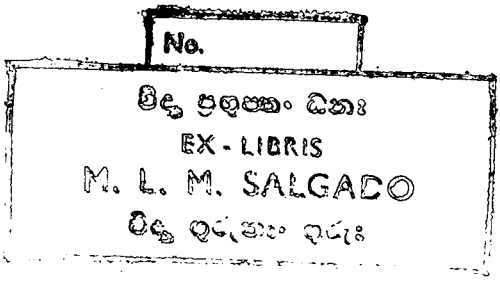
SESSIONAL PAPER VIII—1959

Annual Report of the Coconut Research Board of the Coconut Research Institute for 1957



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ANNUAL REPORT OF THE COCONUT RESEARCH BOARD OF THE COCONUT RESEARCH INSTITUTE FOR 1957

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

REPORT OF THE CHAIRMAN

On January 1, 1957, the Coconut Research Board consisted of the following :—

Ex-officio Members

Chairman—The Director of Agriculture : Dr. M. F. Chandraratne, M.B.E., Ph.D., B.Sc., (Lond.) D.I.C.

Treasury Representative : Mr. E. B. Wiratunge.

Coconut Rehabilitation Commissioner : Mr. B. Mahadeva, C.C.S.

Chairman, Low Country Products Association : Senator E. W. Kannangara, C.B.E., J.P., B.A. (Lond.).

Director (Interim) Coconut Research Institute : Prof. S. C. Harland, F.R.S. (until February, 1957).

Acting Director, Coconut Research Institute : Dr. M. L. M. Salgado, Ph.D. (Cantab.), B.Sc. (Lond.), Dip. Agric. (Cantab.) (from February, 1957).

Senators and Members of Parliament nominated by the Hon. Minister :

Mr. J. C. W. Munasinghe, M.P., Parliamentary Secretary to the Minister of Industries and Fisheries, Mr. W. I. Hugh Fernando, M.P.

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

Representatives of the Low Country Products' Association : Mr. Wace de Niese, Mr. C. A. M. de Silva.

Representatives of the Small-holders nominated by the Hon. Minister : Mr. E. Muttukumaru, J.P., Mrs. L. J. de S. Seneviratne.

Mr. A. W. Warburton Grey, resigned from the Board and was succeeded by by Mr. G. B. Middleton in April, 1957.

Prof. S. C. Harland, F.R.S., who was Director (Interim) from 8th November, 1956, was succeeded by Dr. M. L. M. Salgado as Acting Director as from 8th February, 1957.

Mr. Wace de Niese, was succeeded by Senator Thomas Amarasooriya from May, 1957.

Dr. M. F. Chandraratne, was away on an overseas mission during the last quarter of the year. Mr. S. S. H. de Silva, C.C.S., acted as Chairman during this period.

Meetings

Nine meetings of the Coconut Research Board were held during the year—January 28th, February 25th, April 2nd and 8th, May 15th, June 12th, July 10th, August 19th, September 30th and October 24th.

Committees

Administration Committee (Personnel at 1st January, 1957) :

(1) Dr. M. F. Chandraratne, Chairman.
(2) Mr. E. B. Wiratunge,
(3) Mr. W. I. Hugh Fernando, M.P.,
(4) Mr. J. C. W. Munasinghe, M.P.,
(5) Mr. C. A. M. de Silva,
(6) Senator E. W. Kannangara,
(7) Dr. M. L. M. Salgado, Acting Director, Coconut Research Institute.

17th, 18th, 19th and 20th meetings were held on April 2nd, July 1st, 19th October and 1st December.

Research Committee (Personnel at 1st January, 1957) :

(1) Mr. E. Muttukumaru, Chairman,
(2) Mr. A. W. Warburton Grey,
(3) Dr. M. F. Chandraratne,
(4) Mr. Wace de Niese,
(5) Mr. C. T. Van Geyzel, and
(6) Dr. M. L. M. Salgado, Acting Director, Coconut Research Institute.

