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COCONUT RESEARCH SCHEME

ANNUAL REPORT OF THE BOARD OF MANAGEMENT FOR THE YEAR 1947

(In terms of Section 8 (2) of the Coconut Research Ordinance (Cap. 303)).

Board of Management

On January 1, 1947, the Board of Management consisted of the following members:—

Chairman: The Director of Agriculture (Mr. L. J. de S. Seneviratne, C.C.S.).
Deputy Financial Secretary: (Mr. H. E. Peries, C.C.S.).
The Chairman of the Low-Country Products Association of Ceylon (Mr. C. A. M. de Silva).

Members of the State Council nominated by His Excellency the Governor	Mr. J. Tyagaraja. Mr. Thomas Amarasuriya.
Representatives of the Low-Country Products Association	Mr. Stanley Dias Mr. Vernon Rajapakse.
Representatives of the Planters' Association of Ceylon	Mr. A. Pearson (on leave). Mr. E. Muttukumaru.
Representing the Small-holders, nominated by His Excellency the Governor	Mr. G. Panditteseker a, J.P., U.M. Mr. D. D. Karunaratne, J.P.

On January 17, the Planters' Association of Ceylon nominated Colonel W. G. Mack, O.B.E., E.D., to act on the Board during Mr. A. Pearson's absence on leave.

Mr. Graham Panditteseker a, J.P., U.M., was re-nominated on February 19, by His Excellency the Governor to represent the Small-holders.

On March 29, Mr. C. A. M. de Silva was re-elected Chairman of the Low-Country Products Association of Ceylon and continued to be an *ex-officio* member of the Board.

Mr. A. Pearson, who was away on 6 months' leave returned to the Island on June 10, and relieved Colonel W. G. Mack, O.B.E., E.D.

Mr. Stanley Dias whose term of office terminated on November 1, was replaced by Mr. C. E. L. de Silva as a representative of the Low-Country Products Association of Ceylon.

The inauguration of the New Constitution of Ceylon led to changes on the Board of Management. On the dissolution of the State Council on July 4, Mr. J. Tyagaraja and Mr. Thomas Amarasuriya ceased to be members of the Board; nominations of members of Parliament to fill the vacancies had not been made by the end of the year.

Mr. T. D. Perera, C.C.S., Deputy Secretary to the Treasury, was nominated by the Hon. the Minister of Finance as an *ex-officio* member of the Board from October 23, replacing the former Deputy Financial Secretary.

Mr. L. J. de S. Seneviratne, C.C.S., Acting Director of Agriculture, and Chairman of the Board from February 12, 1944, took up duties as Permanent Secretary to the Ministry of Education on September 30, 1947. He was succeeded by Mr. D. Rhind, B.Sc., I.A.S., O.B.E.

Seven meetings of the Board (the 84th to the 90th) were held during the year on January 6, March 3, April 28, June 21, August 22, September 22 and December 1.

Personal Notes.—The death on July 17, of Mr. S. F. H. Perera is recorded with regret. Mr. Perera was Chairman of the Low-Country Products Association and an *ex-officio* member of the Board from March 1945 to March 1946.

Mr. D. D. Karunaratne, J.P., was elected on September 23, to the House of Representatives as Member for Gampaha.

Mr. C. A. M. de Silva was on October 23, nominated to the Senate by His Excellency the Governor-General.

Committees

Buildings Sub-Committee.—Personnel at January 1, 1947; Mr. G. Panditteseker a (Chairman), Mr. E. Muttukumaru, Mr. A. Pearson.

At the 84th meeting of the Board, Mr. Vernon Rajapakse was co-opted to the Committee during the absence on leave of Mr. A. Pearson.

Three Meetings of the Committee were held on February 1, May 31, and November 22.

Sub-Committee for Staff Matters.—Personnel at January 1, 1947: Mr. C. A. M. de Silva (Chairman), Mr. G. Panditteseker, Mr. Vernon Rajapakse.

At the meeting of the Committee held on June 27, the Chairman, Board of Management, and the Deputy Financial Secretary were present by special request.

Two meetings of this Committee were held during the year on June 27 and July 26, respectively.

Estates Sub-Committee.—Personnel at January 1, 1947: Mr. A. Pearson (Chairman), Mr. C. A. M. de Silva, Mr. Stanley Dias, Mr. B. Parker (Visiting Agent), the Director, Soil Chemist, and Botanist.

During the absence on leave of Mr. A. Pearson, Mr. C. A. M. de Silva officiated as Chairman.

At the 84th meeting of the Board, Mr. D. D. Karunaratne was appointed to act for Mr. A. Pearson on this Committee and at the 89th meeting Mr. Vernon Rajapakse was also elected a member of the Committee.

At the 90th meeting Mr. C. E. L. de Silva was appointed to the place left vacant by Mr. Stanley Dias on the expiry of the latter's term of office on the Board.

Three meetings were held on January 29, April 16, and August 14.

2. Staff.—

Director and Technological Chemist: Dr. R. Child, B.Sc., Ph.D. (Lond.), F.R.I.C.

Botanist: Vacant

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

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

Research Assistant to Technological Chemist: Mr. W. R. N. Nathanael, B.Sc. (Lond.)

Technical Assistant to Botanist: Mr. D. V. Liyanage.

Technical Assistant to Soil Chemist: Mr. L. A. Fernando.

Senior Mechanic: Mr. R. Werapermall.

The Director was on short leave out of the Island from July 9 to September 5. He attended the Centenary Celebrations of the Chemical Society in London on July 15.

Dr. T. S. Raghavan, M.A., Ph.D. (Lond.), F.L.S., F.A.Sc., took up duties as Botanist on August 7. The work of the Division (formerly designated Geneticist's) was carried on since the resignation of Mr. W. V. D. Pieris in September 1946, by Mr. D. V. Liyanage. Mr. Liyanage passed by private study the external B.Sc. Examination of London University held in July; at the 90th meeting of the Board held on December 1, he was promoted to the post of Research Assistant to the Botanist with effect from January 1, 1948.

At the meeting of the Board held on April 20, Mr. C. W. S. de Silva, Field Assistant to the Botanist, was promoted to Senior Field Assistant with retrospective effect from January 1, 1947.

The following new appointments were made during the year: Mr. R. B. Rodrigo was appointed Senior Field Assistant to the Soil Chemist on September 1. Mr. D. P. Wijesinghe was appointed Field Assistant to the Botanist from May 1.

On January 1, Mr. T. H. S. Perera was appointed Nursery Attendant (Botanist's Division) and Mr. P. M. Tissera, Field Attendant (Soil Chemist's Division).

At the Annual General Meeting of the Ceylon Association of Science held on December 6, 1947, Dr. R. Child was elected a member of the Committee of Section E (Physical Sciences), and Dr. M. L. M. Salgado a member of the Committee of Section B (Agriculture and Forestry).

3. Legislation, &c.—

Particulars of the Memorandum of the Board of Management on the Future of the Coconut Research Scheme have been given in the Annual Reports for 1945 and 1946. In 1946 the Report and Supplement were submitted to Government for consideration.

As a result, the following funds were provided by Government for the Scheme on October 4, 1947:—

	Rs.
(a) Cost of factory	250,000
(b) Laboratory equipment	40,000
(c) Cost of opening Demonstration Centres and Nurseries attached to Co-operative Coconut Producers' Societies	20,000
(d) Cost of accommodation for staff	60,000
(e) Salaries of staff required for supervising the New Scheme ..	150,000
	520,000

4. Summarised Departmental Reports.—

A. *Technological Chemist's Department*

(i) *Coconut Water: (a) Sugars.*—In continuation of work reported last year total reducing sugars—before and after inversion, as well as ketoses, were determined on nuts at all stages of ripeness from a second tall palm and also from a Rath Tembili (King Coconut) palm. The results resemble those already reported and only the figures for the King Coconut palm are given here, the bunches being arranged in order of increasing ripeness.

No. of bunch	No. of nuts on bunch	Volume of water Av. per nut, c.c.	Total solids gms/100 c.c.	Ketoses as fructose gms/100 c.c.	Glucose by difference gms/100 c.c.	Sucrose gms/100 c.c.	Total Sugars gms/100 c.c.	Total Sugars As per cent. total solids	Ash (sulphated) gms/100 c.c.
I ..	10 ..	21..	2·89..	0·74..	0·80..	0..	1·54..	53·3..	—
II ..	7 ..	95..	2·77..	0·83..	0·89..	0..	1·72..	62·1..	0·81
III ..	6 ..	273..	3·06..	1·07..	1·23..	0..	2·30..	75·2..	0·65
IV ..	9 ..	443..	4·05..	1·47..	1·71..	0..	3·18..	78·5..	0·48
V ..	8 ..	478..	5·00..	1·88..	2·13..	0·12..	4·13..	82·6..	0·48
VI ..	2 ..	600..	5·75..	1·89..	2·25..	0·88..	5·02..	87·3..	0·56
VII ..	6 ..	399..	6·01..	1·75..	2·44..	0·81..	5·00..	83·2..	0·49
VIII ..	8 ..	274..	5·05..	1·11..	1·52..	1·16..	3·79..	75·0..	0·60
IX ..	4 ..	305..	4·43..	0·95..	1·31..	0·88..	3·14..	70·9..	0·58
X* ..	5 ..	242..	4·20..	0·54..	0·76..	1·24..	2·54..	60·5..	0·54

* Two ripe bunches were not taken, but reserved for seed.

