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Annual Report of the Coconut Research Scheme for 1948

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COMMITTEES

Buildings Sub-Committee.—Personnel at January 1: Mr. Graham Panditte-sekera, J.P., U.M. (Chairman), Mr. A. Pearson, Mr. E. Muttukumaru.

At the 94th meeting of the Board of Management held on July 17, Mr. Albert F. Peris, J.P., U.M., M.P., was elected to fill the vacancy on the Committee, consequent on the retirement of Mr. A. Pearson, and Mr. A. N. D. A. Abeyasinghe was elected as an additional member of the Committee.

Two meetings, on June 26 and August 26, were held by the Committee during the year.

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

No meetings were held during the year.

Sub-Committee to report on the Future Development of the Industrial Side of the Scheme's Research Policy.—Personnel: Senator C. A. M. de Silva, Mr. Albert F. Peris, J.P., U.M., M.P., E. Muttukumaru, Mr. V. Rajapakse, Director.

At a meeting of the Committee held on August 7, Mr. E. Muttukumaru was elected Chairman.

One meeting of the Committee was held on August 7.

Sub-Committee for Revision of C. R. S. Ordinance.—Personnel: Chairman (D. Rhind), Treasury Representative (Mr. H. E. Peries), E. Muttukumaru, Albert F. Peris, N. H. Kirthiratne, Director.

One meeting of the Sub-Committee was held on December 21.

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

At the 94th meeting of the Board of Management held on July 17, Mr. A. N. D. A. Abeyasinghe, Col. W. G. Mack, O.B.E., E.D., and Mr. N. H. Kirthiratne were elected to fill the vacancies created on the retirement of Senator C. A. M. de Silva, Mr. A. Pearson and Mr. V. Rajapakse.

At a meeting of the Sub-Committee held on September 22, Col. W. G. Mack was elected Chairman.

Three meetings were held on January 17, May 27, and September 22.

Sub-Committee to report on the Future Development of the Industrial Side of the Scheme's Research Policy.—Personnel: Senator C. A. M. de Silva, Mr. Albert F. Peris, J.P., U.M., M.P., E. Muttukumaru, Mr. V. Rajapakse, Director.

At a meeting of the Committee held on August 7, Mr. E. Muttukumaru was elected Chairman.

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One meeting of the Sub-Committee was held on December 21.

2. Staff

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

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

Botanist: Dr. T. S. Raghavan, M.A., Ph.D. (Lond.), F.L.S., F.A.Sc.

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

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

Research Assistant to Botanist: Mr. D. V. Liyanage, B.Sc. (Lond.).
Technical Assistant to Soil Chemist: Mr. L. A. Fernando.
Senior Mechanic: Mr. R. Werapermall.

The following new appointments were made during the year: J. K. F. Kirthisinghe was appointed Field Assistant to the Botanist as from March 15, Mr. H. L. L. Perera, Mr. H. J. F. Peiris and Mr. P. B. Perera were appointed Field Advisory Officers from April 5.

At the Annual General Meeting of the Ceylon Association of Science held on December 4, 1948, Dr. M. L. M. Salgado was elected President of Section B. (Agriculture and Forestry) for the 1949 Sessions.

New Replanting Scheme

A new planting scheme for coconuts was approved by the Hon. Minister of Agriculture, and financial provision of Rs. 177,200 was included in the votes of the Department of Agriculture for 1948-49. The Scheme actually aims at establishing nurseries to raise 180,000 seedlings a year, and the working has been placed in the hands of the Coconut Research Scheme.

Summarized Departmental Reports

A. *Technological Chemist's Department*

Work carried out during the year was almost all in connection with *ad-hoc* enquiries. No new major investigations were started.

(i) *Coconut Products:* (a) *Copra.*—Samples examined in the course of enquiries presented no special points of interest.

Dwarf Nuts.—Copra from the dwarf palms at Ratmalagara Estate was analysed; two groups, according to size, and one composite sample were examined with the following results:—

	Moisture	*Oil per cent.*	*Oil Dry Weight per cent.*
Large ..	.. 4·4	.. 65·2	.. 68·2
Small ..	.. 3·8	.. 68·0	.. 70·8
Composite ..	.. 3·7	.. 68·5	.. 71·1

Tapuan Nuts.—A sample of copra cured from the trees at Ratmalagara was examined and found to contain—

Moisture	*Oil per cent.*	*Oil Dry Weight per cent.*
3·9 ..	67·5 ..	70·2

(b) *Poonac.*—On poonac a larger number of enquiries than usual were received as many millers were installing new expellers or renovating old ones. It has been the policy to assist millers by reporting oil percentages on poonac samples in such circumstances but informing them that routine samples must be referred to private consultants.

It is apparent from the analytical figures that many expellers are run below full efficiency. Eleven samples were received in all during the year and only one was really satisfactory having an oil content of 9.7 per cent. (dry wt.) falling between the usual range of composition 8.0—12.0 per cent.

ANALYSIS OF POONAC SAMPLES

Sample	Moisture	Per cent. Oil (Dry Weight)	Per cent. Oil (Wet Weight)
I	10·7	14·3	12·8
II	9·6	9·7	8·8
III	8·8	16·2	14·8
IV	8·6	21·0	19·2
V	8·2	18·9	17·3
VI	7·7	13·0	12·0
VII	8·5	19·4	17·7
VIII	8·8	22·5	20·5
IX	11·8	13·5	15·3
X	12·8	14·4	12·6
XI	5·3	14·0	13·2
Mean	9·2	16·1	14·9

(c) *Coconut Oil.*—Samples of oil were examined in connection with bulk shipment, for which standards are imposed for free fatty acids and colour. Two samples were also received from the Southern Province, and one from Puttalam, for analysis.

Red Oil.—A sample of "red oil" from a soap manufacturer in Kandy was received. It was found to have:

	Per cent.
Free fatty acid (lauric)	33·1
Saponification value	259·4
Iodine value	10·6

Our analytical report advised against its use in a cold process soap, because of its high acidity. A method for bleaching the oil using bichromate of potash and acid was recommended. It was also suggested that the oil could be used in a boiled or semi-boiled soap, when it would lose a good deal of its colour and odour on boiling with caustic soda, and it might be possible to saponify the oil alone using excess alkali, later adding the other fat and resin (if used).

(d) *Desiccated Coconut.*—One sample from a co-operative society and one from a private dealer were examined and reported on.

Malayan Nuts.—Thirty-two Malayan nuts were sent by a planter for conversion into desiccated coconut and comparison with local nuts.

Fifteen of the nuts were found to have germinated and one spoiled. Only the sixteen good nuts were sent for milling.

	gms.		
Weight of 16 good husked nuts	15,208		
Weight of 16 good husks	629		
	15,837		
Weight of shells	3,585		
Weight of parings	465		
Weight of desiccated coconut	3,438	Fine	(2,076 gms.)
		Medium	(1,362 gms.)
Weight of water (by difference)	7,720		
	15,208		

Chemical Analysis

	Per cent. Moisture	Per cent. Oil (Dry)	Per cent. Oil (Wet)
Desiccated coconut (fine)	3·9	71·4	68·6
Desiccated coconut (medium)	2·6	70·0	68·2

The fine and medium samples had 1.32 per cent. and 1.97 per cent. moisture, respectively, on receipt from the mills, but had gone up a bit before the analysis was taken in hand. The above figures indicate that there is no vital difference as regards oil content between the above samples and that from local nuts.

(*e*) *Vinegar.*—A sample of vinegar from a new manufacturer was found to contain 5.10 per cent. *v/v* alcohol, that is it was quite incompletely acetified. The Research Assistant visited the distillery and advised on improvement of the product.

Another distillery was supplied with standard solution for a Salleron "acetimetre."

(*f*) *Fibre.*—Samples of spoiled fibre which had been the subject of a claim, was received from a shipper. Results of examination and comparison with normal fibre indicated that spoilage was due to acidity developing from incomplete removal of sulphur dioxide after bleaching.

(ii) *Coconut Shell Investigation.*—It is still not possible to report much progress in this work. The dust from a dry decortication on alkaline hydrolysis gave no vanillin or related aldehydes.

Methoxy determinations (zeisel) on account shell powder gave—OCH_3. 5.6 per cent. (6.2 per cent. dry wt.)

(iii) *Oil Seeds:* (*a*) *Palms.*—Through the interest of the Director of Agriculture, it has been possible to examine the fats from the seeds of exotic palms, growing in the Royal Botanic Gardens, Peradeniya, including some near relations of Cocos nucifera (L). The results will be published in detail elsewhere, but are briefly tabulated here.

Cocos Quinquefaria.—300 fruits labelled *Cocos quinquefaria* were sent by the Superintendent, Botanic Gardens, and these were found to be the species termed by Beccari, *Syagrus quinquefaria*.

