and Agrocide on the other hand gave similar results within five days, while the other treatments were still slower in their action taking up to a fortnight for a complete kill.

Cattle Repellants

Two patent chemicals " Goodrite " and " Renardine " which have been proved as deer repellents were tried out on coconut leaves as cattle repellents. The results were negative.

Different concentrations of the two chemicals were sprayed on living coconut leaves and cattle were allowed free access to them. The control leaves were practically eaten up, and of the other, those treated with the higher concentrations of the chemicals were less damaged than those treated with the lower concentrations. The trial was repeated with still higher concentrations but the protection afforded even in the latter instance was not sufficient to warrant their use as satisfactory cattle repellents.

MISCELLANEOUS

Routine observations and yield recording of (*a*) 300 palms in Botanist's block B at Bandirippuwa, (*b*) replantation trial at Olaboduwa, (*c*) progeny trial at Marandawila, (*d*) Latin Square experiment at Ratmalagara, (*e*) dwarf palms at Ratmalagara and (*f*) mother palms on a number of estates were continued.

D. V. LIYANAGE,
Botanist.

REPORT OF THE CHEMIST

TECHNOLOGICAL EXPERIMENTS

Experiments on the "Generator" Process for the manufacture of Coconut Toddy Vinegar

During the year, work in this Division was focussed principally on the problem of ascertaining the practicability of introducing the modern quick "Generator" process, for the commercial manufacture of high grade coconut toddy vinegar.

The experimental generator designed for the laboratory trials was a small one of the re-circulating type, cylindrical and straight sided in construction, with a collection chamber capacity of approximately 2 gallons.

The vinegar stock (i.e., the settled toddy after yeast or alcoholic fermentation,) was stored in a 10 litre aspirator bottle fitted with a glass tap and was allowed to run in drop-wise into a "thistle" funnel connected to the distribution apparatus in the top chamber of the generator. The oxidation of the alcohol was accomplished by droplet dispersion of the vinegar stock which was applied to the upper surface of the packing medium (corn cobs in this case) combined with its counter current flow against the air entering at the bottom. The acetic bacteria present on the generator packing are presumed to find conditions satisfactory for the rapid oxidation of the alcohol. The acetification taking place simultaneously and rapidly throughout most of the exposed surface of the generator medium as the vinegar stock trickles through the packing. Being assured by the heat generated during acetification of the vinegar stock the air which enters through the lower vents and false bottom of the generatory passes up through the packing and out through the loose-fitting lid.

The analytical data obtained on 24 charges put quantitatively through this experimental generator are presented in Table I below.

TABLE I

Charges 2 to 25 (Summarised Results)

(Composition of Samples before and after passing through Generator)

	Composition of Toddy used			*Composition of Vinegar Produced*			
Charge No.	*%Total Acidity (As acetic) Gms/100ml.*	*%Alcohol V/V*	*%Total Solids Gm/100 ml.*	*%Total Acidity (as acetic) Gms/100ml.*	*%Alcohol V/V*	*%Total Gms/100 ml.*	*No. of Hrs. taken for complete acetification*
2	1·85	5·9	2·74	3·82	1·6	2·57	—
3	1·75	6·7	3·22	6·24	0·0	3·23	168
4	1·88	6·9	3·26	5·86	0·0	3·07	144
5	1·31	7·7	2·93	6·91	0·0	3·24	120
6	1·27	7·4	2·76	7·42	0·0	3·18	144
7	1·52	8·0	3·18	7·29	0·0	3·31	144
8	3·64	5·0	3·06	7·70	0·0	3·28	120
9	1·68	7·7	2·18	7·54	0·0	2·70	144
10	2·50	5·8	2·55	7·32	0·0	2·70	144
11	4·06	3·5	0·98	7·37	0·0	2·19	72
12	2·16	7·2	2·42	7·38	0·0	2·62	144
13	1·84	6·1	2·58	7·36	0·0	2·36	144
14	1·96	6·4	2·74	7·42	0·0	2·46	168
15	1·96	6·4	2·64	7·45	0·0	2·54	144
16	1·81	6·6	2·75	7·42	0·0	2·68	144
17	2·03	6·6	2·20	7·59	0·0	2·40	144
18	2·15	6·5	2·21	7·30	0·0	2·61	144
19	2·01	6·6	2·37	7·44	0·0	2·64	144
20	2·50	6·1	2·39	7·46	0·0	2·61	144
21	1·22	7·4	2·82	7·40	0·0	2·70	168
22	2·24	6·0	2·52	7·46	0·0	2·66	144
23	3·34	4·4	2·36	7·39	0·0	2·57	120
24	3·78	4·0	2·43	7·50	0·0	2·82	144
25	2·38	6·6	2·35	7·52	0·0	2·61	144
Average	2·20	6·3	2·57	7·15	0·1	2·74	144 (nearest 24 hours)
Range	1·22 to 4·06	3·5 to 8·0	0·98 to 3·26	3·82 to 7·70	0·0 to 1·6	2·19 to 3·31	72 to 168

The first charge put through was of the nature of a starter (or mother culture) to seed the generator and packing with vinegar bacteria.

The summarised results of these experiments convincingly show that complete acetification of coconut toddy can be effected by the " Generator " process. The overall average of 7·15 per cent. of acid recorded on the 24 experimental charges may well be regarded as almost a theoretical recovery. As against 3 to 6 months by the existing method, which produces a vinegar containing a maximum of only 4·5 per cent. acid, complete acetification took place in 144 hours (6 days) by the new process, Besides, the speed of action and high recovery of acid the quality of the vinegar produced by this process was also definitely better and more uniform than any of the local brands now on the market.

Towards the end of the year two vinegar manufacturers who volunteered to implement the new process were assisted to construct vinegar generators of 50 and 150 gallon capacities for commercial production during 1955.

Analytical quality of locally manufactured coconut vinegar

Fourteen samples of locally manufactured coconut vinegar and one sample of artificial vinegar were examined during the year, and a survey of the quality of vinegar produced by the existing industry revealed that much improvement is necessary both in methods of production and the quality of the manufactured article.

The chief difficulty experienced by vinegar makers appears to be their inability to get proper acetification of their toddy due primarily to lack of control during processing. It has come to light that in a number of cases wasteful loss of alcohol and acid takes place owing to injudicious handling of the raw material during the various stages of manufacture. When producers are unable to get their product to contain over 4 per cent. acid of biological origin by genuine brewing, then they appear to resort to wilful adulteration with synthetic acid for the purpose of compliance with legal standards. The highest acid strength for genuine coconut vinegar claimed by any vinegar maker in the island is 4·5 per cent. This means that bottled samples on the market containing more acid than this are most likely to have been fortified with synthetic acid.

The majority of the local vinegars examined in these studies were characterised by off tastes and " mousey " flavours in spite of their storage for protracted periods in maturation casks.

The analytical results obtained in these studies which are presented in Table II coupled with visual observations revealed that the common defects in the local products were low acidity, low total soluble solids, sedimentation and incomplete acetification. None of the samples were comparable with imported vinegars as regards analytical quality. (For Table II, *see* page 37.)

A systematic study of the analytical data is desirable if suitable standards are to be fixed in regard to quality. At present a minimum acidity limit of 4 per cent. is employed as the sole criterion for judging purity. This is insufficient if quality control is to be enforced rigidly with the ultimate view of improving the local product.