The results are similar to those reported for a Rath Tembili palm in the Report for 1945 (page 5); the "kurumbas" of bunch VI contained 600 c.c. of water with a content of over an ounce of sugars per fruit.

(b) *Effect of Manuring on Sugars in Nut Water.*—Analyses were carried out on bulked nut water of nuts from each of the first 27 plots of 2nd pick of the N. P. K. Experiment on Bandirippuwa Estate (see this report, section 4 C). The following are the results summarized according to treatments:—

	Reducing Sugars	Sucrose	Total Sugars gms/100 c.c.
K_0 (nine samples) ..	0·38 ..	1·76 ..	2·14
K^1 (nine samples) ..	0·39 ..	1·79 ..	2·18
K^2 (nine samples) ..	0·35 ..	1·67 ..	2·02
N_0 (nine samples) ..	0·39 ..	1·66 ..	2·05
N^1 (nine samples) ..	0·35 ..	1·78 ..	2·13
N_1 (nine samples) ..	0·37 ..	1·78 ..	2·15
P_0 (nine samples) ..	0·36 ..	1·76 ..	2·12
P_1 (nine samples) ..	0·38 ..	1·73 ..	2·11
P_2 (nine samples) ..	0·37 ..	1·73 ..	2·10

The overall averages and ranges were:

Reducing Sugars	0·31–0·43	Average	0·372
Sucrose	1·51–2·07	,,	1·741
Total sugars	1·92–2·50	,,	2·113

There are no great differences between the treatments and it may be provisionally concluded that manuring as carried out in this experiment has not affected the percentage sugar content of the nut water.

(c) *Sugars in Nut Water during germination.*—The studies previously reported on the changes in sugar composition of nut water during ripening, were extended to the subsequent period of germination. 300 ripe nuts were put down in a nursery and 20 removed at fortnightly intervals for examination; after 18 weeks germination was well advanced and the experiment was concluded.

As previously noted (Annual Report 1945, page 5) after the " kurumba " or drinking stage, at which reducing sugars are at a maximum, the percentage of the latter gradually falls as the nut ripens; the percentage of sucrose increases but insufficiently to offset the fall of reducing sugars and so of total sugars. During germination reducing sugars continue to disappear, but are replaced by sucrose, the total sugar concentration remaining fairly constant until about the 14th week, when there is a further drop. Thus in the present experiment.

	Mean Volume water per nut	*Total solids gms/100 c.c.*	*Reducing sugars gms/100 c.c.*	*Sucrose gms/100 c.c.*	*Total sugar gms/100 c.c*
At beginning ..	240 c.c. ..	4·53 ..	0·70 ..	1·28 ..	1·98
After 14 weeks ..	149 ,, ..	4·30 ..	0·17 ..	2·01 ..	2·18

The full results will be reported in detail elsewhere.

(d) *Fermentation of Coconut Water.*—It is not considered that water from ripe coconuts is a possible commercial source of sugar, owing to the low concentration of sugar, the high proportion of non-sugar substances, and the virtual impossibility of collecting the water in an unfermented state. The suggestion was offered by Dr. Underwood, who visited the Scheme on January 6, 1947, that it might be a source of alcohol, comparable with waste sulphite liquors.

With this in mind the course of natural fermentation of coconut water was studied. Alcohol reached a maximum of 0.40 per cent. w/v on the third day, and then decreased owing to acetification. The prospects for production of industrial alcohol from waste coconut water are not regarded as promising. The details of this investigation have been published in *The Tropical Agriculturist (Ceylon)*, 1947, Vol. 103, No. 2, together with other observations on the utilization of coconut water. Reprints are available.

(e) *Conclusion.*—It is not proposed to conduct further work on coconut water for the present. A paper outlining the results since the work was commenced in 1944 was read by Mr. W. R. N. Nathanael, Research Assistant, to the Ceylon Association of Science in December, 1947, and full collected details will be published elsewhere.

(ii) *Sugars in Copra and Desiccated Coconut.*—Three freshly made samples of *desiccated coconut* were examined; after extraction of oil, the resulting flours were extracted with alcohol and reducing and non-reducing sugars estimated. The results, calculated back to the original desiccated coconut, were:

Sample	*I.*	*II.*	*III.*	*Mc Cance and Widdowson**
Moisture per cent. ..	3·4 ..	3·0 ..	4·6 ..	Tr.
Oil per cent. ..	68·8 ..	68·7 ..	67·3 ..	62·0
Ash per cent.	1·79 ..	1·91 ..	1·86 ..	—
Protein (N × 6·25) per cent. ..	6·79 ..	6·68 ..	6·64 ..	6·6
Reducing sugars per cent. ..	none ..	none ..	none ..	
Non-reducing sugars as sucrose per cent.	4·6 ..	6·3 ..	5·5 ..	6·4 (Total sugars as invert sugar)

* " Chemical Composition of Foods ", Medical Research Council, Sp. Report Series, No. 235, 2nd Edition, 1946.

Bolton, " Oils, Fats and Fatty Foods " 1928, p. 166, notes that the average percentage of oil in desiccated coconut is 68 to 72, a range which agrees with our results.

He also states that " 7 per cent. of cane sugar in the desiccated coconut would be a maximum ". The present results confirm this. Commercial samples of processed coconut are marketed in the U. S. A. containing added sugar: thus Jacob, " The Chemistry and Technology of Food Products ", Vol. I, p. 778 (1944), refers to a sample of " moist shredded coconut " containing 17.3 per cent. moisture and 49.6 per cent. of " carbohydrate. "

Copra.—A sample of white copra from the Pearson copra drier was similarly examined and contained Moisture 7.5, Oil 63.3, reducing sugars nil, non-reducing sugars as sucrose 6.58 per cent. Thus in the more prolonged drying to which this copra is subjected as compared with the quick drying of desiccated coconut, there is no loss of sugars by caramelization or other change.

(iii) *Copra from Rejected seedlings.*—From 7,848 rejected seedlings from the 1946 season in the Bandirippuwa nurseries were recovered 3 candies 160 lbs copra. (2,388 seedlings to a candy). Though all of No. 2 and 3 grades, this copra proved to be very rich in oil, containing over 74 per cent. (77 per cent. dry weight). Full details have been published in *The Tropical Agriculturist (Ceylon)* and a Sinhalese reprint issued.

(iv) *Miscellaneous copra and oil samples.*—(*a*) Two samples of white copra from the Pearson copra drier and one of Estate No. 1 copra from Ratmalagara Estate were examined to check the estate curing.

(*b*) Two samples of coconut oil were reported upon from the Director of Commerce and Industries, and one from a private enquirer. These presented no new points of interest. Attention may be directed to the remarks in last year's report on the examination of samples for private enquirers.

(v) *Coconut Shell Products.*—This work has still not reached a stage where final results can be reported. With the conclusion of work on coconut water, it is hoped to give more concentrated attention to the subject in 1948. Time was spent in 1947 on preparative work.

(vi) *Miscellaneous. (Products other than Coconut).*—(*a*) A local sample of Kon oil (*Schleichera oleosa.* syn. *trijuga.*) had iodine value 53.7, saponification value 233.7, and unsaponifiable per cent. 0.8; from it was prepared for exhibition purposes a sample of *n.*—arachidic acid, m.p. 75.6°, equivalent 312.5.

(*b*) *Water samples* from the fields of the Saline Paddy Station, Lunuwila, were examined for chloride content from December 17, 1947, for the Department of Agriculture and these analyses will be continued during 1948 at ten-day intervals.

(*c*) A sample of a proprietary fertiliser mixture was found to be up to guarantee for potash and nitrogen content.