The fruits as received consisted of hard "nuts" surrounded by a fibrous mesocarp; no epicarp. They were ovate, about 1" × 3/4", average weight 34 gms.

The "nuts" (average weight 3.1 gms.) were separated into husks plus shells (very hard, about 1/8" thick) and kernels 13 per cent. of total. The kernels (one in each fruit) were partly duple, divided by a septum.

Attalea Cohune.—The fruits were very similar to arecanuts externally, both in size and shape. The fruits consisted of hard "nuts", with fibrous epi-and-mesocarps. The nuts (average weight 24.3 gms.) were separated into shells (average weight 21.2 gms.) and kernels (average weight 3.1 gms.). There were one, two and sometimes three kernels in each fruit.

Scheelea Insignis.—Very similar in appearance to *Attalea cohune*. The fruits as received had an average weight of 48.9 gms, and when de-husked the "nuts" weighed 41.6 gms. The shells had an average weight of 36.9 gms. and the kernels 4.7 gms. The same as *Attalea*, the fruits contained one, two and three kernels.

Astrocaryum Standleyanum.—Three fruits of this palm initially unidentified were sent by the Superintendent of the Botanic Gardens. The heaviest was preserved for planting and the other two were examined. The nuts (average weight 16.6 gms.) were separated into 48.8 per cent. of kernel (average weight 8.1 gms.) and 51.2 per cent. of shell (average weight 8.5 gms.). The kernels were extremely tough. Each nut had a single kernel invaded partly by a septum, thus making the kernels kidney shaped.

A second lot of fresh mature fruits (150) were received which enabled us to make a thorough examination. The palm was also identified by the Botanist as *Astrocaryum standleyanum*.

ANALYSIS OF FAT

Name	Per Cent Oil	Iodine Value	Saponification Value	Unsaponifiable Matter	Acid Value	Pericarp Fat per cent	
Cocos quinquefaria	65·2 (dry) 58·6 (wet)	26·2	245·2	1.15%.	4·9	—	
Attalea cohune	72·2 (dry) 67·8 (wet)	15·2	253·3	—	—	8.95 1.72	(dry) (wet)
Scheelea insignis	74·0 (dry) 61·2 (wet)	16·2	247·9	—	—	0.53	(dry)
Astrocaryum standleyanum	31·1 (dry) 20·6 (wet)	10·1	253·8	—	0·0	0.22	(dry)

ANALYSIS OF EXTRACTED RESIDUE

Name	% Nitrogen	K2 O on Ash	Moisture	Ash	Crude Fibre	% Insoluble Ash	% Soluble Ash
Cocos quinquefaria	4·8 (dry) 4·3 (wet)	5·9	10·5	6·1 (dry) 5·5 (wet)	14.5 (dry) 13.0 (wet)	73·0	27·0
Attalea cohune	4·6 (dry) 4·2 (wet)	20·6	6·8	6·2 (dry) 5·7 (wet)	—	32·8	67·2
Scheelea insignis	4·3 (dry) 3·9 (wet)	20·8	9·7	8·0 (dry) 7·2 (wet)	—	34·1	65·9
Astrocaryum standleyanum	1·3 (dry) 1·2 (wet)	3·8	7·3	1·8 (dry) 1·7 (wet)	22·3 (dry) 20·6 (wet)	42·0	58·0

The characters such as percentage content of fat and analytical characteristics of the fats vary with the maturity of the fruit and with the climatic or edaphic factors of the palms' environment. The fats of some of the above are interesting and would repay further study.

(*b*) *Others.*—Other oil-seeds investigated during the year included, *Helianthus annuus*, *Kokoona zeylanica* and *Hibiscus esculentus*.

The sunflower seeds received were of excellent quality and the yield of oil was above the average. The oil itself had an iodine value slightly below the reported range of 125-135; this being advantageous for oil intended for edible purposes. The cake from the decorticated seeds had over 40 per cent. of protein, thus proving to be a valuable stock feed. On the basis of our examination the crop was recommended for further trial.

A sample of seeds from *Kokoona zeylanica*, really insufficient for a complete examination, but certainly of considerable scientific interest, was sent by the Department of Agriculture. The kernel oil was of a most uncommon type with a very high saponification value and extremely high Reichert-Meissl value indicating the presence of derivatives of the lower fatty acids (formic, acetic, &c.). The acrid oil obtained by expression, according to some is supposed to be used as a preventive against leeches. Without a good supply of material, it was not possible to confirm this.

A note on bandakka (*Hibiscus esculentus*, L.) as a source of edible oil was published in the *Tropical Agriculturist*. The oil content and general composition of the seeds examined did not differ materially from American grown seeds. It was not recommended as a suitable oil-seed crop in Ceylon.

(iv) *Miscellaneous Work.*—(Other than coconuts).

(*a*) A sample of commercial linseed oil was analysed for the Tea Research Institute.

(*b*) Further samples of water from the Saline Paddy Station, Lunuwila, were examined for chloride content and pH, at 10-day intervals.

(*c*) Two samples of fruit wines sent by an inquirer were tested for solids, ash, acidity and alcohol.

(*d*) A sample of Municipal compost was sent for analysis. This was examined in the usual way and found to be below standard.

B. *Soil Chemist's Department*

I. *Field Experiments.*—Seven manurial experiments were maintained during the year. With the last pick of 1948 the manurial experiment at Kumbaloluwa Estate, Veyangoda, was closed down.

A new experiment on the manuring of young palms was commenced at Ratmalagara Estate.

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

(*a*) The thirteenth year of the experiment was completed in November, 1948. The yield data for 1948 are as follows:—

	Lb. Copra/Acre	*Calculated as Percentage*	*Difference Lb./Acre*
N_0	1,711	100	—
N_1	1,743	101·9	32
N_2	1,719	100·5	8
P_0	1,731	100	—
P_1	1,716	99·1	15
P_2	1,725	99·7	6
K_0	1,383	100	—
K_1	1,825	132·0	442
K_2	1,965	142·1	582

Significant difference (P· 05) : 132 lb. per acre.
Significant difference (P· 01) : 178 lb. per acre.

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

Year		$K_1—K$	$K_2—K_0$
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**
XIII	1948	442**	582**
Total 13 years		2,939	4,195
Mean per annum		226	323
Mean per annum (1939–1943)		198	288
Mean per annum (1944–1948)		365	502

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

It will be seen that the response to potash has reached a peak in the thirteenth year, and for K_2 (1.50 lb. K_2 0 per palm) exceeds a candy of copra per acre per annum.

(*c*) *The Nitrogen Response.*—The response to Nitrogen manuring (lb. copra/acre) are given below:—

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
XIII	1948	32	8

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

In the thirteenth year the nitrogen response has reached the lowest level at the lower level of manuring ($N_1 - N_0 = 0.5$ lb. per palm).

(*d*) *Influence of manuring on Copra out-turns.*—Data on the influence of manuring on the copra out-turns up to 1943, the eighth year of the experiment have been published in *C. R. S. Bulletin* No. 6 ("Recent Studies on the Manuring of Coconuts in Ceylon").

It was observed during this period that (1) copra out-turns were influenced from the fourth year; (ii) nitrogen affected the out-turn adversely, i.e., more nuts were required per candy; (iii) on the other hand potash improved out-turns to a corresponding degree; (iv) phosphoric acid had little effect.

Data for the subsequent five years of the experiment, 1944-1948, are given below:

COPRA OUT-TURNS—NUTS PER CANDY

Year	IX : 1944		X : 1945		XI : 1946		XII : 1947		XIII : 1948	
Treatment	Out-turn	Difference	Out-turn	Difference	Out-turn	Difference	Out-turn	Difference	Out-turn	Difference
N0	1,177	—	1,203	—	1,356	—	1,140	—	1,285	—
N1	1,225	48	1,234	31	1,390	34	1,174	34	1,319	34
N2	1,258	81	1,262	59	1,464	108	1,187	47	1,383	98
O0	1,209	—	1,219	—	1,390	—	1,161	—	1,308	—
P1	1,226	17	1,237	18	1,391	1	1,163	2	1,334	26
P2	1,223	14	1,243	24	1,421	31	1,178	17	1,344	36
K0	1,288	—	1,243	—	1,450	—	1,230	—	1,419	—
K1	1,206	82	1,221	22	1,384	66	1,156	74	1,303	116
K2	1,181	107	1,190	33	1,350	121	1,132	98	1,284	135

It will be seen from the above table that the influence of manuring on the out-turn is more marked in these years when the average copra out-turn is poor, i.e., in years when more nuts are required per candy. This occurs in dry years such as 1944, 1946 and 1948 in contrast to wet years such as 1945 and 1947.