Studies on the Mineral Constituents of Tall Palm Toddy

In continuation of the work on the mineral constituents of toddy reported last year, analyses were done on ten bulked and six individual samples of toddy in order to determine its range of composition with regard to the concentration of chlorides. The analytical results are given in Table III below. (For Table III, *see* page 38.)

TABLE II

Analytical characteristics of 15 samples of locally manufactured coconut toddy vinegar

Serial No.*	Retail Price	Volume	% Fixed Acid (In terms of acetic) Gm/100 ml.	% Volatile Acid (as acetic) Gm/100 ml.	% Total Acid (as acetic) Gm/100 ml.	% Solids in suspension Gm/100 ml.	% Solids in Solution Gm/100 ml.	% Total solids Gm/100 ml.	% Alcohol w/w	% Alcohol w/v	% Alcohol v/v	Density 30° C/30° C	Density 30° C/4°C	% Sulphated Ash Gm/100 ml.	% Water Soluble Ash	% Water Insoluble Ash	% Alkalinity of Soluble Ash ml. N Acid/100 ml.	% Potash (as K_2O) Gm/100 ml.	% Nitrogen (as N) Gm/100 ml.	% Phosphorus (as P_2O_5 Gm/100 ml.	% Protein ($N \times 6{\cdot}25$) Gm/100 ml.	% Chlorides (as chlorine-Cl'_n) Gm/100 ml.
	Rs. c.	ml.																				
I	0·70	648	0·18	3·07	3·25	Trace	1·66	1·66	2·41	2·39	3·05	1·0069	·0027	0·52	92·666	7·4	Trace	0·166	0·012	0·011	0·075	0·110
II	0·40	620	0·09	3·18	3·27	Trace	1·04	1·04	2·45	2·43	3·11	1·0051	1·0009	0·53	94·1	5·9	Trace	0·137	0·014	0·012	0·088	0·123
III	0·60	630	0·18	3·27	3·45	Trace	1·40	1·40	1·43	1·42	1·81	1·0076	1·0037	0·55	91·0	9·0	Trace	0·196	0·031	0·020	0·194	0·139
IV	0·60	640	0·14	4·68	4·82	Trace	1·38	1·38	1·21	1·20	1·54	1·0095	1·0055	0·45	89·9	10·1	Trace	0·155	0·032	0·020	0·200	0·116
V	0·50	660	0·03	4·38	4·41	Trace	1·49	1·49	0·35	0·35	0·45	1·0111	1·0071	0·50	94·5	5·5	Trace	0·187	0·034	0·021	0·212	0·123
VI	0·60	700	0·04	3·60	3·64	Trace	1·45	1·45	0·42	0·42	0·54	1·0099	1·0059	0·55	94·7	5·3	Trace	0·232	0·030	0·211	0·188	0·131
VII	0·60	560	0·12	3·75	3·87	Trace	1·56	1·56	0·17	0·17	0·22	1·0108	1·0066	0·56	89·9	10·1	0·30	0·184	0·035	0·023	0·219	0·123
VIII	0·60	625	0·12	3·56	3·68	Trace	1·45	1·45	0·42	0·42	0·54	1·0096	1·0056	0·51	87·6	12·4	0·30	0·183	0·032	0·020	0·200	0·127
IX	0·50	605	0·12	3·56	3·68	Trace	1·29	1·29	0·42	0·42	0·54	1·0097	1·0056	0·50	89·8	10·2	0·30	0·213	0·032	0·020	0·200	0·131
X	0·50	670	0·09	4·03	4·12	Trace	1·31	1·31	0·17	0·17	0·22	1·0110	1·0068	0·60	93·2	6·8	0·20	0·226	0·007	0·016	0·044	0·158
XI	0·70	660	0·04	4·39	4·43	Trace	1·15	1·15	0·03	0·03	0·04	1·0119	1·0082	0·58	92·0	8·0	0·20	0·146	0·015	0·016	0·094	0·154
XII	0·65	690	0·08	4·48	4·56	Trace	1·28	1·28	0·60	0·60	0·76	1·0106	1·0068	0·54	91·8	8·2	0·16	0·162	0·011	0·022	0·069	0·131
XIII	0·65	680	0·10	5·13	5·23	Trace	1·22	1·22	0·20	0·20	0·20	1·0117	1·0079	0·50	93·0	7·0	0·20	0·193	0·030	0·021	0·188	0·119
XIV	0·60	660	0·16	3·32	3·48	Trace	1·54	1·54	0·46	0·46	0·59	1·0109	1·0059	0·62	92·0	8·0	0·20	0·266	0·031	0·021	0·194	0·147
XV*	0·35	650	Trace	2·65	2·65	Trace	0·18	0·18	0·03	0·03	0·04	1·0043	1·0000	0·09	—	—	0·12	0·039	0·007	0·002	0·044	0·022
General Average I to XIV ..	0·60	646	0·11	3·89	3·99	Trace	1·37	1·37	0·77	0·76	0·97	1·0097	1·0057	0·54	91·9	8·1	0·13	0·189	0·025	0·019	0·155	0·131
Range I to XIV	0·40–0·70	560–700	0·03–0·18	3·07–5·13	3·25–5·23	Trace	1·04–1·66	1·04–1·66	0·03–2·45	0·03–2·43	0·04–3·11	1·0051–1·0119	1·0009–1·0082	0·45–0·62	87·6–94·7	5·3–12·4	Trace to 0·30	0·137–0·266	0·007–0·035	0·011–0·023	0·044–0·219	0·110–0·158

* Artificial vinegar.

TABLE III

Chlorides in Tall Palm Coconut Toddy

(Ten samples of bulked toddy from 6 tall palms at Bandirippuwa, which flowed between 4 p.m. and 6 a.m.)

Sample No.	Time of Analysis	Per cent. Chlorides on original toddy as			Per cent. Sulphated Ash	Per cent. Chlorides on A S H as		
		Chlorine (cl') Gm/100 ml.	Kcl Gm/100 ml.	NaCl Gm/100 ml.	Gm/100 ml.	Chlorine (cl') Gm/ 100 grms. Ash	Kcl Gm/ 100 grms. Ash	NaCl Gm/ 100 grms. Ash
	A.M.							
1	10	0·110	0·231	0·181	0·44	25·00	52·50	41·14
2	10	0·107	0·225	0·176	0·46	23·26	48·91	38·26
3	10	0·112	0·235	0·185	0·43	26·05	54·65	43·02
4	10	0·112	0·235	0·185	0·49	22·86	47·96	37·76
5	10	0·108	0·227	0·178	0·46	23·48	49·35	38·70
6	10	0·112	0·235	0·185	0·46	24·35	51·09	40·22
7	10	0·112	0·235	0·185	0·44	25·45	53·41	42·05
8	10	0·112	0·235	0·185	0·45	24·89	52·22	41·11
9	10	0·112	0·235	0·185	0·47	23·83	50·00	39·36
10	10	0·108	0·227	0·178	0·48	22·50	47·29	37·08
General Average	10	0·110	0·232	0·182	0·46	24·17	50·74	39·87

Chlorides in Tall Palm Coconut Toddy

(Samples from six individual palms at Bandirippuwa which flowed between 4 p.m. and 6 p.m.)

1	10	0·112	0·235	0·185	0·45	24·89	52·22	41·11
2	10	0·108	0·227	0·178	0·46	23·48	49·35	38·70
3	10	0·105	0·221	0·173	0·44	23·86	50·23	39·32
4	10	0·110	0·231	0·181	0·44	25·00	52·50	41·14
5	10	0·119	0·250	0·196	0·46	25·87	54·35	42·61
6	10	0·106	0·223	0·175	0·43	24·65	51·86	40·70
General Average	10	0·110	0·231	0·181	0·45	24·62	51·75	40·60

It will be seen from the data presented in the above tables that the concentration of chlorides in tall palm coconut toddy falls within the following ranges :—

Chlorides (calculated as chlorine)—0·105 to 0·119 gm/100 ml.