(*d*) *Rubber Seeds and Oil.*—The shortage and high price of drying oils such as linseed led in 1946-7 to interest being renewed in the possibility of the economic utilisation of rubber seed oil. The Scheme co-operated by examining local samples of rubber seed, and by treating samples of kernels for transmission to Prof. T. P. Hilditch, F.R.S., University of Liverpool, who was studying the question on behalf of the Colonial Products Research Council. Biochemical changes in rubber-seed oil cause a large increase in the acidity of the oil; this can be inhibited by a preliminary heat treatment. Kernels dried at 100°C for 20 hours were received in England in good condition and gave oils of satisfactorily low acidity.

So far the large scale application in Ceylon has not been very successful. Two samples of oil prepared by local oil milling firms were unduly acid. For further particulars see the Annual Report of the Rubber Research Scheme (Ceylon) for 1947, and also Colonial Research Reports 1946-47. Comd. 7151, June, 1947, p. 40.

B. *Botanist's Department*

(i) *Bandirippuwa and Ratmalagara Estates.*

(*a*) *Botanist's Block.*—The detailed yield recording of 296 bearing palms in the Botanist's (formerly Geneticist's) block, which was started in 1931, was continued; of these 296 palms, 56 palms have been selected as mother palms. The figures of yield during sixteen years show a fairly uniform performance by individual palms. Those that started as good yielders, have continued to be so throughout this period.

(*b*) The yield recording of other selected palms at Bandirippuwa was continued.

(*c*) *Latin Square Experiment* (*Ratmalagara Estate*).—The annual manuring of palms was completed in December with 1½ lbs of sulphate of ammonia, 1 lb of saphos phosphate and 1½ lbs of muriate of potash. Cultivation was attended to as necessary and the block was maintained in good order. Routine observations on spathe emergence, yield and weight of nuts were kept. By the end of the year, 501 palms out of a total of 576 were in flower. Further details are tabulated below:

A.—Selected seedlings derived from high yielding palms.
B.—Unselected seedlings derived from high yielding palms.
C.—Selected seedlings derived from low yielding palms.
D.—Unselected seedlings derived from low yielding palms.
E.—Selected seedlings derived from nuts of estate heaps.
F.—Unselected seedlings derived from nuts of estate heaps.

	Selected Seedlings				*Unselected Seedlings*			
	A	*C*	*E*	*Total*	*B*	*D*	*E*	*Total*
No. of palms in flower	83	86	88	257	73	89	82	244
No. of nuts picked	1,513	1,340	1,100	3,953	484	1,241	899	2,624

As far as seedling selection is concerned it can be said with some certainty that the selected seedlings are superior to unselected seedlings. In previous reports reference has been made to their ratios of flowering, emergence of spathes and opening of spathes. This year, the eighth year after transplantation, the selected palms have given 1,329 nuts more than the unselected palms, i.e., 50 per cent. more nuts. These data indicate the value of seedling selection, which is often not fully realised.

With regard to the three types of palms in the selected group, the selected high yielders have given 173 nuts more than the selected low yielders and 413 nuts more than the selected seedlings from heap nuts. In 1946, the difference in yield between the selected high yielders and selected low yielders was only 7 in favour of the former, this year the difference has increased to 173. The results must await statistical analysis before any positive statements can be made on the significance of these results.

(*d*) *Dwarf Palms* (*Ratmalagara Estate*).—Ten acres were planted at Ratmalagara Estate during the period 1940-1942. Flowering commenced in late 1943 and by the end of 1947, 725 palms were in flower out of a total of 992. The first harvest was gathered in May 1945 and the subsequent picks and other details are given below:

Period after Transplantation	*Year*	*No. of palms in flower*	*No. of palms in bearing*	*No. of nuts*	*Average/ bearing palm*	*Average/ acre*	*Yield of tall palms of equivalent age*	
							Ave/palm	*Ave/acre*
5th year	1945	236	66	237	3·6	28	—	—
6th year	1946	454	123	342	2·8	34	9·5	38
7th year	1947	725	244	3,704	15·2	370	15·3	460

The yield of dwarf palms is compared in the above table with that of tall palms of identical age. In the seventh year after transplantation the average yield per acre of the dwarfs is only 370 nuts whereas that of the tall palms is 460 nuts. It must be remembered that nuts of the dwarf variety only give about half as much copra as those from tall palms. Even in the sixth year, the return per acre from the tall palms is more than that from the dwarf palms. Thus the dwarf compares unfavourably with the tall palm as regards yield.

The performance of the dwarf plantation, though regularly cultivated and manured has not been satisfactory. The palms are adversely affected even by short spells of drought and further they appear to be very readily susceptible to beetle attack. Probably the dwarf requires a more humid climate with an even distribution of rainfall. Accordingly it may be that dwarf palms on a plantation scale in Ceylon may prove a better success in the Wet zone of the Island.

(ii) *Nurseries and Issues of Planting Material.*—

From the nurseries at Bandirippuwa and Ratmalagara Estates 16,631 selected seedlings were distributed during the year under review; of these 4,129 were grade II and variety seedlings. In addition, 53,800 selected nuts from mother palms and another 10,500 grade II nuts were issued.

(iii) *Co-operative Activities.*—

(a) *Yield recording.*—In view of the increasing demand for planting material, an expansion in this line of work was initiated and 16 additional estates covering an area of over 4,000 acres were visited for palm selection; 429 palms were selected as seed-bearers.

(b) *Experimental Plantation 1.*—Full details of this plantation at Marandawila were given in the report for the previous year. The yield for 1947 was 10,297 nuts giving an average of 35.3 nuts per palm. The palms have suffered much set back during the last three years owing to droughty conditions and this low average, the lowest since 1942, is largely due to the heavy immature nut falls during 1946.

(iv) *Other investigations, &c.*—

(a) *Floral biology.*—Detailed observations on the floral biology of the tall, dwarf and king coconut palms have been made. An account of these will be submitted for publication in the *Tropical Agriculturist*. It was found that in the dwarf and the king coconut the male and the female phases overlap, making self-pollination very probable. The tall palms are protandrous, all the male flowers dropping off before the female flowers become receptive; self-pollination here must be ruled out as a possibility.

(b) *Crossing Experiments.*—

Palms of the tall, dwarf and king coconut varieties were inter-crossed. Unfortunately on account of the bad drought most of the buttons that developed were shed. Experiments were also conducted to study the cause of button fall by artificial cross-pollination, artificial self-pollination and natural self-pollination; here again drought intervened and these experiments have to be repeated.

We are greatly handicapped for want of a suitable tower ladder to reach the crowns of the tall palms for doing these pollination experiments; enquiries for a suitable type of ladder have been addressed to firms in the U.K. and U.S.A. Meanwhile, we are obliged to use the dwarf as the female parent, reciprocal crosses not being possible at present.

(v) *Co-operative Societies.*—

Our staff was called upon to visit coconut co-operative sales societies and advise them on the selection of site, laying-out and management of nurseries. In this connection Sandalankawa, Alawwa, Udubaddawa and Hettipola Societies were visited during the year. (See section 7).

C. Soil Chemist's Department

I. *Field Experiments.*—Six manurial experiments were maintained during the year.

(i) *N.P.K. Experiment—Bandirippuwa Estate.*—

(a) The twelfth year of this experiment was completed in November 1947. The yield data for 1947 are as follows:

	Lb. copra/acre	*Calculated as percentage*
N_0	1,612	100
N_1	1,699	105
N_2	1,581	98
P_0	1,657	100
P_1	1,605	97
P_2	1,631	98
K_0	1,333	100
K_1	1,715	129
K_2	1,845	138

(*b*) *The Potash Response.*—The increments in yield due to Potash manuring are shown below, calculated as lbs. copra per acre.

	Year	K_1-K_0	K_2-K_0
I	1936 ..	26 ..	50
II	1937 ..	47 ..	80
III	1938 ..	47 ..	114*
IV	1939 ..	28 ..	120*
V	1940 ..	190* ..	249
VI	1941 ..	122 ..	196
VII	1942 ..	352 ..	470
VIII	1943 ..	300 ..	407
IX	1944 ..	362 ..	546
X	1945 ..	329 ..	422
XI	1946 ..	312 ..	447
XII	1947 ..	382 ..	512
	Total 12 years ..	2,497	3,613
	Mean per annum ..	208 ..	301 lb.
	Mean per annum (1942-1947)	340	467 lb.