(*e*) *Influence of Manuring on the Formation of Female Flowers and the Setting of nuts.*—Data on the influence of manuring on the formation of female flowers and the setting of nuts up to 1943 have been published in *C. R. S. Bulletin* No. 6.

This and subsequent data have indicated that nitrogen increases the formation of female flowers by about 15 per cent. The data for 1948 have been statistically analysed and the difference due to nitrogen found to be significant.

Phosphoric acid and potash seem to have no effect.

On the other hand potash alone consistently increases the setting of nuts from female flowers.

The full data will be published in next year's report.

(ii) *Co-operative Experiments:*

(*a*) *Western Province* (*Siyane Korale*).—The manurial experiment at Kumbaloluwa Estate, Veyangoda, was closed down at the end of 1948.

The first application of manure was made in November, 1939, and subsequently biennially.

In contrast to the NPK experiment at Bandirippuwa phosphoric acid gave a marked response. There was also a large improvement in copra out-turns due to manuring.

In 1944 chemical analyses of soil samples had shown a considerable accumulation of available phosphoric acid in the NPK plots of the experiment. It was therefore decided to study the effect of omitting phosphoric acid from the NPK plots and adding this constituent to the NK plots. This was carried out during the application of manure in November, 1945. No manuring was done in November, 1947.

The data of this experiment from its commencement are recorded below:—

KUMBALOLUWA EXPERIMENT—YIELDS PER ACRE—1940-48

Treatments	Nuts per Acre	Lb. Copra per Acre	Per cent.	Copra Out-turn
1940 M I				
O	688	246	100	1,568
NK	604	221	90	1,530
NPK	611	228	83	1,503
NPK–O	77	18	17	65
1941 M II				
O	433	166	100	1,465
NK	544	237	143	1,300
NPK	584	258	155	1,270
NPK–O	151	92	55	195
1942 M III				
O	932	343	100	1,524
NK	1,232	491	143	1,404
NPK	1,669	699	204	1,336
NPK–O	737	356	104	188
1943 M IV				
O	656	233	100	1,579
NK	840	318	136	1,480
NPK	1,721	678	288	1,435
NPK–O	1,065	439	188	144
1944 M V				
O	394	161	100	1,367
NK	391	179	111	1,225
NPK	1,393	642	397	1,216
NPK–O	999	481	297	151
1945 M VI				
O	847	289	100	1,641
NK	942	346	119	1,525
NPK	1,966	806	278	1,365
NPK–O	1,119	517	178	266
1946 M VII				
O	556	177	100	1,759
NK	657	243	137	1,516
NPK*	1,291	463	262	1,561
NPK–O†	735	286	162	198
1947 M VIII				
O	358	139	100	1,442
NK	615	285	205	1,208
NPK*	1,462	632	455	1,295
NPK–O†	1,104	493	355	147
1948 M IX				
O	791	274	100	1,617
NK	1,799	670	248	1,504
NPK*	2,045	713	259	1,610
NPK–O†	1,256	438	159	7

* NPK since November, 1945.

† NK since November, 1945.

It will be seen that the omission of phosphoric acid from the NPK plots has not caused a decline in the yield of these plots. The reserves of available phosphate from 2 biennial applications have been sufficient and although the last application of phospheric acid was in 1943 the reserves have been sufficient for a period of five years.

At the same time the addition of phosphoric acid to the NK plots (and that a small application of 2 lb. saphos phosphate equivalent to 0.6 lb. phosphoric acid) confirms the marked response, previously indicated.

Now that this experiment has been closed down a new 3×3×3 NPK factorial experiment on this lateritic soil type should produce results of much interest, and such an experiment is contemplated.

(*b*) *Southern Province*.—The following is a summary of the 9th year of this experiment:—

Treatment	*Nuts per Acre*	*Lb. Copra per Acre*	*Per cent.*	*Copra Out-turn Nuts per Candy*
O ..	313	129	100	1,359
NK* ..	670	323	250	1,162
NPK† ..	2,085	983	763	1,188

* Originally NK, now NPK since November, 1946.
† Originally NPK, now NK since November, 1946.

(*c*) *Manurial Experiments 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) NK and NPK treatments, in 5 randomised blocks of 6 plots each.

At the end of December, 1948, 220 palms were in flower, distributed between the treatments as follows:—

	O	*NK*	*NPK*	*Total*
No cover ..	38	42	38	118
Cover ..	30	35	37	102
Total ..	68	77	75	220

During the year 1,273 nuts were harvested distributed as follows:—

	O	*NK*	*NPK*	*Total*
No cover ..	144	144	232	820
Cover ..	89	137	227	453
Total ..	233	~~681~~ 281	459	1,273

The corresponding copra weights (lb.) are as follows:—

	O	*NK*	*NPK*	*Total*
No cover ..	68	223	149	440
Cover ..	50	61	124	235
Total ..	118	284	273	675

(iii) *Cover Crop Experiment* (*Bandirippuwa*).—This experiment was commenced in 1937, and consists of six randomised blocks of six plots each. In five plots of each block cover crops (mixture of Centrosema pubsences and Calapagonium mucunoides, which finally formed a uniform cover of Centrosema) was established in June, 1937.

Manurial treatments commenced in June, 1939, and repeated biennially were as follows: No cover, but palms manured with NPK in circular trenches, cover and K; cover and NK; cover and PK; cover and NP; cover and NPK.

In 1939 and 1941 manure was broadcast on the cover, harrowed and dug with mamotties. Since 1943, owing to shortage of labour, the manure was broadcast and the cover intensively harrowed.

The mean yields for the treatments expressed as lb. copra per acre are recorded below.

COVER CROP EXPERIMENT

The mean yields for the treatments expressed as lb. copra/acre satistically analysed and corrected by the method of co-variance are recorded below :-

Treatment	2nd Year 1938–39	3rd Year 1939–40	4th Year 1940–41	5th Year 1941–42	6th Year 1942–43	7th Year 1943–44	8th Year 1944–45	9th Year 1945–46	10th Year 1946–47	11th Year 1947–48
No cover-NPK	1,406	1,185	1,369	1,405	1,974	1,674	2,038	1,470	1,634	2,451
Cover -K	1,207	624	1,266	1,185	1,875	1,417	1,936	1,475	1,443	2,050
Cover -NK	1,200	782	1,340	1,164	1,894	1,453	1,943	1,442	1,574	2,204
Cover -PK	1,193	631	1,218	1,072	1,813	1,442	2,008	1,442	1,471	2,059
Cover -NPK	1,241	829	1,365	1,270	2,030	1,556	2,091	1,566	1,655	2,455
Standard Error	106	82	91	174	174	182	256	119	163	230
Significant Difference—P.05	126	97	109	207	206	217	304	142	195	273

The following points are of interest:—

(*a*) The growth of the cover crop coincided with the severe drought of 1938-39 and caused a sharp decline of yield in the second year, reaching a minimum in the third year.

(*b*) The incorporation of the covers along with manures at the end of the second year caused a recovery of the cover plots in the fourth year. This recovery has been maintained during subsequent years.

(*c*) Coconut palms when manured with a complete mixture (NPK), where no cover was grown did not significantly differ in yield from palms, where covers were grown.

(*d*) In most years, and particularly from the ninth year onwards, palms with cover crops manured with NPK give the highest yield.

(*e*) Absence of potash produced a marked significant drop in yield where cover is incorporated

(iv) *3 × 2 × 2—Manurial × Cultivation Experiment (Ratmalagana).*—This factorial experiment consists of combinations of the following treatments: (*a*) K_0 (no potash); K_1 =1 lb. K_2O per palm; K_2O =2 lb. K_2O per palm; (*b*) P_0 =1 no phosphoric acid; P=1 lb. phosphoric acid per palm; C_0=no ploughing; C =ploughing.

The first biennial application of manure and ploughing was carried out in June, 1943. The yield data for the main effects from the second year (1944-45) up to the fifth year (1947-48) are summarized below:

LB. COPRA PER ACRE

Treatment	Second Year 1944–1945	Third Year 1945–1946	Fourth Year 1946–1947	Fifth Year 1947–1948
K_0	1,771	1,691	1,415	1,841
K_1	1,935	1,674	1,395	1,842
K_2	1,893	1,738	1,492	1,975
Significant difference P.05	194	152	181	215
P_0	1,794	1,625	1,276	1,711
P	1,938	1,777*	1,592*	2,061*
C_0	1,783	1,615	1,372	1,851
C	1,949†	1,787*	1,496	1,921
Significant difference P.05	158	123	149	176

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

The following conclusions can be drawn from the above data:—

(a) Potash has not produced a significant response at rates of 1 lb. K_2O and 2 lb. K_2O per palm.

(*b*) Phosphoric acid gave a significant response in the third year; in the fourth and fifth year this response has been highly significant (P .01).