Chlorides (calculated as Kcl)—0·221 to 0·250 gm/100 ml.

Chlorides (calculated as NaCl)—0·173 to 0·196/100 (gm) ml.

The average composition of the toddy samples used (at the time of analysis) was as follows :—

Per cent. total solids .. 14·2 grms. per 100 ml.

Per cent. acidity (as acetic) .. 0·64 grms. per 100 ml.

Per cent. alcohol (V/V)— .. 2·12.

As toddy is not a neutral medium it was not possible to estimate chlorides by the direct titration method. A modification of Volhard's method was evolved using nitrobenzene as a coagulant for the silver chloride produced. This method was found to give concordant and reproducible results.

The concentration of chlorides in the sap from healthy palms was found to be fairly constant—fluctuating within a very small range only. Calculated as chlorine the range was 0·105 to 0·119 gram per 100 ml.

Composition of Coconut Cakes (Poonac)

Following up an inquiry on the manurial value of coconut poonac it was considered useful to carry out complete analyses of the various types of extracted coconut cakes produced in Ceylon oil mills. The samples examined included Expeller Poonac, Chekku poonac, Hydraulic poonac, Parings poonac, Sediment poonac, DCN poonac and the British Ceylon Corporation products X'tralac and Morlac.

The results which are charted in Table IV below show that sediment poonac (from oil filter pads) *calculated on the dry oil-free basis* is richest in nitrogen protein and phosphates, and DCN poonac the richest in potash. The samples of sediment and parings poonac contained the least amount of potash. (For Table IV, *see* page 40.)

The analytical data in general show that hydraulic poonac is the best source of all three major manurial constituents—nitrogen, phosphorus and potash.

Laboratory Investigations

EXAMINATION OF FARMYARD MANURE

In continuation of the work reported last year two more half-yearly samples of farmyard manure were examined. Table V summarise all the results obtained up till now, for the manurial constituents nitrogen, phosphoric acid and potash.

TABLE V

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

Sample No.	*Date of Sampling*	*Per cent. Moisture*	*Per cent. Nitrogen (AS N)*		*Per cent. Phos. Acid (AS P_2O_5)*		*Per cent. Potash (AS K_2O)*	
			Wet basis	*Dry basis*	*Wet basis*	*Dry basis*	*Wet basis*	*Dry basis*
I (*a*)	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*)	July 53	7·81	1·52	1·65	0·65	0·70	2·12	2·30
VI (*a*)	Dec. 53	4·34	0·79	0·83	0·63	0·66	0·87	0·91
VII (*a*)	June 54	2·91	0·71	0·73	0·49	0·50	0·83	0·85
VIII (*a*)	Dec. 54	3·62	0·11	0·12	0·34	0·36	1·17	1.22
	Seven Samples	5·87	1·10	1·18	0·56	0·60	1·36	**1·46**

(*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
II (*b*)	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*)	July 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	1·33	1·41
VII (*b*)	June 54	1·93	0·51	0·52	0·35	0·36	0·63	0·64
VIII (*b*)	Dec. 54	3·99	0·93	0·96	0·42	0·44	0·97	1·01
	Eight Samples	4·82	1·10	1·16	0·56	0·60	1·20	1·27

The average figure still indicate that the manure from pasture-fed cattle, if at all, is a trifle superior to that from the concentrate-fed animals. However, as the composition of the individual samples shows wide fluctuations, the present average figures could not be regarded as being strictly representative.

TABLE IV

Composition of Coconut Cakes (Poonac)

(*a*) Original Samples (as received)

Sample	*Source*	*Per cent. Moisture*	*Per cent. Oil*		*Per cent. Nitrogen (as N)*		*Per cent. Protein (N × 6·25)*		*Per cent. Phosphoric Acid as P_2O_5*		*Per cent. Potash (as K_2O)*	
			Wet basis	*Dry basis*	*Wet basis*	*Dry basis*	*Wet basis*	*Dry basis*	*Wet basis*	*Dry basis*	*Wet basis*	*Dry basis*
Morlac	B. C. C.	10·82	2·26	2·54	3·10	3·48	19·38	21·75	1·22	1·36	2·09	2·34
X'tralac	B. C. C.	10·95	0·53	0·60	3·26	3·66	20·38	22·88	1·21	1·36	2·22	2·49
Sediment Poonac	Marawila	7·32	44·19	47·68	2·96	3·20	18·50	20·00	1·26	1·36	0·44	0·48
Expeller Poonac	Haldanduwana	9·42	11·43	12·62	2·14	2·36	13·38	14·75	1·09	1·21	1·50	1·66
Chekku Poonac	Hybrid Palm	10·89	28·12	31·55	1·59	1·78	9·94	11·12	0·55	0·62	1·27	1·42
DCN Poonac	C. R. I.	10·41	8·50	9·49	2.82	3·15	17·62	19·69	1·10	1·23	2·19	2·44
Hydraulic Poonac	Nattandiya	11·32	8·30	9·37	3·20	3·61	20·00	22·56	1·18	1·33	1·84	2·08
Parings Poonac (1)	Nattandiya	9·06	9·18	10·10	3.03	3·33	18·94	20·81	1·24	1·37	0·84	0·93
Parings Poonac (2)	Haldanduwana	12·12	7·64	8·69	3·38	3·84	21·12	24·00	1·30	1·48	0·70	0·79

(*b*) Oil-free extracted samples

Morlac	B. C. C.	0·72	—	—	3·54	3·57	22·12	22·31	1·38	1·40	2·38	2·40
X'tralac	B. C. C.	2·03	—	—	3·62	3·68	22·62	23·00	1·34	1·37	2·46	2·51
Sediment Poonac	Marawila	8·26	—	—	5·61	6·12	35·06	38·25	2·39	2·60	0·84	0·92
Expeller Poonac	Haldanduwana	7·46	—	—	2·50	2·70	15·62	16·88	1·28	1·38	1·76	1·90
Chekku Poonac	Hybrid Palm	3·84	—	—	2·50	2·60	15·62	16·25	0·86	0·90	2·00	2·08
DCN Poonac (flour)	C. R. I.	7·38	—	—	3·22	3·48	20·12	21·75	1·26	1·36	2·50	2·70
Hydraulic Poonac	Nattandiya	0·44	—	—	3·96	3·98	24·75	24·88	1·46	1·47	2·28	2·29
Parings Poonac (1)	Nattandiya	0·82	—	—	3·66	3·70	22·88	23·12	1·51	1·52	1·02	1·03
Parings Poonac (2)	Haldanduwana	2·10	—	—	4·12	4·21	25·75	26·31	1·59	1·62	0·85	0·87

Notes.—(1) *X'tralac* is solvent extracted copra meal.

(2) *Morlac* is solvent extracted copra meal carefully blended with B. C. C. poonac.

(3) *Sediment Poonac* unpressed samples collected from oil-filter pads.

(4) *N. P. K.* analyses were done on the oil-free meals and calculated back to the originals in each case.

EXAMINATION OF COPRA FROM HYBRID PALMS

Nineteen copra samples from individual hybrid palms sent by the Botanist were examined during the year. The analytical data obtained are shown in Table VI below.