* Significant at P = 0·05 ; all later responses significant at P = 0·01

(*c*) *The Nitrogen Response.*—Shown below are the responses to Nitrogen manuring up to 1947. In the eleventh year a negative (but statistically not significant) response at the higher level was obtained and this same fall is observed in the year under review 1947:

	Year	N_1-N_0	N_2-N_0
II	1937 ..	86 ..	212*
III	1938 ..	121† ..	100†
IV	1939 ..	80 ..	4
V	1940 ..	114 ..	132
VI	1941 ..	126† ..	80
VII	1942 ..	159† ..	84
VIII	1943 ..	113 ..	19
IX	1944 ..	76 ..	5
X	1945 ..	64 ..	19
XI	1946 ..	63 ..	—27
XII	1947 ..	87 ..	—31

* Significant at P = 0·01 † Significant at P = 0·05

It may be recalled that in the course of this 3 × 3 × 3 factorial NPK experiment, applications of fertilizers have been made biennially in the odd years from 1935 onwards. At the time of application the land is ploughed; it is disc-harrowed twice a year, usually at the end of each rainy season in January and June. Extra disc-harrowing is sometimes given if pasture and weed growth is heavy. Cattle are not allowed within the experimental area.

As far as responses to nitrogen fertilizers are concerned, it will be seen from the above table that in the second year after the first manuring, a highly significant response equivalent to 212 lbs. copra per acre was obtained at the higher level of nitrogen application, viz., 1 lb. N. per palm. This declined in the third year and subsequently there has been no significant response to the higher level of nitrogen. Even at the lower level there has been no significant response since 1942.

It seems probable that under the cultivation regime adopted in the experimental area there is an accumulation of nitrogen which renders further application in the form of artificials excessive. Such application may indeed result in a depression of coconut yields. This subject has been further discussed in a lecture "The Possibilities of Ley Farming and Alternate Husbandry on Coconut Estates." (See section 5 (i)).

(d) Influence of Manuring on Copra out-turns.

The following data show the influence of manuring on copra out-turns for the experimental year under review. The beneficial effects of potash are again observed. Nitrogen applications seem to result in a smaller nut.

	Copra out-turn/ No. of nuts per candy	*Difference*
N_0 ..	1,140 ..	—
N_1 ..	1,174 ..	34
N_2 ..	1,187 ..	47
P_0 ..	1,161 ..	—
P_1 ..	1,163 ..	2
P_2 ..	1,178 ..	17
K_0 ..	1,230 ..	—
K_1 ..	1,156 ..	74
K_2 ..	1,132 ..	98

(ii) *Co-operative Experiments.—(a) Southern Province (Ahangama) and Western Province (Siyane Korale).—*

The following Table summarises the results of the 8th year of these 2 Co-operative experiments:—

Southern Province					Western Province				
Treatments	*Nuts/ acre*	*Lbs. Copra per acre*	*Per Cent.*	*Copra out-turn*	*Treatments*	*Nuts/ acre*	*Lbs. Copra per acre*	*Per Cent.*	*Copra out-turn*
O ..	735..	291..	100..	1,415..	O ..	436..	169..	100..	1,445
* NK ..	992..	418..	144..	1,330	‡ NK ..	750..	347..	205..	1,210
† NPK ..	2,036..	891..	306..	1,280	§ NPK ..	1,783..	771..	456..	1,295

* Originally NK, now NPK since November, 1946.
† Originally NPK, now NK since November, 1946.
‡ Originally NK, now NPK since November, 1945.
§ Originally NPK, now NK since November, 1945.

The Influence of Manuring on the Proportion of Female Flowers developing into Ripe Nuts.—In the Annual Report for 1944 (Sessional Paper I.—1948, page 11), data from the Bandirippuwa factorial experiment were given from which it was provisionally concluded that potash had little effect on the formation of female flowers, that nitrogen increased flower production by some 16 per cent., and that phosphoric acid seemed slightly to depress it. Under Bandirippuwa conditions, about 30 per cent. of the female flowers are developed into mature nuts after fertilization. This percentage is not greatly influenced by fertilizers, though potash has perhaps a slightly beneficial effect.

On the Western Province and Southern Province experiments the results are different. Detailed figures crop by crop have been given in the Reports for 1944-45-46. The following table shows the data in yearly totals for 1945-46-47.

Western Province Experiment	*1945*			*1946*			*1947*		
	**Nuts*	*Female Flowers*	*% set*	*Nuts*	*Female Flowers*	*% Set*	*Nuts*	*Female Flowers*	*% set*
O ..	3,720 ..	7,199 ..	51·7 ..	2,441 ..	5,561 ..	43·9 ..	1,571 ..	3,061 ..	51·3
NK ..	4,047 ..	7,125 ..	56·8 ..	2,883 ..	6,362 ..	45·3 ..	2,701 ..	4,734 ..	57·1
NPK ..	8,632 ..	17,811 ..	48·5 ..	5,668 ..	13,512 ..	41·9 ..	6,417 ..	12,598 ..	50·9
Southern Province Experiment	*June 1945-February 1946 (5 crops)*			*March 1946-February 1947 (5 crops)*					
O ..	3,449 ..	8,009 ..	43·1 ..	2,646 ..	5,699 ..	46·4 ..			
NK ..	6,456 ..	13,945 ..	46·3 ..	3,570 ..	7,002 ..	50·3 ..			
NPK ..	9,185 ..	20,903 ..	43·9 ..	7,330 ..	15,501 ..	47·3 ..			

* Totals for 12 plots of 18 palms to each treatment.

It will be observed that under these conditions, i.e., on a lateritic soil containing only traces of phosphate at the start of the experiment, phosphoric acid applications have given a marked increase in crop. The increased production of flowers has been the main factor, since in general the percentage setting is not greatly different from the controls. On Bandirippuwa, as noted in previous reports, soil phosphoric acid reserves were high when the experiment was started, and applications of this constituent have not to date (1948) given significant responses in yield.

It may perhaps be remarked that the percentage of setting is much higher on these two experiments than on Bandirippuwa; this may be connected with the much lower average crops on the former.

(*b*) *Manurial Experiment on Young palms (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 randomized blocks of 6 plots each.

Periodical height measurements of the seedlings were made until November 1943, when the palms were four years old and averaged 14.9 feet in height. At this stage accurate height measurements are more difficult. Particulars of these measurements will be found in previous reports.

From March 1944, periodical counts of leaf emergence have been made. During 1947, two such counts were made in January and June, with the following results:—

Leaves developed per palm from July 1946 to January 1947

	O	NK	NPK	Mean
No cover ..	4·88 ..	5·21 ..	5·42 ..	5·17
Cover ..	4·68 ..	4·46 ..	4·98 ..	4·71
Mean ..	4·78 ..	4·83 ..	5·21 ..	4·94

Leaves developed per palm from January to June, 1947

	O	NK	NPK	Mean
No cover ..	3·58 ..	3·70 ..	3·95 ..	3·75
Cover ..	3·32 ..	3·30 ..	3·60 ..	3·41
Mean ..	3·46 ..	3·50 ..	3·78 ..	3·58

These results are similar to those reported for 1946 (*Annual Report, Sessional Paper* XVI—1948, page 12), which showed no significant differences. These counts will be discontinued in 1948, since the palms are now coming into flower and bearing, which will provide much better criteria of treatment effects.

At June 1947, 133 palms were in flower, distributed between the treatments as follows:

	O	NK	NPK	Total
No Cover ..	26 ..	34 ..	21 ..	81
Cover ..	17 ..	15 ..	20 ..	52
Total ..	43 ..	49 ..	41 ..	133

During the year 377 nuts were harvested (from 26 palms in bearing) distributed as follows:—

	O	NK	NPK	Total
No cover ..	65 ..	85 ..	131 ..	281
Cover ..	27 ..	2 ..	67 ..	96
Total ..	92 ..	87 ..	198 ..	377

(iii) *N.P.K. X Cultivation Experiment—Ratmalagara Estate.*—

This experiment is of a $3 \times 2 \times 2$ factorial design and its object is to compare the effect of combinations of potash at three levels (O; K_1—1 lb., of K_2O and K_2—2lbs. of K^2O per palm); phosphoric acid at two levels; (O and P—1 lb. P_2O_5 per palm); and two levels of cultivation (ploughing *vs.* no ploughing). All the plots are given a basic dose of 0.6 lb., N per palm biennially as sulphate of ammonia. Premanurial records were kept for a year and the first applications of fertilizers made in 1943. Four years records were thus completed in 1947, and an analysis of these will be presented in the 1948 report.

H. *Laboratory Investigations.*—

(i) (*a*) From 1937 to 1942 the potash contents were determined of nut water samples from the 18 plots receiving no potash, and from the 18 plots receiving 1.50 lb. K_2O per palm on the N. P. K. experiment at Bandirippuwa Estate. The results were sufficient to show a large increase in the potash content of water from the manured plots.

From 1946 onwards these determinations have been extended to all 54 plots of the N. P. K. experiment. From each plot the water is collected from 100 nuts (or all nuts from the plot if its crop is less than 100), and the volume measured. Samples are then drawn, filtered at once and potash determined as cobaltinitrite on aliquots.