(*c*) Ploughing gave a significant response in the second and third years; but no significant response in the subsequent years.

(v) *3×3×3 NPK Manurial Experiment on Young Palms (Ratmalagara)*,—A 3×3×3 NPK manurial experiment, consisting of 54 plots, in 6 blocks of 9 plots each, was commenced at Ratmalagara Estate, Madampe.

The land which was once under jungle had been planted with food crops in 1943 and go back to Illuk (*Imperata cylindrica*). The Illuk was cleared and burnt, holes - × 4' × 4', dug 28 feet apart, were filled with 2 layers of husks, filled with 6" of soil above the layer of husks, burnt and again filled with top soil.

The whole area was stumped and catch-water drains provided. The land was disc-harrowed and cow pea planted as a catch crop.

The seedlings were planted during the first week of December.

The first differential manurial treatments will be made in 1949.

2. *Laboratory Investigations*:

(a) *Potash content of Coconut Water of the Nuts of the NPK Manurial Experiment.*—In continuation of the work carried out in 1946 and 1947, the potash content in samples of coconut water from the nuts of the NPK experiment were determined for each of the six picks.

The data for 1948 are recorded below:

POTASH CONTENT IN COCONUT WATER—TOTAL OF 18 PLOTS IN GRAMS

	K_0	K_1	K_2	N_0	N_1	N_2	P^0	P^1	P_2
Date of Pick	No Potash	0.75 lb. K_2O/palm	1.50 lb. K_2O/palm						
5. 2.48	376·55	523·68	772·68	535·08	607·74	530·09	624·76	547·74	500·41
6. 4.48	234·14	504·86	953·80	630·63	694·62	547·55	621·84	574·62	580·54
8. 6.48	302·37	625·96	983·14	707·96	644·31	559·20	670·92	627·28	613·27
3. 8.48	173·67	385·49	573·48	433·49	401·91	297·24	386·45	390·31	355·88
5.10.48	62·92	143·08	244·87	171·15	161·52	118·20	140·59	157·41	152·87
30.11.48	94·79	197·09	321·07	245·92	206·82	160·21	208·55	213·91	190·49

THE CORRESPONDING MEAN YIELDS OF COPRA ARE GIVEN BELOW: MEAN YIELDS OF COPRA (LB.) TOTAL OF 18 PLOTS

Date of Pick	K^0	K_1	K_2	N_0	N_1	N_2	P^0	P_1	P_2
5. 2.48	1,243	1,538	1,652	1,407	1,545	1,481	1,490	1,473	1,470
6. 4.48	1,580	2,077	2,201	1,918	1,927	2,013	1,920	1,966	1,982
8. 6.48	1,387	2,012	2,129	1,825	1,882	1,821	1,865	1,847	1,816
3. 8.48	844	1,189	1,337	1,154	1,171	1,045	1,136	1,137	1,097
5.10.48	556	693	778	711	677	639	691	660	678
30.11.48	485	545	643	601	575	497	567	584	522

The results are similar to those of 1946 and 1947. In the potash manured plots the potash contents of the coconut water shows an almost linear increment with doses of potash applied to the soil.

This is very similar to the increments of yield (copra) of palms due to the corresponding applications of potash.

(b) *Studies in the Chemistry of Cattle Manuring.*—These investigations which were commenced in 1947 (*vide* annual report for 1947) were completed in 1948.

(c) *Miscellaneous.*—Analysis of a few samples of sediment poonac, husk ash and maladive fish dust were undertaken during the course of advisory work. These analyses revealed no points of interest.

C. *Botanist's Department*

(i) *Bandirippuwa and Ratmalagara Estates*:

(a) *Botanist's Block B.*—The 296 palms in this block have been classified into three groups: (1) low yielders, (2) high yielders and (3) average yielders, according to the yield and other associated characters of the palms. This was originally purely a classification by sight as illustrated in Leaflet No. 1. The yields of the palms in the three groups during the period 1942-1948 are tabulated below:

AVERAGE YIELD OF NUTS PER PALM PER YEAR

	No. of Palms	1942	1943	1944	1945	1946	1947	1948	Mean
1. Low yielders	4	14·3	53·3	25·0	21·5	50·8	14·5	40·8	31·3
2. High yielders	56	84·9	104·1	85·5	70·4	109·4	89·3	81·4	89·2
3. Average Yielders	236	55·4	78·5	62·9	44·1	75·9	60·9	66·8	65·2
Average for all palms	296	60·2	83·0	66·7	48·7	81·9	65·6	69·2	67·9

The variations within each group from year to year are largely related to the weather cycle and the variations between groups appear genetic in as much as these palms that started as high yielders have continued as such and the other palms have failed to reach this level in spite of regular cultural treatment.

(*b*) *Latin Square Experiment.*—Some data collected from this experiment up to the end of 1948 are tabulated below:

PERCENTAGE OF PALMS IN FLOWER

Year:	*1944*	*1945*	*1946*	*1947*	*1948*
Period after Transplantation	*5th Year*	*6th Year*	*7th Year*	*8th Year*	*9th Year*
Treatment—					
A	7·3	43·8	74·0	86·5	92·7
B	—	19·8	53·1	76·0	86·5
C	8·3	44·8	71·9	89·6	92·7
D	5·2	40·6	74·0	92·7	95·8
E	9·4	38·5	68·8	91·7	96·9
F	5·2	36·5	68·8	85·4	92·7

YIELD OF NUTS

	1945	*1946*	*1947*	*1948*	*Total*
A	29	285	1,523	2,760	4,597
C	25	278	1,306	2,612	4,221
E	14	235	1,119	2,462	3,830
Total	68	798	3,948	7,834	12,648
B	0	55	483	1,518	2,056
D	0	191	1,221	2,578	3,990
F	0	133	881	2,259	3,273
Total	0	379	2,585	6,355	9,319

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 heap nuts
F. Unselected seedlings derived from heap nuts.

The palms are too immature for any positive significance to be attached to the results. However, it is to be observed that the selected seedlings from the high yielding palms have given the best crop in 1948, viz., 2,760 nuts, and in general the figures collected so far seem to indicate that the performance of the selected palms is superior to that of the unselected.

(*c*) *Dwarf Palm Block (Ratmalagara).*—Routine observations on the 992 young dwarf palms were continued. Again this year the dwarfs suffered very severely during the drought.

(ii) *Nurseries and Issue of Planting Material.*—During the year 52,381 selected nuts and 17,180 selected seedlings were supplied from the nurseries at Ratmalagara and Bandirippuwa Estates. A scheme to open up nurseries for the major coconut co-operative sales societies was inaugurated and the first nursery was established at Sandalankawa with a capacity of about 10,000 nuts. During the early half of the year nearly 5,000 nuts were planted in this nursery.

(iii) *Co-operative Activities:*

(*a*) *Yield Recording.*—Yield recording of the palms already selected was continued. During the year under review, 15 more estates covering over 5,000 acres were visited and 594 palms were taken over for yield-recording.

(b) *Experimental Plantation 1.*—The biannual manuring of the palms was completed in December, 1948. The yield in 1948 was 19,393 nuts giving an average of 66.4 nuts per palm; this was the best crop collected from this block, since the transplanting in 1934. A complete summary of yield of nuts from 1940-48 is given below:

Period after Transplantation	*Year*	*No. of Palms in bearing*	*Per cent. of Total No (292)*	*No. of Nuts*	*Avr./Palm*	*Avr./Acre*
6th Year ..	1940 ..	20 ..	6·8 ..	191 ..	9·5 ..	36
7th Year ..	1941 ..	159 ..	54·4 ..	2,440 ..	15·3 ..	460
8th Year ..	1942 ..	247 ..	84·6 ..	11,320 ..	45·8 ..	2,136
9th Year ..	1943 ..	288 ..	98·6 ..	14,880 ..	51·7 ..	2,807
10th Year ..	1944 ..	291 ..	99·7 ..	15,410 ..	53·0 ..	2,908
11th Year ..	1945 ..	291 ..	99·7 ..	11,835 ..	40·7 ..	2,233
12th Year ..	1946 ..	291 ..	99·7 ..	12,790 ..	44·0 ..	2,413
13th Year ..	1947 ..	292 ..	100·0 ..	10,297 ..	35·3 ..	1,943
14th Year ..	1948 ..	292 ..	100·0 ..	19,393 ..	66·4 ..	3,659

The plantation forms the first generation palms of seven known mother palms.

(iv) *Other Observations*:

(a) *Floral Biology.*—Observations on the floral biology in tall, king-coconut and dwarf palms were continued and the duration of the male and female phases determined. The female lasts from 5 to 7 days in tall palms and from 10 to 15 days in dwarfs and king-coconuts. The male phase lasts from 18 to 22 days in all the three varieties. In the tall palms the male phase precedes the female phase where as in the other two varieties they overlap.