TABLE VI

Analytical Data on Hybrid Palm Copra

Palm No.	*No. of Halves*	*Weight of Copra (Grams)*	*Per cent. Moisture*	*Per cent. Oil*	
				Wet basis	*Dry basis*
11	33	3535	6·29	64·25	68·56
13	30	3895	7·84	62·32	67·62
85	34	3965	7·19	63·58	68·50
86	14	1493	7·04	63·45	68·26
113	28	3617	7·31	63·35	68·35
148	27	3142	6·03	64·77	68·93
151	36	3860	6·82	63·54	68·20
154	12	1365	6·87	62·17	66·75
184	30	3793	6·78	64·56	69·26
185	11	1475	7·21	63·27	68·19
196	18	2041	7·30	63·84	68·87
197	27	3122	7·14	63·61	68·50
198	30	3945	6·89	63·98	68·71
221	30	3440	7·29	64·97	70·07
240	21	2415	6·97	63·26	67·99
264	30	3560	8·24	63·63	69·35
277	10	1415	6·28	63·06	67·29
288	24	3175	5·84	63·78	67·74
290	50	5184	7·22	62·93	67·83
Average (19 samples)	26	3077	6·98	63·60	68·37
Range	10 to 50	1365 to 5184	5·84 to 8·24	62·17 to 64·97	66·75 to 70·07

Based on a large number of analyses carried out at the Coconut Research Institute, the overall average oil content (dry basis) of Ceylon Estate Copra, No. 1, is reckoned to be 68·3 per cent. It will be seen that the corresponding figure for the 19 samples of Hybrid Palm copra examined is 68·37, the values ranging between 66·75 and 70·07. The oil content of the samples may therefore be regarded as normal.

COIR DUST AS MULCH

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

TABLE VII

(Immature Nut-fall recorded during 1954)

Quarter	*Size*	*Coir Plot*	*Control Plot*	*Overgrazed Plot*	*Rainfall (inches)*
First	Large	20	17	51	
	Medium	19	22	40	19·72
	Small	45	57	53	
	Total First Quarter	84	96	144	
Second	Large	27	13	28	
	Medium	21	15	30	27·19
	Small	103	100	243	
	Total Second Quarter	151	128	301	
Third	Large	18	14	24	
	Medium	28	20	28	13·32
	Small	67	80	112	
	Total Third Quarter	113	114	164	
Fourth	Large	35	16	19	
	Medium	19	18	14	33·47
	Small	62	51	64	
	Total Fourth Quarter	116	85	97	
Total for the year	Large	100	60	122	
	Medium	87	75	112	93·70
	Small	277	288	472	
	General Total, 1954	464	423	706	

The general annual immature nut-fall totals for the three plots since the commencement of the experiment are as follows :—

Year	*Coir Plot*	*Control Plot*	*Overgrazed Plot*	*Rainfall (inches)*
1951	976	931	919	94·09
1952	719	605	472	62·40
1953	578	536	670	88·30
1954	464	423	706	93·70
Decrease in 4 years	52·5%	54·6%	23·2%	

All three plots show a decrease in nut-fall over the 4 year period. As the decrease is highest in the control plot it cannot be stated that the coir mulch by itself had any favourable effects in checking immature nut-fall.

MISCELLANEOUS WORK

(*a*) This included analyses and reports on various samples of copra, poonac and coconut oil sent mostly by mill owners seeking advice.

(*b*) A sample of toddy contaminated with rain water sent by a vinegar maker was analysed and reported on.

W. R. N. NATHANAEL,
Chemist.

REPORT OF THE ANIMAL HUSBANDRY OFFICER

The amendments to the Food Production on Estates Ordinance now provide for exemption from penalty to those coconut estates where dairy cattle are kept. It has been proved conclusively at Bandirippuwa Research Station that, in the wet zone (rainfall 70 in.) milk can be produced at a profit from ordinary Sinhala village cattle, provided they are improved by selection, good feeding and proper care and attention. The mixed rough pastures of grass and legumes under the coconuts must not be over-grazed and the cattle require 3 lb. of extracted poonac per day as concentrate. It has been found that pastures can be maintained without deterioration if there is rotational grazing and a total cattle population of 1 animal to 2 acres is not exceeded.

The black herd of indigenous (Sinhala) dairy cattle at Bandiruppuwa and the red herd at Ratmalagara are being steadily improved by selective breeding and good management. The present herd strength is as follows :—

Bandirippuwa		*Ratmalagara*	
Adult cows ..	.. 25	Adult cows ..	.. 15
Stud bulls ..	.. 2	Stud bulls ..	.. 1
Heifers ..	.. 16	Heifers ..	.. 10
Bull calves ..	.. 10	Bull calves ..	.. 3
	53		29

The red herd at Ratmalagara Research Station is being built up for the purpose of studying the correct conditions for the maintenance of dairy cattle in the semi-dry zone, where it is more difficult to maintain pastures under coconut during long periods of drought. Both herds are being continuously recorded.

New grasses and legumes are under trial to test their resistance to drought and their palatability. The following were obtained from the Commonwealth Scientific and Industrial Research Organisation in Australia : *Stylosanthes bojeri, Stylosanthes sundaica, Brachiaria lata* and other *Brachiaria* species. Of these *Stylosanthes bojeri* alone gave promising results. Signal grass, *Bracharia brizantha* obtained from the Government Farm, Polonnaruwa, has established itself well under the conditions obtaining at Bandirippuwa. This drought-resisting grass is palatable and is being multiplied for further trials under coconuts at Ratmalagara Research Station and elsewhere in the semi-dry zone. A nursery of elephant or Napier grass, *Pennisetum purpurem* has been established on land immediately below the cattle sheds, where it is manured by the wash waters from above. This is intended to provide fodder during periods of drought, when the ordinary pastures dry up. 18,000 cuttings of this fodder grass have been supplied free to coconut estates.

A 12 months feeding trial with adult pasture-fed cattle was carried out during the year. The summarised results are as follows :—

	With poonac	*Without poonac*
Average milk yield per animal per lactation period	1,024 pints ..	616 pints
Average weight of animals	455 lb. ..	365 lb.
Average lactation period	9½ months ..	8 months

Thus cattle fed on poonac in addition to pasture grass, yielded more milk, weighed more, had a longer lactation period and in addition had less physiological disturbances. There have been no casualties or sickness in the herd, during the year under review.

Sixteen heifer calves are being specially fed on the following test feeds starting in September, 1954 :—

(*a*) Pasture grass, " Morlac " plus " Churn " minerals.
(*b*) Pasture grass " Xtralac " plus " Churn " minerals.
(*c*) Pasture grass, Parings poonac, plus " Churn " minerals.
(*d*) Pasture grass plus " Churn " minerals only.

Note.—" Morlac " and " Xtralac " are solvent-extracted poonac, in which the oil content is approximately 2 per cent. and 1 per cent. respectively.

The object of this is to give these young animals a good start in life in order to improve the standard of Sinhala cattle in succeeding generations.

Pigs and poultry are being used for manurial purposes by being kept in portable pens which are moved from square to square at 7 day and 3 day intervals respectively and records of the coconut crops are also being maintained The crops have improved the pigs are in excellent condition but owing to the present unsatisfactory system of marketing eggs in bulk without grading, the poultry section continued to operate at a loss. Beehives are also being maintained in the Botanist's mother palm block to improve the setting of female flowers.