In the following table the results for 1947 are shown as the calculated total recovery of potash (K_2O) in grams from each set of 18 plots:—

Potash in Coconut Water—Totals of 18 Plots in grams

Date of Pick	K^0 No potash	K^1 0·75 Lb. K_2O per palm	K^2 1·50 Lb. K_2O per palm	N^0	N^1	N^2	P^0	P^1	P^2
7. 2.47	206·98	401·70	542·73	382·00	413·18	356·23	335·40	388·43	407·48
3. 4.47	348·48	486·52	689·61	481·30	494·04	499·18	511·88	446·45	516·28
19. 6.47	330·30	736·60	1006·10	702·00	746·20	624·80	717·10	672·50	668·40
11. 8.47	456·00	1003·20	1339·20	979·10	1015·40	803·90	980·90	886·40	931·10
10.10.47	248·27	559·35	842·70	597·61	559·59	493·12	582·00	550·69	517·68
10.12.47	268·40	536·00	771·60	550·10	532·80	493·60	560·70	472·40	542·90

The Corresponding yields of copra were as follows:—

Date of Pick	K^0 No. potash	K^1 0·75 lb. K_2O per palm	K^2 1·50 lb. K_2O per palm	N^0	N^1	N^2	P^0	P^1	P^2
7. 2.1947	680	940	921	883	873	785	779	834	928
3. 4.1947	1,134	1,250	1,362	1,254	1,349	1,143	1,334	1,206	1,206
19. 6.1947	1,349	1,760	1,869	1,621	1,735	1,622	1,712	1,620	1,646
11. 8.1947	1,515	2,159	2,260	1,980	2,040	1,914	2,014	1,958	1,962
10.10.1947	981	1,313	1,500	1,266	1,291	1,237	1,299	1,239	1,256
10.12.1947	1,176	1,456	1,550	1,387	1,362	1,483	1,400	1,358	1,424

The results are similar to those reported for 1946. The potash content of the coconut water shows increases almost linear with the doses of potash applied to the soil.

The work is being continued, with a view to studying possible interactions as reflected in the potash content of the water.

(*b*) A similar set of analyses was carried out on samples of nut water from one crop of the manurial experiment at Kumbaloluwa Estate. The results were as follows:

Potash in Coconut Water—Pick M VIII- May 10, 1947

Treatment	Volume of Water	K_2O Grs litre	Nuts	Total K_2O
0	9,820 c. c.	1·87	89	21·22
* NK	15,694 „	2·19	104	37·63
† NPK	16,988 „	1·63	326	90·27
0 Husk	9,640 c. c.	1·26	92	12·56
* NK Husk	16,236 „	2·26	130	47·70
† NPK Husk	15,130 „	0·78	470	55·47

* Originally NK, now NPK since November, 1945
† Originally NPK, now NK since November, 1945.

(ii) *Analysis of Fresh Cattle Dung and Urine.*—A study was made in 1943 of the manurial value of the dung and urine voided by buffaloes (see *Annual Report for 1943; Sessional Paper* IV.—1945—p. 12).

In 1947 a similar study was commenced with neat cattle, using five animals,

It is the usual practice locally to manure coconut palms by tying a pair of animals to a palm for 10 nights, in such a way as to collect the droppings in a shallow circular trench, which is then covered. The results of the present study indicate that a pair of local cattle in 10 days void 184 lb., of fresh dung, containing 29.4 lb. dry matter, including 0.52 lbs. nitrogen, 0.24 lb. P_2O_5 and 0.14 lb. K_2O; as well as 6.74 gallons of urine containing 0.76 lbs. nitrogen and 0.99 lb. K_2O.

Full details will be published elsewhere.

(iii) *Miscellaneous.*—In the course of advisory work, samples of waste Maldive fish and of compost were analysed. These presented no points of particular interest. Some samples of rubber seed extracted cake were analysed in connection with the Technological Chemist's work on rubber-seed oil (see para A.vi.2.).

5. (1) Publications.—

R. Child, " Coconut Shells as an Industrial Raw Material, IV. Coconut Shell Charcoal; (B) Activated Carbon." *Current Science*, 1947, *16*, 5-8.

R. Child and W. R. N. Nathanael, " Utilization of Coconut Water ", *Tropical Agriculturist (Ceylon)*, 1947, *103*, 85-89.

R. Child and W. R. N. Nathanael, " Chemical and Agricultural Notes from the Coconut Research Scheme (Ceylon), V. Copra from Rejected Coconut Seedlings." *Ibid.*, *103*, 24-38.

R. Child, " The Costs of Production of Coconuts and Copra in Ceylon." *Ceylon Econ. J.*, 1946, *12*, 24-38.

Press Articles.—The Director's Annual review of the Ceylon Coconut Industry appeared in the *Times of Ceylon*, 4th March, 1947, under the caption " Coconut Exports lowest on Record since 1916."

Dr. M. L. M. Salgado's lecture to the Chilaw-Negombo Planters' Association " The Possibilities of Ley Farming and Alternate Husbandry on Coconut Estates ", appeared in the *Times of Ceylon*, 19-24 July, 1947 (Offprints are available).

(ii) *Library.*—On December 31, 1947, the Library contained 706 books and 1,345 bound volumes of periodicals (including 211 loaned by the Director), besides numerous pamphlets and reprints. The chief purchases of books were Watt's " Dictionary of the Economic Products of India " (9 volumes), and Volumes I to VII of the new edition of Thorpe's " Dictionary of Applied Chemistry ".

Purchase of Volumes XII to XXXIV (1921-1932) of *Soil Science* completed the library set of this journal (Vols. I-LXV). The gift from Prof. D. R. R. Burt is gratefully acknowledged of Vols. CXIX-CXXVIII (1927-1931) of *Nature*; and from Mr. W. V. D. Peiris of the *Report of the Proceedings of the Third Entomological Meeting* (Pusa, 1919), 3 vols.

New subscriptions to journals entered in 1947 included *Proceedings of the Indian Academy of Sciences; New Zealand Journal of Science and Technology; Plastics; Oléagineux.*

Grateful acknowledgment is made to Government Departments and Research Organizations overseas which send exchange publications. Special reference may be made to the welcome re-commencement of publication of the *Kew Bulletin*, *The Malayan Agricultural Journal*, and the *Journal of the Rubber Research Institute, Malaya*. The Indian Central Coconut Committee commenced their quarterly *Indian Coconut Journal* in the fourth quarter, 1947.

Visitors are welcome to use the Library for reference on week days between 9 a.m. and 12 noon and 2 to 4 p.m. (Saturdays 9 a.m. to 12 noon); not on Sundays and Public Holidays.

6. Coconut Conference, 1947.—

A Coconut Conference was organized by a joint Committee of the Planters' Association, the Low-Country Products Association, the Ceylon Coconut Board, and the Coconut Research Scheme in July. The Scheme took an active part, and the office staff was responsible for the issue of all notices, programmes and booklets; the Director edited and prepared for publication the 64-page booklet containing the papers read at the Conference. (A few copies of this are still available from the Scheme's Office).

The Papers read on the first day, July 4, 1947, included—

" The Regeneration of Coconut Properties ", by the Director, Dr. R. Child.

" Some Problems of Coconut Manuring ", by the Soil Chemist, Dr. M. L. M. Salgado.

The second day of the Conference took the form of a Field Day at Bandirippuwa Estate and over 150 visitors saw the work in progress in the laboratories and on the Estate.

7. Meetings, &c.—

(i) *Tea Research Institute Conference, February, 1947.*

The Director, Messrs. Nathanael, Liyanage, L. A. Fernando and C. M. Fernando attended the Tea Research Institute Conference at Talawakelle on 26/27 February.

(ii) *Ceylon Association of Science, December, 1947.*

The Director, Dr. R. Child, gave his Presidential Address to Section E (Physical Sciences) on December 5, his subject being " Recent Advances in the Chemistry and Technology of the Fats ".

Mr. W. R. N. Nathanael read a paper " The Sugars of Coconut Water " before Section E on December 4.

(iii) *School of Agriculture, Peradeniya.*—The Director was a guest speaker at the Speech Day of the School of Agriculture on November 15.

(iv) *Ceylon Coconut Board.*—The Director was nominated a member of the re-constituted Ceylon Coconut Board on October 31, by the Hon. the Minister for Commerce and Trade; he attended meetings on November 17, and December 12.

(v) *Central Board of Agriculture.*—The Director attended the twelfth meeting of the Central Board of Agriculture on February 24.

(vi) *Planters' Associations.*—The Staff Officers of the Scheme attended meetings of the Low-Country Products Association during the year. The Soil Chemist, Dr. M. L. M. Salgado, gave an address to the Chilaw-Negombo Planters' Association on July 18, 1947; the Botanist, Dr. T. S. Raghavan, addressed the same Association on September 9, 1947, his subject being " The Improvement of the Coconut Palm ". The Scheme's Library was made available to the Chilaw-Negombo Planters' Association for its meetings on three occasions.