Experiments were carried out to determine the relationship between relative humidity and pollen viability. Pollen grains were kept in desiccators with varying concentrations of sulphuric acid.

It was found that there is a definite relationship between viability and relative humidity. Pollen from tall palms kept in a desiccator with 43.4 per cent. H_2SO_4. i.e., 50 per cent. relative humidity showed 40 per cent. germination in a 10 per cent. sugar and 2 per cent. gelatine solution on the 18th day of storage. On the other hand pollen kept in a desiccator with 18.5 per cent. H_2SO_4, i.e., 90 per cent. relative humidity, completely lost their viability after the third day of storage. Under ordinary atmospheric conditions the viability of pollen from tall palms lasts for one to two days only. (*cf.* H. Marechall, *Agri. J. of Fiji*, 1928, *1*, 16-45).

(b) *Hybridisation Work.*—Work on hybridisation was limited as a suitable tower ladder was not yet available.

Six high yielding tall palms at Bandirippuwa Estate and a few dwarf palms at Ratmalagara Estate were selected for crossing work. As the inflorescences open, they are emasculated and bagged and when the female flowers are receptive artificial cross pollination is effected. Further, other inflorescences were treated for parthenocarpy, &c. Altogether 18 spadices were treated in this manner.

Setting of nuts in inflorescences artificially pollinated was rather low. In seven inflorescences treated artificially only 22 per cent. of the female flowers developed into nuts, whereas under natural conditions there is a setting of roughly 33 per cent. of the female flowers.

The ultimate object is to grow the nuts derived from high yielding tall × tall in an isolated seed garden and allow them to cross among themselves freely and distribute the nuts derived therefrom for planting purposes. To achieve this object tall × tall crossing has to be done on a mass scale between proved high yielders.

(c) *Trial of Marandawila Coconut Progenies at Walpita.*—Through the courtesy of the Director of Agriculture, land was made available at Walpita Government Farm for laying out a progeny test on nuts drawn from the experimental plantation No. 1 (see above).

Out of the 292 palms at Marandawila (Experiment Plantation I) being the progenies of nine mother palms, 232 have been taken for their second generation progeny testing. The test of the 232 progenies takes the form of two cubic (5^2) lattices (*a*) and (*b*) to which the progenies are assigned as follows:—

Lattice (*a*): 107 progenies which yielded more than 12 nuts for the pick, plus 18 duplications bringing the number of hypothetical progenies to 125.

Lattice (*b*): 125 progenies, which yielded 6-12 nuts for the pick. Each lattice has 3 groups. Each group contains 25 blocks with 5 progenies in each block. Any one progeny is represented by one plot in each group. Thus in each lattice a progeny is replicated thrice. Lattice (*a*) has 3 plant-plots i.e., 9 plants per progeny, and lattice (*b*) has 2 plant plots, i.e., 6 plants per progeny. Germination records have been kept of all the nuts from which seedlings have been raised.

Planting up of lattice (*a*) 125 × 9 = 1,125 seedlings was completed in December, 1948.

5. (i) Publications

Annual Report of the Coconut Research Scheme for 1946. Ceylon Government Sessional Paper XVI—August, 1948.

R. Child and W. R. N. Nathanael: "A Note on Bandakka (*Hibiscus esculentus*, L.) as a Source of Edible Oil", *Tropical Agriculturist (Ceylon)*, 1948, *104*, 79-80.

R. Child: "Coconut Shells", a popular article written for the magazine of the King's College, London, Chemical Society, was reprinted in the *Tropical Agriculturist*, 1948, *104*, 38-40.

Leaflets.—T. S. Raghavan: "Further Notes on Seedling Selection", Leaflet No. 14—August 3, 1948.

Press Articles.—The Director's annual review of the Ceylon Coconut Industry appeared in *The Times of Ceylon* (Estates and Industries Supplement), March 6, 1948, under the caption "Coconut Industry must put profits back into the land". The Director's address to the Kurunegala Planters' Association on May 12, 1948, was printed in the *Ceylon Daily News*, May 13 and 14, 1948.

Reprints of all the above publications are available.

(*ii*) *Library.*—On December 31, 1947, the library contained 740 books and 1,229 bound volumes of periodicals. The principal purchase during the year was the latest reprint of the *Encyclopædia Britannica* (24 volumes and 1947 Year Book).

Grateful acknowledgment is made to Government Departments and Research Organizations, overseas, which send exchange publications. An addition to the list in 1948 was *Pacific Science*, published by the University of Hawaii.

Visitors are welcome to use the Library for reference on working 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. Visitors

Overseas visitors included Dr. H. W. Jack, Agricultural Adviser to the Commissioner-General, S. E. Asia (June 10); Mr. J. C. Clunies Ross of the Keeling Cocos Island (November); and Mr. G. V. Jacks, Director, Commonwealth Bureau of Soil Science, England (November 30).

The Hon. Mr. Dudley Senanayake, Minister of Agriculture and Lands, visited the station on September 14, and also inspected Ratmalagara Estate.

Dr. A. R. Lowe, Principal Research Officer, and Mr. J. E. R. Hensman, Industrial Chemist of the Department of Industries, visited the Station on May 21.

The students of the School of Agriculture, Peradeniya, paid their annual visit on December 20.

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7. Lectures, Meetings, &c.

(*a*) The Director gave the following lectures, on May 12, to the Kurunegala Planters' Association on "Progress in the Coconut Industry's Recovery Programme". On July 23, to the Ceylon Natural History Society in Colombo on "The Origin and Geographical Distribution of the Coconut".

The following papers were read at the Annual Sessions of the Ceylon Association of Science held in December:—

"The Potash Content of Coconut Water as a Guide to Manuring of Coconut Palms" by Dr. M. L. M. Salgado.

"Preliminary Studies in Cattle Manuring on Coconut Estates" by Dr. M. L. M. Salgado and Mr. L. A. Fernando.

(*b*) The Staff Officers attended meetings of the Low Country Products Association, Chilaw-Negombo Planters' Association and the Kurunegala Planters' Association, during the year.

The Director, as a member of the Coconut Board, attended most of the monthly meetings.

The Estates

8. Bandirippuwa Estate

Crops harvested during 1948 were:

Crop No.	*Nuts from Estate Area*	*Nuts from Research Area*	*Total*	*Average 1931–1947*	*1948, Above or Below Average*
I ..	89,605 ..	22,135 ..	111,740 ..	66,673 ..	+ 66·1 per cent.
II ..	118,640 ..	30,156 ..	148,796 ..	111,456 ..	+ 33·5 ,,
III ..	96,736 ..	29,721 ..	126,457 ..	132,362 ..	— 4·4 ,,
IV ..	89,247 ..	22,141 ..	111,388 ..	118,084 ..	— 5·7 ,,
V ..	51,043 ..	14,423 ..	65,466 ..	77,037 ..	— 15·0 ,,
VI ..	25,385 ..	8,214 ..	33,599 ..	63,548 ..	— 47·1 ,,
	470,656	126,790	597,446	569,160	+ 5·0 ,,

The virtual failure of the North East Monsoon rains in the latter part of 1947 was reflected in the 1948 crops, which were abnormally above average for the first two crops, and below average for the latter pickings.

The nuts were disposed of as follows:—

Sold to mills	97,468	
Sold for planting	24,260	
Supplied to nurseries for research work ..	5,132	
Cured for copra	455,688	
Loss in copra kiln fire	7,200	
Rejections and shorts	7,698	(1·3 per cent.)
	597,446	

The 455,688 nuts cured gave 325 candies, 377 lb. of copra, an out-turn of 1,399 nuts to a candy; the nuts of the fourth and fifth crops were particularly small.

The revenue from Bandirippuwa Estate actually accruing in 1948 was:

Revenue from Estate Management	Rs. c.	Rs. c.
Crops 1947—		
Sale of nuts	4,067 80	
Sale of copra	7,390 2	
		11,457 82
Crops 1–5, 1948—		
Sale of nuts	11,378 48	
Sale of copra	39,511 75	
		50,890 23
Sale of husks	1,738 46	
Sale of shells	514 5	
		2,252 51
Sundries	9 8	
		9 8
		64,609 64

Revenue from Research Management	Rs. c.	Rs. c.
Crops 1947—		
Sale of nuts	—	
Sale of copra	2,546 17	
		2,546 17
Crops 1–5, 1948—		
Sale of nuts	—	
Sale of copra	11,389 74	
		11,389 74
Sundries	5 45	
		5 45
		13,941 36

Total from revenue for 1948 was thus Rs. 78,551 which may be summarized as follows:—

	Rs. c.	
Sale of 145,302 nuts realising	15,446 28	Rs. 106·30 per 1,000 nuts
Sale of 26 tons 0 cwt. 1 qr. 11 lb. white copra realising	21,720 72	Rs. 208·67 per candy
Sale of 67 tons 5 cwt. 0 qr. 8lb. ord. copra	39,116 96	Rs. 145·40 per candy
Sale of 238,341 husks realising	1,738 46	Rs. 7·30 per 1,000 husks
Sale of 213,150 shells realising	514 5	Rs. 2·42 per 1,000 shells
Sale of sundries	14 53	
	78,551 0	

Expenditure for the year totalled Rs. 24,780.89 for the estate area, Rs. 3,804.34 for research area. Estate receipts therefore exceed expenditure by Rs. 39,828.75, and research receipts exceeded expenditure by Rs. 10,137.02 Cost of production of nuts on the estate area (including copra curing, transport expenses and depreciation on kiln) was Rs. 52.66 per 1,000 nuts.