D. C. ELLEWELA,
Animal Husbandry Assistant.

ANNUAL REPORT OF THE PLANTING OFFICER

Nurseries.—Thirteen nurseries were maintained during the year :—

Name of Nursery	*Capacity*	
Ratmalagara	145,880	
Carmel	45,000	
Walpita	60,000	
St. Anne's	31,800	
Labuduwa	28,350	
Hettipola	60,000	
Veyangoda	10,000	
Dunagaha	30,000	
Killinochchi	40,000	
Kalawewa	72,500	
Dematawala	120,000	
Wilpotha	169,370	
Wennappuwa	30,000 ..	843,000 nuts.

843,000 seed-nuts were planted in nurseries and 30,600 nuts have been supplied on orders.

The capacities of the existing nurseries were expanded this year to accommodate extra seed-nuts. As the existing nursery at Kurunegala could not be expanded, a 10-acre block of crown land was obtained at Karawaddena for a new nursery. Clearing of this land was started in December, 1954. A new nursery was also established at Wennappuwa on a piece of land obtained from the Wennappuwa Coconut Producers Co-operative Society.

Seedlings.—With the reduction in the price of seedlings, the demand far exceeded the supply and all seedlings produced at our nurseries were booked in advance and disposed of in time.

Advisory Work.—The 7 Advisory Field Officers are carrying out a planned programme of work in their respective ranges. Field Demonstrations and Propaganda Shows are held at intervals at various centres and the support received is very encouraging.

The present Advisory Staff is insufficient to provide a satisfactory Advisory Service and provision is now being made to increase the staff to 20 Officers in the near future.

Expenditure.—The following is a detailed statement of expenditure for the financial year 1953–54 :—

	Rs.	*c.*
Officers	9,564	97
Travelling	27,946	47
Transport	18,451	43
Vehicles	109, 58	74
General Stores	9,071	78
Incidental	2,494	94
Salaries	69,892	57
Buildings	17,421	84
Buildings	825	22
Nurseries	75,759	65
Seed-nuts	183,975	14
Propaganda	3,245	46
Provident Fund & M. Aid	11,812	41
	441,420	62

P. D. L. FERNANDO,
Planting Officer.

ACCOUNTS OF THE COCONUT RESEARCH INSTITUTE FOR THE YEAR ENDED DECEMBER 31, 1954

My No. P–2 (3)/13.

The Chairman,
Coconut Research Institute,
Peradeniya.

The accounts of the Coconut Research Institute for the year 1954, were audited under my direction and the Balance Sheet as at December 31, 1954, is forwarded herewith duly certified together with the following statements :—

(i) Revenue Account,
(ii) Statements of the Working Accounts of :
  (*a*) Bandirippuwa Estate
  (*b*) Ratmalagara Estate
  (*c*) Nursery
  (*d*) Planting Division
  (*e*) Animal Husbandry Division, and
(iii) Capital Expenditure account.

Revenue Account

2. (*a*) *Cess Collection—Rs. 983,269·97.*—The Cess Revenue for the year under review was Rs. 983,269·97, as compared with Rs. 333,415·09 for the previous year. The increase of Rs. 649,854·88 was due to the increase in the rate of cess from April, 1954, which was as follows :—

	1953	*1954*
Desiccated coconuts ..	8¾ cents per cwt. ..	35 cents per cwt.
Fresh coconuts ..	25 cents per 1,000 ..	1·00 per 1,000
Coconut oil ..	9⅜ cents per cwt. ..	37½ cents per cwt.
Copra	6¾ cents per cwt. ..	25 cents per cwt.

Estate Working Accounts

(*b*) *Profits from Estates—Bandirippuwa—Rs. 50,695·46 ; Ratmalagara—Rs. 46,934·03 ; Rubber Seed Garden, Ratmalagara Estate, Rs. 480·55.*—The working accounts of the Estates show a profit of Rs. 98,110·04 as compared with the profit of Rs. 108,082·07 for the previous year. The decrease of Rs. 9,972·03 was mainly due to the fall in the average selling price of coconuts from Rs. 181 per 1,000 in 1953 to Rs. 142 per 1, 000 in 1954.

The sum of Rs. 215·93 shown as income from sale of food crops in Ratmalagara Estate was derived from food crops planted for research work in the Estate. As the work in Bandirippuwa and Ratmalagara Estates is confined to research these Estates are exempted from the provisions of the Food Production (Estates) Ordinance, No. 2 of 1943.

(c) *Nursery—Rs. 2,588·80.*—The profit of Rs. 2,588·80 derived from the nursery in 1954 shows a drop from the profits for the previous year which amounted to Rs. 6,741·75. This fall in profits was due to fewer seed nuts purchased and sold in 1954, i.e., 32,910 seed nuts as compared with 65,050 seed nuts in 1953.

(d) *Planting Division Working Account, Rs. 444,720·72.*—This is an activity which had, up to September 30, 1954, been carried out by the Coconut Research Board as an agent for and on behalf of the Director of Agriculture, out of Funds provided by him. Under this arrangement the Board ran nurseries for the purpose of raising seedlings, &c., for replanting Schemes, and furnished accounts to the Director of Agriculture quarterly for reimbursement of expenses incurred. These accounts were, accordingly, not incorporated in the Accounts of the Coconut Research Institute. With effect from October 1, 1954, however, in terms of a decision of the Ministry of Agriculture and Food, the funds for carrying on this activity were provided by way of a grant to the Institute. In making this decision the Ministry has stated that " most of the capital expenditure would be found from the money now accruing to the Institute under the increased cess as the buildings and land would, after the replanting and new planting programme is over, be utilized for research work. " Accordingly, the grant of Rs. 500,000 provided in the Estimates of the Department of Agriculture for 1954/55 was paid to the Institute.

In the annual statement of accounts of the Institute for 1954 a separate account entitled " Planting Division Working Accounts " has been furnished showing the grant of Rs. 500,000 and the expenses incurred therefrom and crediting to it the proceeds of sale of seedlings, resulting in a credit balance of Rs. 444,720·72 as at December 31, 1954, which has been transferred to the Revenue Account of the Institute for the year 1954, as one of the items of the Institute's Revenue. In view of the fact that this was a grant received for a specific purpose the unspent balance of Rs. 444,720·72 cannot rightly be regarded as revenue accruing to the Institute.

Moreover, as the grant in question does not fall within the sources of income of the Board as specified in Section 6 (1) of the Coconut Research Ordinance, No. 29 of 1928, it is not proper to include the unexpended balance of such grant as income of the Institute.

It is noted that as regards Capital expenditure, the sum of Rs. 1,135·55 incurred during the period October 1 to December 31, 1954, has been met from the gross proceeds of sale of seedlings in crediting the net proceeds to the " Planting Division Account. "

The Assets acquired by the Coconut Research Institute out of the funds provided by the Director of Agriculture up to September 30, 1954, for the Planting Division have not been included in the Accounts of the Institute for the year ended December 31, 1954.

Seedlings from these Nurseries were sold at 30 cents each when the cost of production amounted to 70 cents each.

(e) *Animal Husbandry—Loss Rs. 2,781·09.*—The loss in this division was Rs. 2,781·09 compared to the loss of Rs. 3,242·41 in the previous year. Losses are to be expected in this division as it is primarily maintained for research purposes and the produce, e.g., milk, is sold to the staff at a nominal rate of 25 cents per pint.