20th, 21st, 22nd, 23rd, and 24th were held on 10th January, 28th March, 18th May, 12th August, 28th September.

Extension Committee (Personnel at January 1st, 1957) :

(1) Mr. C. T. Van Geyzel, Chairman,
(2) Mr. C. A. M. de Silva,
(3) Mr. W. I. Hugh Fernando, M.P.,
(4) Mr. A. W. Warburton Grey,
(5) Mr. B. Mahadeva,
(6) Mr. E. Muttukumaru,
(7) Mrs. L. J. de S. Seneviratne, and
(8) Dr. M. L. M. Salgado, Acting Director, Coconut Research Institute.

17th and 18th meetings were held on 28th March, and 9th October.

Salaries Sub-Committee (Personnel at January 1st, 1957) :

(1) Senator E. W. Kannangara, Chairman,
(2) Mr. C. A. M. de Silva,
(3) Mr. E. B. Wiratunge,
(4) Mr. B. Mahadeva,
(5) Mr. W. I. Hugh Fernando,
(6) Mr. J. C. W. Munasinghe, and
(7) Dr. M. L. M. Salgado, Acting Director, Coconut Research Institute.

Four meetings were held on 11th March, 18th March, 18th July, and 26th November.

Sub-Committee on Land Purchases :

(1) Mr. G. B. Middleton,
(2) Mr. C. A. M. de Silva,
(3) Dr. M. L. M. Salgado, Acting Director, Coconut Research Institute.

M. F. CHANDRARATNE,
Chairman, Coconut Research Board.

ANNUAL REPORT OF THE ACTING DIRECTOR (1957)

STAFF of the Coconut Research Institute at the end of 1957 were as follows :—

ADMINISTRATION DIVISION

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

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

SOIL CHEMISTRY DIVISION

Soil Chemist : Dr. M. L. M. Salgado, Ph.D. (Cantab.), B.Sc., (Lond.), Dip. Agric. (Cantab.),
Research Assistant : Mr. D. A. Nethsinghe, B.Sc. (Ceylon), A.R.I.C. (Lond.), on overseas study leave
Officer-in-Charge : Mr. V. Nalliah.

CHEMISTRY DIVISION

Chemist : Mr. W. R. N. Nathanael, B.Sc. (Lond.), M.Sc. (Lond.), A.R.I.C.,
Research Assistant : Mr. T. S. Balakrishnamurthi, B.Sc. (Lond.).

BOTANY DIVISION

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

AGRONOMY DIVISION

Acting Agronomist : Mr. K. Santhirasegaram, B.Sc., Hons. (Cey.),
Research Assistant : Vacant,
Animal Husbandry Officer : Mr. G. C. M. Goonesekera.

PLANTING DIVISION

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

ADVISORY DIVISION

Chief Advisory Officer : Muhandiram E. A. Peiris,
Understudy : Mr. C. A. Wickramasooriya, B.Sc. (Cey.).

CROP PROTECTION DIVISION

Crop Protection Officer : Mr. H. F. Goonewardene, B.Sc. (Sydney), B. Agric. Sc. (NZ).

PUBLIC RELATIONS DIVISION

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

BIOMETRY

Biometrician : Mr. V. Abeywardena.

ESTATES

Superintendent, Bandirippuwa Estate : Mr. D. F. Withana,
Superintendent, Ratmalagara Estate : Mr. H. J. F. Pieris,
Superintendent, Isolated Seed Garden : Mr. R. B. Rodrigo.

MECHANIC

Senior Mechanic : Mr. R. Weeraperumall.

Prof. S. C. Harland, F.R.S., Director (Interim), left the Island on 8th February, 1957. Dr. M. L. M. Salgado, Deputy Director and Soil Chemist was appointed Acting Director.

Mr. W. R. N. Nathanael, Chemist, was on six months study leave from 25th March until 25th September. He spent a part of his time at the Long Ashton Research Station, Bristol, where he made intensive studies on the practical aspects of chemical procedures for the diagnosis of mineral deficiencies in plants under the guidance of Professor T. Wallace, F.R.S., and Dr. E. J. Hewitt.