(vii) *Co-operative Societies.*—In connection with the Scheme's efforts to assist Coconut Co-operative Sales Societies on the agricultural side, meetings of the following Societies were addressed by the officers mentioned:

Sandalankawa	September 28	Director
Boyawalana	October 27	Secretary
Dunagaha	October 28	Director
Polgolla	November 1	Secretary
Marawila	November 8	Director and Secretary
Alawwa	December 12	Mr. L. A. Fernando
Hettipola	December 13	Director and Secretary

In addition the following visits were paid in connection with the projected laying out of nurseries:—

Hettipola	November 11	Mr. D. V. Liyanage, Research Assistant
Alawwa	November 6	Mr. C. W. S. de Silva, Senior Field Assistant
Sandalankawa	November 10	
Udubaddawa	November 21	

(viii) *Visitors.*—Overseas visitors included Mr. Thet Su, Deputy Director of Agriculture, Burma; Mr. Roger H. Heyworth, Director, Unilever House, London; Dr. C. Watts Padwick, Imperial Chemical Industries Ltd., London; and Dr. G. Underwood, Consulting Chemical Engineer, London.

The final-year students of the School of Agriculture, Peradeniya, paid their annual visit to the Scheme on December 20, 1947. Parties from St. Thomas' College, Mount Lavinia, and Maris Stella College, Negombo, also visited Bandirippuwa Estate.

THE ESTATES

9. Bandirippuwa Estate.—

Crops harvested during 1947 were:—

Crop No.	*Nuts from Estate Blocks*	*Nuts from Research Blocks*	*Total*	*Average 1931-1946*	*1947—above or below average*
					Per cent.
I	37,693	10,531	48,224	67,826	—28·9
II	95,425	21,995	117,420	111,083	+ 5·7
III	107,503	28,273	135,776	132,148	+ 2·7
IV	89,003	27,586	116,589	118,177	— 1·3
V	61,706	17,667	79,373	76,891	+ 3·2
VI	71,073	20,010	91,083	61,828	+47·3
	462,403	126,062	588,465	567,953	+ 3·6

The nuts were disposed of as follows:—

Sold	208,888	
Cured for copra	354,014	
For Research and Nursery purposes	13,222	
Rejections and shorts	12,341	2·1 percent.
	588,465 nuts	

The 354,014 nuts cured gave 283 candies 429 lb. of copra, or 1,247 nuts to a candy.

The revenue from Bandirippuwa estate actually accruing in 1947 was:—

	Revenue from Estate Management		*Revenue from Research Management*	
Crops 1946—	*Rs. c.*	*Rs. c.*	*Crops 1946—*	*Rs. c.*	*Rs. c.*
Sale of nuts	376 66				
Sale of copra	7,105 38		Sale of copra	1,629 92	
		7,482 4			1,629 92
Crops 1-5, 1947—			*Crops 1-5, 1947—*		
Sale of nuts	15,675 88		Sale of nuts	402 52	
Sale of copra	22,350 42		Sale of copra	10,764 25	
		38,026 30			11,166 77
Sale of husks	1,613 30				
Sale of shells	1,295 85		Sundries	8 92	
		2,909 15			8 92
Seed nuts to Nursery	715 0				
		715 0			
Sale of food-crops	72 33				
Sundries	204 15				
		276 48			
Sale of cadjans	226 36				
Less expenses	171 34				
		55 2			
		49,463 99			12,805 61

Total gross revenue in 1947 was thus Rs. 62,269.60 which may be summarized as follows:—

	Rs. c.	Average price
Sale of 176,606 nuts realising	16,455 06	Rs. 93·17 per 1,000 nuts
Sale of 24 tons 2 cwts. 91½ lb. white copra realising ..	20,800 34	Rs. 215·41 per candy
Sale of 42 tons 10 cwt. 93 lbs. of ordinary copra realising	21,049 63	Rs. 123·70 per candy
Sale of 5,550 seednuts to nursery realising ..	715 0	Rs. 130 per 1,000
Sale of 312,221 husks realising	1,613 30	Rs. 5·17 per 1,000
Sale of 193,600 shells realising	1,295 85	
Sale of food crops realising	72 33	
Sale of cadjans less expenses realising ..	55 2	
Sale of sundries realising	213 7	
	62,269 60	

Expenditure for the year totalled Rs. 18,752.88 for the estate area, Rs. 4,055.21 for the Research Area. Estate Receipts, therefore exceeded expenditure by Rs. 30,711.11 and Research Receipts exceeded expenditure by Rs. 8,750.40. Cost of production of nuts on the estate area (including copra curing, transport expenses and depreciation on copra kiln) was Rs. 35.06 per 1,000 nuts.

Sundry Debtors and Creditors Account.—

Of the income accruing in 1947 and included in the above statement Rs. 7,482.04 (estate) and Rs. 1,629.92 (research) from 1946 crops, had been credited to the Estate Working Account for 1946 through Sundry Debtors Account. The Estate working account for 1947 does not therefore, include these sums. The following amounts have been credited to the Estate Working Account on account of 1947 crops lying unsold at the end of the year:—

	Rs. c.
1947 5th and 6th crops, estate ..	.. 11,457 82
1947 6th crop, research ..	.. 2,546 17

The Bandirippuwa Estate Working account for 1947 thus shows a balance of Rs. 44,353.54 carried forward to Revenue.

Meteorological Observations at Bandirippuwa Estate.—

The usual routine observations were made daily at 0800 h. and 1530 h. Ceylon Standard Time (0230 h and 1000 h G.M.T.). The morning observations are telegraphed to the Colombo Observatory, to the Civil Airport, and to R.A.F. Headquarters. Monthly abstracts of all observations are sent to the Colombo Observatory.

Rainfall in 1947 totalled 59.93 inches against an average (1933-1946) of 78.07 inches. Rainy days numbered 159, wet days (0.04 inch or over) 133. Up to the end of September rainfall was limited but well distributed and this following on the copious rains at the end of 1946, led to hopes for record crops in 1948. However the end of the year saw an unprecedented failure of the North-East Monsoon rains; only 0.56 inch fell in November, compared with an average (1933-1946) of 4.96 inches, and 2.23 inches in December (average 5.18 inches).

10. Ratmalagara Estate.—

Crops harvested in 1947 are shown in the following table, with the figures for 1938 to 1946 for comparison:—

Crop No.	*1938*	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*Average 1938–1945*
1	30,896*	23,752	22,302	29,153	21,718	25,504	33,163	36,706	44,601	24,093	29,756
2	28,130	26,413	16,391	38,285	26,478	37,197	52,912	47,987	71,117	51,583	38,323
3	37,413	30,160	28,233	49,339	39,218	55,008	64,634	61,248	52,300	52,779	46,395
4	44,180	34,278	25,704	60,232	44,584	56,378	58,152	39,175†	35,479	52,524	44,240
5	34,573	32,515	37,000	45,606	39,205	48,978	52,719	35,191†	29,548	41,418	39,482
6	20,945	23,865	20,800	29,682	22,958	36,230	29,066	28,473	24,978	31,455	26,333
	196,137	170,983	150,430	252,297	194,161	259,295	290,646	248,780	258,023	253,852	224,529

* Harvested by previous proprietor.

† Only five crops were harvested in 1945 the 4th crop taken in October 1945, and totalling 74,366 nuts really represented the 4th and 5th combined; for comparative purposes the 74,366 have been distributed in the ratio of previous averages for the 4th and 5th crops.

In previous reports nuts harvested from the Latin Square Experiment, and from the Dwarf Palm Blocks (see 4.B. *Geneticist's Department* (*i*) (*c*) and (*d*)) have not been included in the Estate totals; neither are they included in the above table.

The following numbers of nuts were harvested from the Latin Square Experiment and may be added to the respective estate totals:

	1945	*1946*	*1947*
Dwarf palm nuts totalled :—	68 ..	1,177 ..	6,577

1945	*1946*	*1947*
237 ..	342 ..	3,704 (cf. Section 4, B.)

The out-turn of these nuts is only about 2,000 to a candy of copra; it would perhaps hardly be legitimate to add these into the estate grand total and they will continue to be shown separately.