(*f*) *Books and Periodicals—Rs. 6,657·90.*—The expenditure on books and periodicals for the Board's Library during the year amounted to Rs. 6,657·90. A proper system of recording the issues and receipt of books did not exist during the year 1954 nor was an annual survey of books held at the end of the year. These defects have already been pointed out in para 2 (*e*) of the Audit Report dated March 16, 1955, on the accounts for 1953.

Balance Sheet

LIABILITIES

3. *Capital outlay: Rs. 1,274,927·28.*—The Capital Assets shown in the Balance Sheet amount to Rs. 1,273,494·37, as compared with a capital outlay of Rs. 1,274,927·28. 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 necessary adjustment of the Capital outlay Account has not been effected although this was suggested in the Audit Report on the accounts for 1953.

4. *Provident Fund: Rs. 280,041·61.*—It is desirable that a working account of this Fund for each year should be prepared and rendered along with the Annual Accounts.

5. *Medical Aid Fund: Rs.4,484·77.*—This Fund was created in 1954, with the object of providing for "Medical, surgical, midwifery, opthalmic and dental charges incurred by members of the Fund, their wives and children." The membership is confined to the Board's staff and the minimum contribution by each member is Re. 1 p.m. The Board pays to the Fund an amount equal to that contributed by each member monthly. There does not appear to be any provision in the Coconut Research Ordinance as amended up to date for the creation of this Fund. In regard to this Fund it is desirable that Working account for each year should be prepared and rendered along with the Annual Accounts.

6. *Research Reserve Fund: Rs. 365,000.*—This Fund, it has been explained, was created by the Board to "meet heavy Capital Expenditure on Land, Buildings and Equipment as the work develops."

ASSETS

7. *Co-operative Nurseries: Rs. 35,093·67.*—This expenditure had been incurred in previous years in opening nurseries for various Co-operative Producers' Societies without involving any permanent improvements of a capital nature accruing to the benefit of the Institute. It would, therefore, not be correct to show this as an asset in the Balance Sheet.

8. *Sundry Debtors—over-payment, Planting Division Imprest: Rs. 33,635·62.*—On December 31, 1953, the Coconut Research Institute, owed Rs. 98,584·12 to the Planting Division, which was then financed by the Director of Agriculture. During 1954 the Institute paid the Planting Division a sum of Rs. 132,219·74 as an advance to purchase seed nuts for supply during May/June. 1955. The balance that was due to the Institute from the Planting Division on December 31, 1954, was therefore Rs. 33,635·62.

9. *Investments: Rs. 1,566,378·91.*—Two investments in Savings Certificates hav been shown at the surrender values of Rs. 18,030 and Rs. 9,736 on Decembe 31, 1954. The Bank of Ceylon, Negombo Fixed Deposit Account—Rs. 550,452·05

includes interest accrued at 1¼ per cent. per annum up to December 31, 1954. All other investments have been shown at cost. The middle market values of the investments as at December 31, 1954, are as follows :—

Investments	*Face Value*	*Market Rate*	*Market Value*
	Rs. c.		*Rs. c.*
Government National Defence Loan, 1962–67 ..	375,000 0	88 13/16	333,046 88
Government Loan, 1966–71	150,000 0	94½	141,750 0
Sri Lanka Government Loan, 1969–74 ..	2,000 0	93 5/16	1,863 50
Government Defence Loan	5,000 0	101	5,050 0
State Mortgage Bank Debentures ..	5,000 0	48½	4,850 0
National Housing Debentures, 1969–71 ..	450,000 0	100	450,000 0
Savings Certificates	20,000 0	—	18,030 0
Savings Certificates	12,000 0		9,736 0
Fixed Deposits (Negombo Bank) ..	550,000 0		550,000 0
On Deposit account			
Ceylon Savings Bank	686 19		686 19
P. O. Savings Bank	474 67		474 67
	1,570,160 86		1,515,487 24

It is desirable to indicate in the Balance Sheet the basis of valuation of the investments shown therein and also to show the face value of the holdings and their middle market value by means of a footnote to the Balance Sheet.

GENERAL

10. *Unauthorised Expenditure.*—The expenditure exceeded the sanctioned Estimates in respect of several items as indicated in the Statement annexed. The excesses were, however, subsequently approved by the Board. It should 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.

11. *Delay in Rendering of Accounts 1954.*—The annual statements of Accounts of the Institute for 1954 were received in Audit only on October 6, 1955. Hence the delay in furnishing this report. The early rendering of Annual Balance Sheet and Accounts for Audit should receive the attention of the Board.

12. *Form of Balance Sheet.*—The Balance Sheet as drawn up at present contains numerous unimportant details without any effort at grouping the items so as to render it more intelligible. It is suggested that the desirability of drawing up a simplified Balance Sheet showing the items, classified under significant groups such as " Fixed Assets " " Current Assets " and " Investments " on one side, and on the other side " Capital ", " Reserves " and " Current Provisions and Liabilities " might receive the attention of the Board.

Audit Office,
Colombo 7, February 20, 1956.

D. S. DE SILVA,
Acting Auditor-General.

Statement of Excess Expenditure

Item	Estimate	Supplementary Provision	Total Provision	Expenditure	Excess Expenditure
1. *Personal Emoluments*					
(1) Coconut allowance to staff	— ..	— ..	— ..	1,961 69..	1,961 69
(2) Coconut allowance to P. D. staff	— ..	— ..	— ..	13 65..	13 65
(3) Maternity Benefits P. D.	— ..	— ..	— ..	84 0..	84 0
2. *Other Charges*					
Travelling Board Members ..	4,500 0..	— ..	4,500 0..	5,656 50..	1,156 50
3. *Office*					
(1) Stationery ..	4,100 0..	600 0..	4,700 0..	5,062 80..	362 80
(2) Entertainment allowance	250 0..	25 0..	275 0..	394 55..	119 55
(3) Workmen's Compensation Insurance ..	800 0..	— ..	800 0..	1,367 33..	567 33
4. *Buildings and Machinery* ..	11,700 0..	577 0..	12,277 0..	12,410 36..	133 36
5. *Laboratory and Library*					
(1) Books and Periodicals ..	5,000 0..	1,000 0..	6,000 0..	6,657 90..	657 90
(2) P. D. Books and Periodicals	— ..	— ..	— ..	9 65..	9 65
(3) Laboratory upkeep ..	14,200 0..	2,400 0..	16,600 0..	24,293 26..	7,693 26
6. *Research (Field)*					
Research Chemist ..	2,000 0..	— ..	2,000 0..	2,546 51..	546 51
7. *Reserve Fund*					
Overseas training of Staff ..	500 0..	— ..	500 0..	862 45..	362 4
8. *Bandirippuwa*					
Coconut Replanting Block ..	800 0..	200 0..	1,000 0..	1,275 99..	275 99
9. *Ratmalagara*	6,625 0..	— ..	6,625 0..	8,170 11..	1,545 11

COCONUT RESEARCH INSTITUTE OF CEYLON

(Balance Sheet as at December 31, 1954)