Mr. Nathanael also visited the Rothamstead and East Malling Research Stations in England and the Macaulay Institute for Soil Research in Scotland. In London, Mr. Nathanael was awarded the M.Sc., degree of the London University, in recognition of his original work on the use of Coconut Toddy as a Fermentation Substrate. Mr. Nathanael was also awarded the Associateship of the Royal Institute of Chemistry.

Mr. T. B. Paltridge (Colombo Plan), Agronomist, left the Island on 8th September, 1957, to take up an assignment in the United States as a Scientific Liaison Officer for the Australian Government.

Mr. K. Santhirasegaram, B.Sc., Hons. (Ceylon), succeeded him as Acting Agronomist.

Prof. F. Hardy, Professor of Soil Science at the Imperial College of Tropical Agriculture, Trinidad, was at the Institute for one week, to report and assess the work of the Soil Chemistry Division.

Mr. A. D. Bruce, Agricultural Officer of the Department of Agriculture, Ghana, was at the Institute for a short period during the course of his mission to Ceylon to study various aspects and methods of agriculture.

Appointments

The following new appointments were made during the year :—

Mr. P. G. F. Fernando, Laboratory Attendant to Soil Chemist as from March 1, 1957.

Mr. R. Solomon Silva, Field Attendant to Biometrician as from March 1, 1957.

Mr. A. G. K. R. P. de Silva, Field Attendant to Agronomist as from March 1, 1957.

Mr. D. E. G. Nedimala, Technical Assistant to Soil Chemist as from March 18, 1957.

Mr. R. M. de Silva, Field Assistant to Soil Chemist as from April 1, 1957.

Mr. K. A. D. W. Jinadasa, Field Attendant to Animal Husbandry Officer as from April 1, 1957.

Mr. M. Jeganathan, Technical Assistant to Chemist as from April 24, 1957.

Mr. W. P. Bertie Fernando, Technical Assistant to Botanist as from August 15, 1957.

Mr. P. V. R. Fernando, Attendant to Agronomist as from September 2, 1957.

Mr. P. J. E. Fernando, Attendant to Agronomist as from September 2, 1957.

Mr. K. P. C. Fernando, Attendant to Agronomist as from September 2, 1957.

Mr. S. M. P. Subasinghe, Technical Assistant to Crop Protection Officer as from November 1, 1957.

Muhandiram E. A. Peiris, formerly of the Department of Agriculture, was appointed as the Chief Advisory Officer with effect from 14th December, 1957.

Mr. C. A. Wickramasooriya, who was Research Assistant to the Botanist, has been appointed the Understudy to the Chief Advisory Officer with effect from the same day.

Resignations

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

Mr. H. W. Tillekaratne, Field Assistant to Soil Chemist as from January 7, 1957.

Mr. J. H. Hanisdeen, Field Assistant to Planting Officer as from December 1, 1956.

Mr. E. R. Chelliah, Technical Assistant to Chemist as from January 31, 1957.

Mr. T. M. Tikiri Banda, Field Attendant to A. H. O. as from January 2, 1957.

Mr. K. B. Cyril Fernando, Nursery Attendant to Planting Officer as from 22nd April, 1957.

Mr. H. L. L. Perera, Advisory Field Officer as from 28th June, 1957.

Confirmations

The following officers have been confirmed in their appointments:—

Messrs. R. D. Hector Appuhamy, W. Benjamin Fernando, H. Bandappuhamy as Field Attendants (Pollination) to Botanist as from 1st January 1957.

Messrs. Richard Appuhamy, W. A. Wijeratne, and F. Milton Silva as Typist Clerks.
Mr. K. Santhirasegaram, Research Assistant to the Agronomist.
Mr. M. S. Velu, Field Assistant to the Crop Protection Officer.
Mr. C. Muttuchamy, Field Assistant to the Agronomist.
Messrs. P. H. A. Gomes, W. L. H. M. Wijegunaratne, and T. D. J. R. D. Peiris as Advisory Field Officers.