The revenue actually accruing during the year was:—

Revenue from Estate Management				*Revenue from Research Management*			
Crops, 1946—	*Rs.*	*c.*	*Rs.* *c.*	*Crops, 1946*—	*Rs.*	*c.*	*Rs.* *c.*
Sale of copra ..	3,921	14		Sale of copra ..	951	4	
Crops 1–5, 1947—				*Crops 1–5, 1947*—			
Sale of copra ..	16,507	91		Sale of copra ..	4,541	38	
Sale of food crops ..	417	98		Sale of pines ..	649	98	
Sale of sundries ..	374	0		*Sundries* ..	801	14	
			21,221 3				6,943 54

Total gross revenue in 1947 was thus Rs. 28,164.57, which may be summarised as follows:

	Rs. *c.*	*Average Price*
Sale of 53 tons 13 cwt. 45½ lb. copra realising ..	25,921 47	Rs. 109.96 per candy
Sale of food crops realising ..	417 98	
Sale of 10,833 lb. of pineapples realising ..	649 98	6 cents per lb.
Refund on citrus nursery and rubber seed garden ..	708 89	
Sundries	466 25	
	28,164 57	

Expenditure for the year totalled Rs. 16,257.82 for estate area and Rs. 2,980.77 for Research Area.

Cost of production of nuts on Estate area (including copra curing and transport expenses) was Rs. 77.56 per 1,000 nuts.

Sundry Debtors and Creditors Account.—

Of the income accruing in 1947 and included in the above statement Rs. 3,921.14 (Estate) and Rs. 951.04 (Research) from 1946 crops, had been credited to the Estate Working Account for 1946 through Sundry Debtors Account. The Estate Working Account for 1947 does not, therefore, include these sums.

The following amounts have been credited to the Estate Working Account on account of 1947 crops lying unsold at the end of the year:—

		Rs. *c.*	*Rs.* *c.*
1947 crops (Estate)	Nuts ..	2,787 7	
	Copra ..	734 32	
			3,521 39
1947 crops (Research)	Nuts ..	561 0	
	Copra ..	226 62	
			787 62
			4,309 1

The Ratmalagara Estate Working Account for 1947, thus shows a balance of Rs. 8,382.81 carried forward to Revenue.

Weather Records.—The usual records were kept of rainfall and of hours of bright sunshine (on the Campbell-Stokes recorder installed in January 1941). Monthly statements are sent to the Colombo Observatory. Rainfall in 1947, totalled 47.16 inches falling on 121 rain days. The corresponding figures in 1946 were 69.67 inches falling on 136 rain days.

Hours of bright sunshine averaged daily 6.9. Previous figures have been 1943—6.7; 1944—6.9; 1945—7.7; 1946—7.0.

11. Visiting.—

Mr. B. Parker, Visiting Agent, inspected the Estates on February 13 and 14, and September 24 and 25, 1947. His reports were circulated to the members of the Board of Management.

12. Finance.—

The audited statements of accounts for 1947, are appended.

D. RHIND,
Director of Agriculture and Chairman,
Board of Management,
Coconut Research Scheme.

February 2, 1949.

Statement of Receipts and Disbursements for the Year ended December 31, 1947

(In Compliance of Section 8 (2) of Ordinance No. 29 of 1948)

Receipts	Rs. c.	*Disbursements*	Rs. c.
Balance at January 1, 1947	4,847 91	Capital Account :	
(a) Revenue Account :		New clearing	
Annual grant from Government	176,544 83	Laboratory equipment	1,646 66
Special grant for Factory	250,000 0	Special equipment	1,072 50
Grant for Demonstration Centres	20,000 0	Depreciation reserve	6,165 0
Special equipment grant	40,000 0	Office furniture	857 98
Grant for staff bungalows	60,000 0	Bungalow furniture	169 0
Cess collections for 1947	23,682 71	Estate draught animals	163 15
Interest	3,811 25	Personal Emoluments :	320
Income from Bandirippuwa Estate :		Salaries to senior staff	44,471 92
Estate area	40,829 85	Salaries to junior staff	19,431 25
Research area	11,175 69	Rent allowance	1,585
Income from Ratmalagara Estate :		War allowance	22,233
Estate area	17,248 64	Provident Fund bonus and interest for 1947	7,159 87
Research area	5,712 28	Other Charges :	
Sale of planting material	16,371 95	Travelling expenses to staff	9,986 84
Charges to staff for electricity	758 63	Travelling expenses—Board Members	3,544 65
Sundry receipts	274 17	Office :	
Sale of publications	103 10	Entertainment Allowance	85 0
Rental for telephone	49 35	Stationery	1,000 80
(b) Advance Accounts :		Postages	1,044 54
Repayments of loan by staff		Printing and Advertising	2,159 54
Rice, sugar and chillies	4,779 36	Legal Expenses	84 25
Kerosene oil	2,356 94	Incidental Expenses	2,070 56
Bulbs	106 26	Telephone Rental	395 0
General stores	10 50	Workmen's Compensation Insurance	72
Fertiliser advance account	—	Maintenance of office Equipment	167 25
	6,826 83	Laboratories :	
(c) Reserve Accounts :		Upkeep, Chemicals, &c.	6,616 25
Staff contributions to Provident Fund	4,636 3	Scientific Books and periodicals	4,201 28
Scheme's bonus and interest	7,159 87	Buildings :	
(d) Sundries :		Upkeep	6,058 25
Sundry debtors	*17,212 84	Insurance	539 44
Ceylon Savings Bank	13,046 60	Running Expenses of Electrical Plant	4,458 50
		Estates :	
		Bandirippawa Estate :	
		General charges	5,631 34
		Upkeep	2,627 83
		Food crops	126 59
		Cultivation and manuring	3,607 46
		Collection	3,916 40
		Cadjan account	171 34
		Ratmalagara Estate :	
		General charges	4,533 27
		Upkeep	1,544 73
		Food crops	1,602 95
		Cultivation	4,579 70
		Collection	2,144 22
		Brick account	700 34
		Research :	
		General	
		Genetical work	1,248 86
		Soil Chemist's work	4,394 30
		Purchase of planting materials	10,359 43
		Advisory :	15,057 14
		Sandalankawa Nursery Working account	133 75
		Advance Accounts :	
		Rice, sugar and chillies	2,223 2
		Kerosene oil	108 58
		General stores	495 0
		Fertilisers	8,710 11
		Bulbs	—
		Investments :	
		Ceylon Savings Certificates	645 92
		Post Office Savings Bank	4,000 0
		State Mortage Bank	5,000 0
		New Investments :	
		National Development Loan	250,000 0
		Ceylon Savings Certificates	8,000 0
		Sundries :	
		Passage Fund	
		Revenue account	4,532 39
		Loans to staff	2,393 44
		Sundry creditors	10,850 0
			*2,344 68
		Balance at December 31, 1947 :	511,243 56
		No. 1 account	
		No. 2 account	208,462 3
		Petty cash imprest	6,000 0
			2,000 0
	727,705 59		727,705 59

*Sundry debtors :

	Rs. c.
Interest	684 25
Income from B/E (Estate)	7,825 4
Income from B/E (Research)	1,629 92
Income from R/E (Estate)	3,937 38
Income from R/E (Research)	1,230 97
Cess collections	1,905 8
	17,212 84

Bank Reconciliation Statement for the Month of December, 1947

	No. 1 Account Rs. c.	No. 2 Account Rs. c.
Balance as per cash book	208,462 03	6,000 0
Add value of uncash cheques	6,502 40	3,208 76
	214,964 43	9,208 76
Less credits not gone into bank	3,149 92	5,638 57
	211,814 51	3,570 19

Ratmalagara Estate Working Account, 1947

	Rs. c.	Rs. c.
Estate Expenses :		
Superintendence and watchers	3,379 85	
General charges	2,697 95	
Upkeep	1,544 73	
Food crops	1,602 95	
Manuring and cultivation	4,579 70	
Picking collection and curing	2,188 21	
		15,993 39
Research Expenditure on Estate Account :		
Rubber seed garden and Citrus nursery	708 89	
Botanist work	133 54	
Soil Chemist's work	2,138 34	
		2,080 77
Depreciation Reserve :		
Copra kiln	134 43	
Draught animals	130 0	
		264 43
To revenue account		8,362 81
		27,601 40

	Rs. c.	Rs. c.
Income :		
Estate area :		
By sale of nuts	2,787 7	
By sale of copra	17,242 23	
By sale of sundries	374 0	
		20,403 30
Research area :		
By sale of nuts	561 0	
By sale of copra	4,768 0	
By sale of sundries	1,451 12	
		6,780 12
Others :		
Food crops	417 98	
		417 98
		27,601 40

Bandirippuwa Estate Working Account, 1947

Estate Expenses :		
Superintendence and watchers	3,193 72	
General charges	4,293 42	
Upkeep	2,627 83	
Manuring and cultivation	3,831 60	
Food crops	126 59	
Picking collection and curing	4,289 34	
		18,362 50
Research Expenditure on Estate Account :		
Genetical work	618 3	
Soil Chemist work	3,437 18	
		4,055 21
Depreciation Reserve :		
Depreciation on patent drier	294 38	
Depreciation of draught animals	96 0	
		390 38
Revenue account		44,353 54
		67,161 63

	Rs. c.	Rs. c.
Income :		
Estate area :		
By sale of nuts	20,458 68	
By sale of copra	29,740 44	
By sale of sundries	3,113 30	
		53,312 42
Research area :		
By sale of nuts	402 52	
By sale of copra	13,310 42	
By sale of sundries	8 92	
		13,721 86
Others :		
Food crops	72 33	
Cadjans	226 36	
Less expenses	171 34 55 2	
		127 33
		67,161 63

September 22, 1948.