Sundry Debtors and Creditors Accounts.—Of the income accruing in 1948 and included in the above statement, Rs. 11,457.82 (estate) and Rs. 2,546.17 (research) from 1947 crops, had been credited to the Estate Working Account for 1947 through Sundry Debtors Account. The Estate Working Account for 1948 does not, therefore, include these sums. The following amounts have been credited to the Estate Working Account on account of 1948 crops lying unsold at the end of the year:—

		Rs. c.	Rs. c.
1948 6th crop (Estate)	Nuts	2,010 90	
	Copra	2,663 46	
			4,674 36
1948 6th crop (Research)	Nuts	769 80	
	Copra	1,496 60	
			2,266 40
			6,940 76

The Bandirippuwa Estate Working Account for 1948 thus shows a balance of Rs. 42,854.83 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 Airports, Ratmalana, and to R. A. F. Headquarters. Monthly abstracts of all observations are sent to the Colombo Observatory.

The rainfall in 1948 totalled 78.35 inches against an average (1933-1948) of 76.77 inches. Rainy days numbered 162; wet days (0.04 inches or over) 125. The corresponding figures for 1947 were 59.93 inches falling on 159 rainy days (133 wet days). A fall of 10.62 inches of rain was recorded for the 24 hours early 8 a.m. on October 21, 1948, a record for the station.

An absolute drought of 24 days was experienced between February 11 and March 5, inclusive. Only traces of rain fall in the 30 days between August 14 and September 12, inclusive.

9. Ratmalgara Estate

A record total of nuts was harvested in 1948 as follows:—

Crop No.	*1948*	*1947*	*Average 1938–1946**
I ..	86,619 ..	24,093 ..	29,756
II ..	25,445 ..	51,583 ..	38,323
III ..	31,387 ..	52,779 ..	46,305
IV ..	80,826 ..	52,524 ..	44,240
V ..	39,344 ..	41,418 ..	39,482
VI ..	66,968 ..	31,455 ..	26,333
	330,589	253,852	224,629

* Details of all crops for 1938 to 1946 will be found in last year's report.

Crops were disposed of as follows:—

Sold (crops 2 & 4) ..	..	90,727
Cured for copra ..	..	233,516
Rejections ..	..	6,346 (1·9 per cent.)
		330,589

The 233,516 nuts cured gave 180 candies, 191 lb. of copra, equivalent to an out-turn of 1,295 nuts per candy.

The revenue actually accruing during the year was:

Revenue from Estate Management	*Rs. c.*	*Rs. c.*	*Revenue from Research Management*	*Rs. c.*	*Rs. c.*
Crops 1947—			*Crops 1947*—		
Sale of nuts ..	2,787 7		Sale of nuts ..	561 0	
Sale of copra ..	734 32		Sale of copra ..	226 62	
		3,521 39			787 62
Crops 1948—			*Crops 1948*—		
Sale of nuts ..	9,609 85		Sale of nuts ..	1 25	
Sale of copra ..	18,030 39		Sale of copra ..	7,105 2	
		27,640 24			7,106 27
Sale of sundries ..	247 62		Sale of pines ..	430 5	
		247 62	Sale of suckers ..	297 50	
					727 55
			Sundries ..	430 94	
					430 94
		31,409 25			9,052 38

Total gross revenue in 1948 was thus 40,461.63, which may be summarized as follows:—

	Rs. c.	
Sale of 121,164 nuts realising ..	.. 12,969 17	Rs. 106·95 per 1,000
Sale of 45 tons 13 cwt. 1 qr. 22 lb. ord. copra ..	.. 26,006 35	Rs. 142·34 per candy
Sale of pineapples (7,167 lb.) ..	.. 430 5	Rs. 0·06 per lb.
Sale of 5,950 suckers	.. 297 50	Rs. 0·05 per sucker
Refund on Citrus nursery and rubber seed garden ..	.. 673 56	
	40,461 63	

18359

21092

Expenditure for the year totalled Rs. 18,869.67 for estate area and Rs. 2,808.60 for research area.

Cost of production of nuts on estate area (including copra curing and transport expenses) was Rs. 65.60 per 1,000 nuts.

Sundry Debtors and Creditors Account.—Of the income accruing in 1948 and included in the above statement, Rs. 3,521.39 (estate) and Rs. 787.62 (research) from 1947 crops had been credited to the Estates Working Account for [illegible] through Sundry Debtors Account. The Estate Working Account for 19[illegible] does not, therefore, include this sum. The following amounts have been credited to Estates Working Account on account of 1948 crops lying unsold at the end of the year:—

		Rs. c.
1948 crops (Estate copra)	.. ..	3,536 69
(Research copra)	.. ..	1,097 1
		4,633 70

The Ratmalagara Estate Working Account for 1948 thus shows a balance of Rs. 20,149.68 carried forward to revenue.

Weather Records.—The usual records were kept of rainfall and of hours of bright sunshine. Monthly statements of these are sent to the Colombo Observatory. Rainfall in 1948 totalled 52.75 inches falling on 94 rain days. Corresponding figures in 1947 were 47.16 inches on 121 rain days.

Hours of bright sunshine average daily 7.3. Previous records are 1943—6.7; 1944—6.9; 1945—7.7; 1946—7; 1947—6.9.

10. Visiting

Mr. B. Parker, Visiting Agent, inspected the estate on March 5 and 6 and August 16 and 17. His reports were circulated to the members of the Board of Management.

11. Finance

The audited statements of accounts for 1948 are appended.

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

Peradeniya, January 5, 1950.

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Statement of Receipts and Disbursements for the Year ended December 31, 1948

(In Compliance of Section 5 (2) of Ordinance No. 29 of 1923)

Receipts	Rs. c.		*Disbursements*	Rs. c.	
Balance at January 1, 1948		216 462 2	Capital Account :—		
			New clearing	8,449	25
A.—Revenue Account :—			Laboratory equipment	1,002	20
Annual grant from Government	30,000 0		Office equipment	985	72
Contributions for 1948	26,842 10		Office furniture	937	70
Interest	11,721 65		Bungalow furniture	2,215	45
			Labour cottage at Ratmalagara Estate	1,833	77
Income from Bandirippuwa Estate—			Nursery cottage at Ratmalagara Estate	186	35
Estate area	53,982 35		New buildings at Bandirippuwa Estate	60	0
Research area	11,209 32		Draught animals	295	0
			Depreciation reserve	7,457	39
Income from Ratmalagara Estate—			Personal Emoluments :—		
Estate area	28,809 45		Salaries to Senior Staff	81,255	92
Research area	8,264 76		Salaries to Junior Staff	25,119	54
			Rent allowance	1,593	60
Other income—			Dearness allowance	29,350	12
Sale of planting material	23,816 34		Provident Fund Bonus and Interest for 1948	10,783	76
Charges to Staff for electricity	949 50		Rehabilitation Account :—		
Sundry receipts	4,809 77		Propaganda	224	81
Sale of Publications	144 18		Field day	162	11
Rental for Telephone	89 0		Sandalankawa Nursery	2,607	0
			Co-operative advisory work	7,095	30
B.—Advance Accounts :—			New Nursery at Ratmalagara Estate	7,959	71
Department of Agriculture Advance Account	23,775 0		Other Charges :—		
Repayments of loans by staff	9,455 25		Travelling expenses to staff	13,956	35
Rice and sugar	2,226 39		Travelling expenses to Board members	3,289	60
Kerosene oil	70 21		Office :—		
Bulbs	72 52		Entertainment allowance	165	20
General stores	2,703 91		Stationery	805	52
Fertiliser Advance Account, Bandirippuwa Estate	3,924 35		Postages	1,158	87
Fertiliser Advance Account, Ratmalagara Estate	3,792 24		Printing and advertising	4,081	41
Poonac Account	233 34		Incidental expenses	786	32
Ratmalagara Estate Brick Accounts	196 70		Telephone rental	396	0
			Workmen's compensation insurance	105	10
C.—Reserve Accounts :—			Maintenance of office equipment	508	73
Staff Contributions to Provident Fund	7,565 90		Cost of Audit	1,068	10
Scheme's Bonus and Interest	10,782 76		Laboratories :—		
			Upkeep	1,735	92
D.—Sundries :—			Scientific books	7,359	23
Secretary-Accountant's security	7,000 0		Petrol stores	561	82
Loan from Government	50,000 0		Buildings :—		
			Upkeep	4,616	20
Sundry Debtors— Rs. c.			Insurance	1,497	85
Interest 953 24			Running expenses of Electrical Plant	4,231	6
Cess collections 7,818 11			New well	966	90
Income from Bandirippuwa Estate—			Estates :—		
Estate area 14,512 43			Bandirippuwa Estate—		
Research area 4,640 48			General charges	7,347	49
Sale of planting materials 261 43			Upkeep	4,250	62
	21,191 65		Foodcrops	185	24
			Cultivation and manuring	4,880	70
			Collection	4,497	4
			Cadjan account	71	60
			Replanting	2,012	32
			Patent kiln	1,199	5
			Ratmalagara Estate—		
			General charges	7,295	34
			Upkeep	1,723	28
			Food crops	1,033	80
			Cultivation	4,318	87
			Collection	2,139	98
			Patent kiln	879	49
			Research :—		
			General	2,014	52
			Botanical work	9,124	11
			Soil Chemist's work	7,895	97
			Purchase of planting material	23,174	98
			Advance Accounts :—		
			Poonac	233	50
			Rice and sugar	2,622	31
			Kerosene oil	68	84
			Department of Agriculture Advance Account (Replanting)	12,762	12
			General stores	7,216	74
			Fertiliser advance account, Bandirippuwa	6,293	72
			Fertiliser advance account, Ratmalagara	3,662	63
			Bulbs	95	70
			Investments :—		
			Post Office Savings Bank	6,000	0
			Ceylon Savings Bank	6,000	0
			National development loan	125,000	0
			Ceylon Savings certificates	720	0