LIABILITIES	Rs. c.	Rs. c.	ASSETS	Rs. c.	Rs. c.
1. *Capital Outlay :*			1. *Buildings* as at December 31, 1953 ..	378,793 68	
As at December 31, 1953	1,167,938 53		In 1954	32,587 19	
In 1954	106,988 75				411,380 87
		1,274,927 28	2. *Estates :*		
2. *Provident Fund :*			Bandirippuwa	187,554 68	
Cont. and Int. at December 31, 1953 ..	107,727 25		Ratmalagara	78,138 0	
Rs. c.					260,692 68
In 1954 .. 33,761 66			3. *Improvements to Estates :*		
Less refunds in 1954 .. 1,302 93			Previously .. Rs. c.	67,220 2	
	32,458 73		In 1954 : Bandirippuwa .. 3,025 19		
		140,185 98	Ratmalagara .. 8,170 11		
Bonus and Interest at December 31, 1953 ..	107,938 0			11,195 30	
In 1954 .. 33,150 58					78,415 32
Less refunds in 1954 .. 1,232 95			4. *Animal Husbandry Division :*		
	31,917 63		Previously	7,783 57	
		139,855 63	In 1954	—	
3. *Medical Aid Fund :*					7,783 57
Conr. as at December 31, 1953 ..	—		5. *Estate Kiln :*		
In 1954 .. 2,777 50			Previously	15,604 96	
Less refunds in 1954 .. 531 16			In 1954	—	
2,246 34					15,604 96
Less ref. transfer to "S/Crs" (1954) 4 0			6. *Laboratory Equipment :*		
	2,242 34		Previously	109,530 91	
		2,242 34	In 1954	39,192 42	
Boards Con. as at December 31, 1953 ..	—				148,723 33
In 1954 .. 2,777 50			7. *Laboratory Buildings :*		
Less refunds in 1954 .. 525 7			Previously	152,485 22	
2,252 43			In 1954	—	
Less transfer to M/A Fund Reserve (1954) .. 10 0					152,485 22
	2,242 43		8. *Gas Plant :*		
		2,242 43	Previously	7,282 64	
4. *Reserve Funds :*			In 1954	939 13	
Depr. as at December 31, 1953 ..	165,424 58				8,221 77
In 1954	10,181 23		9. *Furniture*		
		175,605 81	Bungalows—Previously ..	31,376 57	
Passage as at December 31, 1953 ..	4,000 0		In 1954	1,841 80	
In 1954	2,000 0				33,218 37
		6,000 0	Office—Previously	10,457 15	
Reserach as at December 31, 1953 ..	50,000 0		In 1954	4,110 0	
In 1954	315,000 0				14,567 15
		365,000 0	10. *Power Plant :*		
Medical Aid F. res. at December 31, 1953 ..	—		Previously	86,908 35	
In 1954	10 0		In 1954	742 98	
		10 0			87,651 33

LIABILITIES					ASSETS				
	Rs.	c.	Rs.	c.		Rs.	c.	Rs.	c.
5. *Sundry Creditors :*					11. *Museum :*				
Security of Officers	2,300	0			Previously	3,276	20		
Lab. Equipment	10,757	36			In 1954	—			
Sundries (1954) P. Div.	201	96						3,276	20
Laboratory upkeep	4,172	69			12. *Co-op. Nurseries :*				
Sundries (1954)	16,189	42			Previously	35,093	67		
			33,621	43	In 1954	—			
6. *Surplus Account :*								35,093	67
Excess of income over expenditure as per Rev. account, 1954	744,160	9			13. *Vehicles :*				
	Rs.	c.			Previously	—			
Surplus in 1953 B. S. ..	369,837	48			In 1954	13,219	88		
Add Revenue adjustments 1951, 1952 and 1953 ..	3,754	53						13,219	88
	373,592	1			14. *Machinery :*				
			1,117,752	10	Previously	—			
					In 1954	3,160	5		
								3,160	5
					15. *Sundry Debtors :*				
					Nursery W/ account (sale of seedlings B/E)	171	0		
					Nursery W/ account (Rej. seedling Copra R/E)	540	7		
					B/E working account	10,895	40		
					R/E working account	11,369	35		
					A/H. O. working account ..	1,289	46		
					Accrued interest	2,146	56		
					Ceylon Coconut Quarterly ..	1,040	0		
					Sundries	136	20		
					Rubber seed garden B/E	58	49		
					Telephone rentals	25	0		
					General stores advance	22	74		
					B/E Fertiliser advance	18	18		
					Electricity charges to staff ..	112	0		
					Cess collections	74,397	61		
					Sundry receipts	10	20		
					Board members travelling ..	10	0		
					B/E Bungalows, 1955	3,957	47		
					Scientific books and periodic. ..	2	50		
					Interest on transport loans ..	0	2		
					Director of Agriculture :	Rs.	c.		
					Overpayment P. D. Imp. 1954	132,219	74		
					Less due 1953 ..	98,584	12		
								33,635	62
					P. D Nur. W/ account Sale of seedlings ..			48,684	78
					P. D. Attendant's bungalow ..			1,499	88
								189,922	53

LIABILITIES	Rs. c.	ASSETS	Rs. c.	Rs. c.
		16. *Advance accounts :*		
		Transport loans to staff	50,892 92	
		General stores	5,247 2	
		Travelling	547 2	
		Furniture	2,040 86	
		Fertilizers, 1954	724 21	
				59,452 3
		17. *Investments :*		
		Ceylon Government 2¼ per cent. Development Loan, 1962–67	375,000 0	
		Ceylon Government 3 per cent. Loan, 1966–71	150,000 0	
		Sri Lanka Government 3 per cent. Loan (1969–1974)	2,000 0	
		Ceylon Government 3 per cent. Defence Loan	5,000 0	
		Ceylon State Mortgage Bank 3 per cent. debent.	5,000 0	
		5 Year Savings Certificate (3rd series) ..	18,030 0	
		12 Year Savings Certificate ...	9,736 0	
		National Housing 3½ per cent. (Deb.) 1969–1971	450,000 0	
		Bank of Ceylon (Ng.) 1¼ per cent. F. Deposit	550,452 5	
		Ceylon Savings Bank	686 19	
		P. O. Savings Bank	474 67	
				1,566,378 91
		18. *Cash Balance as at December 31, 1954 :*		
		Bank of Ceylon (No. 1) account ..	98,361 17	
		Bank of Ceylon (Ng.) No. 2 account ..	10,000 0	
		National Bank of India, Ltd. ..	21,616 20	
		Bank of Ceylon Imprest account ..	20,000 0	
		Cash in hand	18,217 79	
				168,195 16
	3,257,443 0			3,257,443 0

Certified correct.

S. C. KAHAWITA,
Secretary/Accountant,
Coconut Research Institute of Ceylon.

Lunuwila, September 30, 1955.

The accounts of the Coconut Research Institute for the year ended December 31, 1954, have been audited under my direction. Subject to observations contained in my report No. P—2 (3) 13 dated February 20, 1956, made to the Chairman, Board of Management of the Coconut Research Institute, as a result of this audit, I am of opinion that the Balance Sheet and Financial Statements above set forth have been drawn up so as to present fairly the financial position of the Institute as at December 31, 1954, and the results of its operations for the year ended on that date.

Audit Office,
Colombo 7, February 20, 1956.

Acting Auditor-General.