Nursery Working Account, 1947

	Rs. c.	Rs. c.
Planting Material :		
To Purchase of seednuts	10,080 9	
Plucking seednuts	87 71	
Transport of seednuts	1,865 36	
		12,042 16
Nurseries :		
To Preparation and maintenance	2,568 41	
Selection of nuts	83 37	
		2,651 78
Repairs to nursery pump	109 13	
Repairs to road and culvert	615 76	
Gunny bags	140 0	
Nursery hut	3 86	
		868 75
Nursery Attendants (Four) :		
To Salaries	1,721 35	
Dearness allowance	2,027 36	
Rent allowance	180 0	
Travelling	1,041 82	
		4,970 53
		20,533 22

Income	Rs. c.	Rs. c.
By Sale of seedlings in 1947	7,771 75	
Seedlings booked in advance	1,915 75	
	9,735 50	
Less refund in 1947	195 25	9,540 25
By Sale of seednuts in 1947	3,254 97	
Seednuts booked in advance	2,320 0	5,574 97
Transport charges in 1947	1,366 16	
Paid in advance	100 0	1,466 16
To Loss carried forwarded to Revenue account		3,950 84
		20,533 22

Capital Expenditure Account, 1947

	Rs. c.	Rs. c.
On Revenue Account :		
New clearing, Ratmalagara Estate	1,677 66	
To Estate draught animals ..	320 0	
Furniture ..	332 15	
		2,329 81
On Capital Grant Account :		
To Equipment grant ..	7,237 50	
Co-operative nursery ..	133 75	
		7,371 25
		9,701 6

Capital Expenditure Account, 1947 :	Rs. c.
By Transfer to revenue account adjusted in balance sheet ..	2,329 81
Transfer to capital grant adjusted in balance sheet ..	7,371 25
	9,701 6

Revenue Account, 1947

Expenditure	Rs. c.	Rs. c.
To Personal Emoluments :		
Salaries of senior staff ..	44,471 92	
Salaries of junior staff ..	14,925 67	
Provident Fund bonus and interest ..	7,159 87	
Rent allowance ..	1,405 46	
Dearness allowance ..	18,375 67	
		86,338 59
To other charges :		
Staff travelling ..	10,031 46	
Board travelling ..	3,544 65	
		13,576 11
To Office :		
Stationery	1,000 80	
Postage	1,101 14	
Printing and advertising ..	2,159 54	
Legal expenses ..	84 25	
Incidental expenses ..	2,070 56	
Telephone rental ..	345 65	
Entertainment allowance ..	85 0	
Maintenance of office equipment	167 25	
Workmen's Compensation Insurance	72 0	
		7,086 19
To Laboratory and Library :		
Upkeep of laboratory ..	6,616 25	
Scientific books and periodicals	4,201 28	
		10,817 53
To buildings :		
Upkeep	6,058 25	
Insurance	539 44	
Running expenses of electric plant	4,473 50	
		11,071 19
Research :		
Research I (General) ..	955 77	
Research II (Botanist) ..	4,548 59	
Research III (Soil Chemist) ..	5,654 24	
		11,158 60
To Reserve Funds :		
Pensions	1,000 0	
Depreciation reserve ..	7,314 21	
		8,314 21
Cash shortage written off on the authority of the Board ..	..	2,393 44
		150,755 86

Income	Rs. c.	Rs. c.
By Revenue Account :		
Government grant under the Ordinance		26,544 83
Cess collections		27,500 82
Interest on investments		4,984 83
By Working Accounts :		
	Rs. c.	
Bandirippuwa Estate ..	44,353 54	
Ratmalagara Estate ..	8,362 81	
	52,716 35	
Less loss on nursery ..	3,899 84	
		48,816 51
By Others :		
Charges to staff for electricity	758 63	
Sale of publications ..	163 10	
Sundries	274 17	
Profit on advance accounts ..	15 35	
		1,211 25
Excess of expenditure over revenue	..	41,097 62
		150,755 86

S. C. KAHAWITA,
Secretary-Accountant,
Coconut Research Scheme, Lunuwila.

Balance Sheet as at December 31, 1947

Liabilities	Rs. c.	Rs. c.
Capital Outlay :		
At December 31, 1946	609,342 63	
In 1947	9,701 6	
		619,043 69
Passage Fund :		
At December 31, 1946	3,695 11	
In 1947	1,000 0	
	4,695 11	
Less expenditure in 1947	4,532 39	
		162 72
Provided Fund :		
At December 31, 1946	54,091 90	
In 1947	11,795 90	
		65,887 80
Depreciation Reserve :		
At December 31, 1946	115,213 42	
In 1947	7,989 2	
	123,202 44	
Less expenditure from revenue in 1947	4,622 78	
		118,579 66
Sundry Creditors :		
In 1947	3,224 3	
Suspense account	871 29	
		4,095 32
Capital Grant Accounts :		
Factory account		250,000 0
Buildings account		60,000 0
Equipment account	40,000 0	
Less expenditure in 1947	7,237 50	
		32,762 50
Nurseries and Demonstration Centres	20,000 0	
Less expenditure in 1947	133 75	
		19,866 25
Special Grant 1947		150,000 0
		1,320,497 94

Assets	Rs. c.	Rs. c.
Buildings		203,874 1
Bandirippuwa Estate	187,554 68	
Ratmalagara Estate	73,138 0	
		260,692 68
Improvements to Estates :		
Previously	9,240 82	
In 1947	1,677 66	
		10,918 48
Animals :		
Previously	2,260 0	
In 1947	320 0	
		2,580 0
Estate Kilns :		
Bandirippuwa	4,067 26	
Ratmalagara	1,432 91	
		5,500 17
Laboratory Buildings :		64,297 91
Laboratory Equipment :		
Previously	34,670 82	
In 1947	7,237 50	
		41,908 32
Gas Plant		3,458 83
Furniture :		
Bungalows		5,396 44
Office previously	2,191 72	
In 1947	332 15	
		2,523 87
Accumulators		17,500 62
Museum		276 25
Co-operative Nursery (Sandalankawa)		123 75
Sundry Debtors :		
Cess collections	3,818 11	
Interest accrued	959 24	
Bandirippuwa Estate working account	14,512 43	
Ratmalagara Estate working account	4,640 48	
Nursery working account	261 43	
		24,191 69
Advance Accounts :		
Fertilizers	1,601 90	
Rice, sugar and kerosene oil	176 65	
Transport loans to staff	8,034 48	
General stores	1,230 54	
		11,043 57
Investments :		
Ceylon Government 3½ per cent. 1957-62 Loan	59,400 0	
Ceylon Government Home Defence Loan	20,000 0	
Ceylon Government National Loan	20,000 0	
Ceylon Government National Development Loan	250,000 0	
State Mortgage bank debentures	5,000 0	
Ceylon Savings Certificates	20,121 71	
12-Year Savings Certificates	8,000 0	
Post Office Savings Bank	4,018 33	
Ceylon Savings Bank	7,128 65	
Bank of Ceylon Savings account	10,000 0	
		403,668 69
Cash in Hand :		
Bank of Ceylon No. 1 account	208,462 5	
Bank of Ceylon No. 2 account	6,000 0	
Cash	2,000 0	
		216,462 5
Deficit Account :		
Excess of expenditure over revenue	41,697 62	
Add Capital expenditure	2,329 81	
	44,027 43	
Add deficit from 1946 Balance Sheet	1,158 75	
		45,186 18
		1,320,497 94

S. C. KARAWITA,
Secretary-Accountant,
Coconut Research Scheme, Lunuwila.

September 23, 1948.

The accounts of the Coconut Research Scheme above set forth have been audited under my direction. I have obtained all the information and explanations that I have required and I certify as a result of this audit that in my opinion, the Balance Sheet is properly drawn up so as to exhibit a correct view of the affairs of the Scheme.

Audit Office,
Colombo 7, October 18, 1948.

P. W. KAITE,
for Auditor-General.