Bank Reconciliation Statement

No. 1 Account	Rs. c.	
Balance as per Cash Book	82,695 5	
Add value of cheques unpaid	6,963 47	
	89,658 52	
Less credit not gone into Bank	1 87	
Balance as per Bank statement	89,656 65	

Receipts	Rs. c.	*Disbursements*	Rs. c.
No. 2 Account		Sundries :—	
Balance as per Cash Book ..	6,000 0	Sundry debtors (amount at credit on account of Set books)	24 64
Add value of cheques uncashed .	5,750 34	Loans to staff	9,741 0
	11,750 34	Purchase of Kandewatta	188 0
Less credit not gone into Bank .	6,524 8	Sundry creditors :—	
Balance as per Bank statement .	5,225 26	Staff travelling .. Rs. c.	
		Postages .. 44 62	
		Running expenses of electrical plant .. 56 60	
		General charges R/E .. 17 80	
		Collection R/E .. 43 99	
		Collection R/E .. 372 94	
		Research—I .. 15 0	
		Botanical work .. 72 28	
		Soil Chemist's work .. 714	
		Purchase of planting material 832 87	
		Depreciation reserve .. 1,039 10	
			3,224 3
			476,416 1
		Balance at December 31, 1948 :	
		No. 1 account	82,695 5
		No. 2 account	6,000 0
		Petty cash account	2,000 0
	567,111 6		567,111 6

Ratmalagara Estate Working Account, 1948

	Rs. c.	Rs. c.		Rs. c.	Rs. c.
Estate Expenses :—			Income :—		
Superintendence and watchers	4,674 42		Estate area—		
General charges ..	4,598 59		By sale of nuts ..	9,649 47	
Upkeep	1,723 26		By sale of copra ..	21,567 8	
Cultivation and manuring ..	4,318 87		By sale of sundries ..	405 37	
Picking, collection and curing .	2,423 18				31,621 92
		17,738 34	Research area—		
Research Expenditure on Estate Account :—			By sale of nuts ..	1 25	
Rubber seed, garden and citrus nursery	715 37		By sale of copra ..	8,202 3	
Botanist's block ..	601 5		By sale of sundries ..	1,502 75	
Soil Chemist's block ..	1,492 18				9,706 3
		2,808 60			
Other expenses :—					
Food crops .. 1,036 90					
Less Income . 522 57					
	514 33				
Depreciation and animals ..	117 0				
		631 33			
To revenue account ..		.. 20,149 08			
		41,327 95			41,327 95

Bandirippuwa Estate Working Account, 1948

	Rs. c.	Rs. c.		Rs. c.	Rs. c.
Estate Expenses :—			Income :—		
Superintendence and watchers	3,552 34		Estate area—		
General charges ..	6,551 18		By sale of nuts ..	13,389 32	
Upkeep	4,250 62		By sale of sundries ..	2,961 59	
Manuring and cultivation ..	4,880 70		By sale of copra ..	42,153 43	
Picking, collection and curing .	4,681 29				57,804 34
		23,916 13	Research area—		
Research Expenditure on Estate Account :—			By sale of nuts ..	769 80	
Botanist block ..	545 36		By sale of copra ..	12,880 47	
Soil Chemist block ..	3,258 98		By sale of sundries ..	5 45	
		3,804 34			13,655 72
	Rs. c.				
Other Expenses :—					
Food crops ..	185 74				
Less income ..	86 83				
		98 91			
Cadjan account	71 60				
Less sundries .	60 2				
		11 58			
Depreciation Reserve :—					
Patent kiln ..	667 87				
Draught animals	86 40				
		754 27			
		864 76			
To revenue account ..		.. 42,854 89			
		71,440 6			71,440 6

Nursery Working Account, 1948

	Rs. c.	Rs. c.		Rs. c.
Planting Material :—			Income :—	
To Purchase of seed nuts	16,723 84		By sale of seedlings	14,803 0
Picking &c.	48 55		By sale of seednuts	8,048 25
Transportation	678 92		By refund of transport charges	622 59
		17,451 31		
Nurseries :—				
To Preparation, maintenance, &c.	6,537 20			
Manure	38 2			
Repairs to road and culvert	620 0			
Implements &c.	31 5			
		7,283 27		
Nursery Attendants (Four) :—				
Salaries and allowance and other emoluments	4,428 16			
Travelling	1,319 96			
		5,748 12	By loss carried forward to Revenue Account	6,018 80
		30,482 70		30,482 70

Revenue Account, 1948

Expenditure	Rs. c.	Rs. c.	Revenue	Rs. c.	Rs. c.
To Administration and Technological Chemist :—			By Annual Government grant	30,000 0	
			Cess collections for 1948	45,213 25	75,213 25
			Interest on investments	13,038 1	
			Charges to staff for electricity	949 50	
			Sale of publications	144 18	
Personal emoluments —			Sundry receipts	4,809 77	18,941 46
Salaries	33,754 85		By Estates :—		
Dearness allowance	10,311 80		Bandirippuwa working a/c	42,854 83	
Rent allowance	779 51		Ratmalagara working a/c	20,149 68	63,004 51
Provident Fund Bonus and interest	5,376 30	50,222 52			157,159 22
Other charges :—					
Travelling	3,295 26		By Advance account profit on Sugar Account	3 80	
Travelling board	3,280 60	6,575 86	Less loss of kerosene oil account	3 22	0 58
Office :—					
Stationery	855 57				
Postage	1,216 57				
Printing and advertising	4,373 25				
Legal expenses	168 0				
Incidental expenses	780 93				
Telephone rental	315 0				
Entertainment allowance	165 30				
Maintenance of Office equipment	241 23				
Compensation Insurance	105 99				
Audit charges	1,948 10	9,254 65			
Reserve Funds :—					
Depreciation	6,795 62				
Passage	1,000 0	7,795 62			
Buildings :—					
Upkeep	4,618 76				
Insurance	1,897 82				
Running expenses of electrical plant	4,362 51				
Well and petrol store	1,668 97	12,546 6			
Laboratory and library—					
Upkeep of laboratory	2,510 32				
Scientific books and periodicals	2,459 65	4,969 97			
To Research :—					
Research—I (General)		1,614 40			
To Soil Chemist :—					
Salaries	10,765 50				
Dearness allowance	8,053 62				
Rent allowance	504 46				
Provident Fund bonus	2,603 11				
Travelling	4,713 74				
Research—III	8,636 52				
	44,284 95				
Less 50 per cent. charged to Special Vote	22,142 47	22,142 48	C/D		157,159 80