Revenue Account (1954)

EXPENDITURE

	Rs. c.	Rs. c.
1. *Personal Emoluments :*		
C. R. I.—		
Salaries	148,959 12	
Dearness allowance	71,208 31	
Rent allowance	5,286 43	
Provident Fund bonus and interest ..	31,229 77	
Coconut allowance	1,961 69	
Recreation	500 0	
Medical Aid Board's contribution ..	2,228 50	
		261,373 82
2. *Other Charges :*		
C. R. I.—		
Board Members' Travelling	5,656 50	
Staff travelling	16,914 48	
		22,570 98
3. *Office :*		
C. R. I.—		
Stationery	5,062 80	
Postages	1,554 47	
Printing and advertising	1,358 38	
Incidental expenses	640 79	
Telephone rental	590 0	
Entertainment allowance	394 55	
Maintenance of office equipment ..	288 98	
Workmen's Compensation Insurance ..	1,367 33	
Cost of Audit	2,000 0	
		13,257 30
4. *Buildings and Machinery :*		
Upkeep	16,471 8	
Insurances	2,822 20	
Running expenses of E. Plant ..	12,410 36	
Tractor up-keep	2,283 50	
		33,987 14
5. *Laboratory and Library :*		
Books and periodicals	6,657 90	
Laboratory upkeep	24,293 26	
		30,951 16

REVENUE

	Rs. c.	Rs. c.
1. *Government Grant :*		
Annual grant under 6 (1) (*b*) of Ordinance ..	30,000 0	
		30,000 0
2. Cess collections		983,269 97
3. Interest on investments		17,719 61
4. Sale of publication		174 83
5. Charges to staff for Electricity		1,648 50
6. Sundry receipts		1,520 18
7. Ceylon Coconut Quarterly		1,753 62
8. *Working Accounts : Surplus :*		
	Rs. c.	
Bandirippuwa Estate ..	50,695 46	
Ratmalagara Estate ..	46,934 3	
Rubber seed garden R/E ..	480 55	
Nursery	2,588 80	
Planting division ..	444,720 72	
	545,419 56	
Less Losses :		
Animal Husbandry Division ..	2,781 9	
		542,638 47

EXPENDITURE			REVENUE	
	Rs. c.	Rs. c.		Rs. c.
6. *Research* (Field) :				
Research—Chemist	2,546 51			
Research—Botanist	20,597 78			
Research—S/Chemist	7,933 47			
Research A. H. O.—Pas. Expt. ..	8,727 82			
		39,805 58		
7. *Reserve Funds :*				
Depreciation	8,903 46			
Passage	2,000 0			
Research	315,000 0			
Overseas Training of Staff	862 45			
		326,765 91		
8. *Capital Expenditure*		105,853 20		
9. *Excess Revenue over Expenditure transferred to Balance Sheet :*				
C. R. I.	299,439 37			
Planting Division W/account ..	444,720 72			
		744,160 9		
		1,578,725 18		1,578,725 18

Bandirippuwa Estate Working Account (1954)

EXPENDITURE			INCOME		
	Rs. c.	Rs. c.		Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
General charges	13,796 49		By Sale of Nuts	19,547 30	
Upkeep	5,582 67		Sale of Nuts (P. D.)	13 65	
Collection	4,966 48		Sale of Copra	43,378 88	
Cultivation	3,361 7		Sale of Husks and Sundries ..	972 55	
		27,706 71	Sale of Shells	122 0	
					64,034 38
2. *Depreciation :*			2. *Research Area :*		
Kiln	186 80		By Sale of Nuts	165 83	
Animals	45 35		Sale of Copra	14,423 76	
		232 15	Sale of Sundries	10 35	
3. Revenue account (transferred) ..	..	50,695 46			14,599 94
		78,634 32			78,634 32

Ratmalagara Estate Working Account 1954

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Estate :*			1. *Estate Area :*		
General charges	10,988 18		By Sale of Nuts	13,224 93	
Upkeep	3.144 32		Sale of Copra	37,030 95	
Collection	3,813 44		Sale of Sundries	743 40	
Cultivation	4,809 6		Sale of Shells	45 0	
		22,755 0			51,044 28
2. *Food Crops :*			2. *Research Area :*		
Expenditure	157 8		By Sale of Copra	19,266 34	
		157 8			19,266 34
3. *Depreciation :*			3. *Food Crops :*		
Kiln	627 94		By Sale	215 93	
Animals	52 50				215 93
		680 44			
4. Revenue Account (transferred)		47,414 58	4. *Rubber Seed Garden*	480 55	
					480 55
		71,007 10			71,007 10

Nursery Working Account (1954)

EXPENDITURE	Rs. c.	Rs. c.	INCOME	Rs. c.	Rs. c.
1. *Labour :*			1. *Sale of Seed-Material :*		
Cost of Checkroll wages, &c. ..	47 70		Seedlings	710 20	
		47 70	Seed-nuts	5,911 75	
2. Cost of seed-nuts		5,871 25			6,621 95
3. Revenue Account		2,588 80	2. *Other Income :*		
			Sale of rejected seedlings—		
			Copra	765 99	
			Less. Cess and Brokerage	10 82	
					755 17
			3. *Selection and Transport :*		
			Selection and Transport charges ..	1,196 50	
			Less expenses	65 87	
					1,130 63
		8,507 75			8,507 75

Planting Division Working Accounts

	Rs. c.	Rs. c.
1. Cost of Seed-Materials	58,516 70	
2. Maintenance of Nurseries	24,884 71	
3. Selection and Transport	7,991 92	
		91,393 33
4. Personal Emoluments	21,178 47	
5. Other Charges, travelling	9,021 1	
6. Office expenditure	1,692 14	
7. Buildings and machinery	1,150 11	
8. Books and periodicals	9 65	
		33,051 38
Excess of revenue over expenditure to Revenue Account		444,720 72
		569,165 43

	Rs. c.	Rs. c.
1. Government Grant		500,000 0
2. *Sale of Seed-Materials :*		
Seedlings	70,300 98	
Less Capital Expenditure	1,135 55	
		69,165 43
		569,165 43

Animal Husbandry Division Working Account (1954)

EXPENDITURE

	Rs. c.	Rs. c.
1. *Cattle :*		
Labour	1,874 76	
Food	2,279 73	
Medicines and Ropes	878 58	
Sheds	251 10	
		5,284 17
2. *Poultry :*		
Labour	960 78	
Food	1,047 85	
Trough	727 3	
		2,735 66
3. *Pigs :*		
Expenditure	645 11	
		645 11
4. *Depreciation :*		
Equipment for cattle	288 56	
Equipment for poultry	76 0	
		365 18
		9,030 12

INCOME

	Rs. c.	Rs. c.
1. *Cattle :*		
By Sale of Milk	4,476 50	
Sale of Butter and Ghee	203 81	
Sale of Animals	451 0	
Sale of Manure and Grass cuttings	110 50	
		5,241 81
2. *Poultry :*		
By Sale of Eggs	678 85	
Sale of Birds	68 37	
		747 22
3. *Pigs :*		
By Sale of Piglings	260 0	
		260 0
4. Revenue Account (transferred)		2,781 9
		9,030 12

Capital Expenditure Account 1954

	Rs. c.	Rs. c.		Rs. c.
A.—*Capital Expenditure on Revenue Account :*			By adjustment revenue account	105,853 20
1. *Laboratory :*				
Equipment	33,209 42			
Furniture and fittings	5,983 0			
House for Gas plant	939 13			
		40,131 55		
2. *Buildings :*				
Junior Staff Bungalows	15,921 49			
Junior Staff Drainage	1,047 30			
Junior Staff Garage	666 22			
General Stores : Buildings ..	14,952 18			
		32,587 19		
3. *Furniture :*				
Bungalows	1,800 30			
Office	4,110 0			
		5,910 30		
4. *Improvement to Estates :*				
Bandirippuwa Estate	3,025 19			
Ratmalagara Estate	8,170 11			
		11,195 30		
5. *Electricity and Water Supply :*				
Tools	742 98			
		742 98		
6. *Machinery and Vehicles :*				
Land Rover	12,416 88			
Tractor	2,869 0			
		15,285 88		
		105,853 20		105,853 20