	Rs. c.	Rs. c.		Rs. c.
Botanist :—			B/F	157,159 80
Salaries ..	18,504 39			
Dearness allowance ..	6,049 86			
Rent allowance	416 72			
Provident Fund Bonus and interest ..	1,994 1			
Travelling ..	6,164 26			
Research—II ..	13,427 65			
	46,856 89			
Less 75 per cent. charged to Special Vote ..	35,142 66			
		11,714 23		
Loss on nursery working account ..		6,018 86		
Depreciated value of hot air drier at Ratmalagara Estate dismantled and now written off		1,216 28		
		134,071 9		
Excess revenue over expenditure to Balance Sheet ..		23,088 71		
		157,159 80		157,159 80

Capital Account

	Rs. c.	Rs. c.		Rs. c.
On Revenue Account :—				
To Replanting Bandirippuwa Estate	2,042 32		By Transfer to Revenue Account adjusted in Balance Sheet	
		2,042 32	Transfer to Capital Special account adjusted in Balance Sheet ..	17,390 42
Ratmalagara Estate New Clearing V/B	9,088 8			8,087 70
Cottages at Ratmalagara Estate	2,016 12			
		11,104 20		
Cart bulls Ratmalagara ..	225 0			
		225 0		
Bungalow furniture ..	2,215 45			
		2,215 45		
Office furniture ..	937 70			
Office equipment ..	865 75			
		1,803 45		
Special Capital Grant :—				
Laboratory equipment ..	1,228 30			
Patent Kiln at R/E ..	879 49			
		2,107 79		
Co-operative Nurseries (Sandalankawa)	2,660 20			
Ratmalagara new nurseries ..	2,959 71			
Seedlings issued ..	300 0			
		5,919 91		
Buildings :—				
Hostel	60 0			
		60 0		
		25,478 12		25,478 12

Expenditure on Special Recurrent Vote for 1949

	Rs. c.	Rs. c.		Rs.
Advisory section :—			By Balance as per Balance Sheet ..	150,000
Operative Adolumenta of Adpersonal Efficers (3)—				
Salary, allowances, &c. ..	4,814 22			
Provident Fund Bonus and interest ..	259 14			
		5,073 36		
Charges :—				
Advertising, &c. ..	104 0			
Travelling	1,702 43			
Stationery	174 65			
Field Day	142 11			
Propaganda	234 34			
		2,357 53		
Coconut Research Scheme expenditure charged to the Vote :—				
Chemist division expenditure Research—III ..	44,284 95			
Less 50 per cent. charged to C. R. S. revenue account ..	22,142 48			
		22,142 47		
Botanist's division expenditure Research—II ..	46,856 89			
Less 25 per cent. charged to C. R. S. revenue account ..	11,714 23			
		35,142 66		
		64,716 2		
Balance carried to Balance Sheet		85,283 98		
		150,000 0		150,000 0

Depreciation Account, 1948

Items	Depreciation at	Capital Value	Depreciation Reserve at Jan. 1, 1948	Depreciation Value on Jan. 1, 1948	Additions in 1947	Value on Jan. 1, 1948	Depreciation in 1948
	Per cent.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.
1. Buildings	2	203,854 3	65,256 92	138,617 11	1,596 64	140,213 75	2,804 27
2. Laboratory structures	3	64,297 31	22,973 23	41,324 8	309 71	41,633 79	832 67
3. Laboratory equipment	10	31,932 46	19,259 63	12,672 83	—	12,672 83	1,267 28
Gas plant	10	3,436 83	2,729 20	707 63	—	707 63	70 76
5. Steel bows furniture	5	4,948 44	2,175 33	2,773 11	—	2,773 11	138 65
6. Office furniture	5	2,139 72	1,086 30	1,053 42	—	1,053 42	52 67
7. Locomobiles and Engines	12½	17,503 61	5,233 6	12,270 55	701 76	12,972 30	1,621 53
8. Museum	5	276 20	120 30	155 90	—	155 90	7 79
9. Patent kiln B/F	10	4,067 26	596 84	4,064 10	2,014 62	6,078 78	607 87
10. Hot air driers B/F	10	1,432 91	216 53	1,216 38	—	1,216 38	—
11. Implements B/F	10	900 0	90 0	864 0	—	864 0	86 40
12. Animals B/F	10	1,300 0	130 0	1,170 0	—	1,170 0	117 0
		336,168 77	118,679 66	217,489 11	4,622 78	220,111 89	7,686 89

Balance Sheet as at December 31, 1948

Liabilities	Rs. c.	Rs. c.	Assets	Rs. c.	Rs. c.
1. Capital Outlay:			1. Buildings:		
At December 31, 1947	649,043 60		At December 31, 1947	303,873 5	
In 1948	29,473 12		In 1948	3,076 12	
		644,231 81			306,950 15
2. Passage Fund:			2. Estates:		
At December 31, 1947	162 72		Bandirippuwa	187,554 58	
In 1948	1,000 0		Ratmalagara	73,138 5	
		1,162 72			260,692 63
3. Provident Fund:			3. Improvements to Estates:		
At December 31, 1947	85,887 80		Previously	10,918 48	
In 1948	18,451 72		In 1948—		
		94,339 52		Rs. c.	
4. Depreciation Reserve:			Bandirippuwa	2,042 32	
At December 31, 1947	118,679 66		Ratmalagara	9,088 8	
In 1948	7,686 89			11,130 40	
	126,316 55				22,048 88
	Rs. c.		4. Animals:		
Less expenditure from revenue in 1948	7,467 93		Previously	2,580 0	
Repairs to Patent kiln	1,190 5		In 1948	225 0	
	8,658 98				2,805 0
	117,689 57		5. Estate Kilns:		
Less reserve on hot-air drier dismantled	216 53		Bandirippuwa	4,067 26	
		117,473 4	In 1948	879 49	
5. Sundry creditors in 1948	1,247 42				4,946 75
Surpass account	871 29		6. Laboratory buildings		64,297 31
Government loan	50,000 0		7. Laboratory equipment:		
Accountant's security	2,000 0		Previously	41,908 32	
		54,118 71	In 1948	1,228 30	
Special capital grant account:					43,136 62
Factory account		250,000 0	8. Gas plant		3,436 83
Buildings	60,000 0		9. Furniture:		
Less expenses	60 0		Bungalows—		
		59,940 0	Previously	5,398 44	
Equipment account at December 31, 1947	32,762 80		In 1948	2,215 45	
Less expenses in 1948	2,107 79			7,613 89	
		30,654 71	Office—		
Nurseries, &c., at December 31, 1947	19,366 25		Previously	2,523 87	
Less expenses in 1948	5,919 91		In 1948	1,803 45	
		13,446 34		4,327 32	
Special grant	150,000 0				11,941
Less expenses as per statement 1948	64,716 8		10. Accumulators		17,502 21
		85,283 92	11. Museum		276 20
Sundries excess receipts on rice advance account		38 22	12. Co-operative Nurseries:		
			Previously	133 75	
			In 1948	5,919 91	
					6,053 6
			13. Sundry debtors:		
			Cess collections	8,371 15	
			Interest accrued	1,063 83	
			Bandirippuwa Estate work account	4,374 56	
			Ratmalagara Estate work account	5,136 71	
			Books and periodicals	24 64	
			Replanting division account	6,776 15	
					25,747
			14. Advance Accounts:		
			Fertilizers	3,891 52	
			Bulbs and poonac	73 4	
			Transport loans to staff	9,223 23	
			General stores adv. accounts	5,457 67	
					18,585
		1,341,479 5			

	Rs. c.		Rs. c.	Rs. c.
B/F	1,341,479 05	15. Investments:		
		Ceylon Government 3½ per cent., 1957–62 Loan ..	Rs. c. 50,400 0	
		Ceylon Home Defence Loan	20,000 0	
		Ceylon National Loan ..	20,000 0	
		Ceylon National Development Loan ..	375,000 0	
		State Mortgage Bank debentures ..	5,000 0	
		Ceylon Savings Certificates .	20,850 17	
		12-Year Savings Certificates	8,000 0	
		Ceylon Savings Bank ..	13,281 1	
		Bank of Ceylon Savings account ..	10,[illegible] [illegible]	
		Post Office Savings Bank ..	10,018 33	
				941,69[illegible] [illegible]
		16. Deficit Account:		
		Excess of revenue over expenditure ..	23,088 71	
		Less capital expenditure charged to revenue ..	17,390 42	
			5,698 29	
		Deficit from 1947 Balance Sheet ..	45,186 18	
				50,887 90
		17. Bank accounts: Rs. c.		
		No. 1 account .. 82,695 5		
		Less replanting account .. 17,775 0		
			64,920 5	
		No. 2 account ..	6,000 0	
		Cash in hand ..	2,000 0	
				72,920 5
	1,341,479 5			1,341,479 5

Lunuwila, June 17, 1949.

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

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, August 31, 1949.

P. W. KAULE,
for Auditor-General.