Promotions

Mr. S. Edirisinghe, Nursery Attendant of the Botânist's Division was promoted as Conductor of the Isolated Seed Garden as from 1st June, 1957.
Mr. W. S. A. Tissera, Attendant was promoted Clerk/Typist (Sinhalese) with retrospective effect from 1st January, 1957.
Mr. Vincent de Paul Fernando, Nursery Attendant was promoted as Field Assistant to the Planting Officer.

Exhibitions and Field Days : As per Public Relations Officer's Report.

Meetings and Articles : As per Public Relations Officer's Report.

Publications : As per Public Relations Officer's Report.

Welfare : As per Welfare Officer's Report.

M. L. M. SALGADO,
Acting Director, Coconut Research Institute.

REPORT OF THE WELFARE OFFICER

Mr. F. H. B. Felix Silva who was in charge of welfare work since January 1, 1955, was appointed Welfare Officer in November, 1957.

There were in all 143 employees in the permanent cadre of the Institute at December 31, 1957. This excludes daily-paid minor employees and labourers in estates and outstation nurseries recruited in terms of the respective trades of the Wages Board Ordinance—numbering a little over 800 in the entire daily-paid personnel. Welfare Service is extended to all employees without distinction between any category of employees.

All applications from employees for provident fund, gratuities, medical aid, transport loan, transport of personnel, distress loans, housing loans, workmen's compensation claims, allocation, furnishing and maintenance of quarters and buildings, and generally the establishment work of the Institute have been dealt with during the year. In addition statistics pertaining to officers on whose behalf several welfare schemes are being formulated have been maintained, private financial difficulties confronting officers have been probed into confidentially and every endeavour has been made to remedy or relieve embarrassment or distress ; arrangements have been made with the C. W. E. for the supply of provisions and other essential requirements to the staff at competitive rates through the Coconut Research Institute's Co-operative Welfare Society ; a canteen has been established with an initial grant of Rs. 4,133·84 by the Board for capital expenditure. The Board has also been very generous in providing an annual grant of Rs. 1,500 towards meeting of the cost of running the Stores and Canteen. Credit purchases have been extended. Necessary encouragement has been given to all officers for investments of their savings in the Co-operative Welfare Society at which very reasonable rates of interests are paid.

Two hundred and eighty-seven applications for medical aid have been approved for payment during the course of the year and special concessions have been obtained from consultant doctors in the panel. The rates of contributions have been doubled in the case of married officers of the Institute since Januray 1, 1957—limiting up to Rs. 1,000 in the case of married Senior and Intermediate Officers and Rs. 300 in the case of married Assistant and Minor Staff Officers of the Institute. The maximum limit of the unmarried Senior and Intermediate Grade of officers has also been raised to Rs. 500.

Games, both indoor and outdoor, have been given the maximum encouragement and assistance. The highlight of the year was the fact that the Cricket Team were the "E" Division Champions of the Government Services Cricket Tournament. In the individual performances Mr. R. M. de Silva topped both the batting and bowling averages, his highest score being 213 not out vs. Prisons and 7 for 16 vs. Registrar of Companies as his best bowling performances. The general feature of the season was that unlike previous seasons the fate of the side did not hang on the performance of one man as the captain, Mr. Bertie Kurera, and a few other members helped the side to victory either with ball or bat. Mr. R. M. de Silva has been further congratulated on being selected to represent the combined Government Services Tournament side vs. Combined Mercantile Services. This is perhaps the first time in the history of Government Services Tournament Cricket that a Provincial Team won the Championship and also a member of such a team was selected to represent the Combined Government Services Team.

The Annual Christmas Party was held on December 17, 1957, with a children's sport meet and useful gifts were distributed to staff and labourers' children. The labourers and their children were also served with food bags by the chief organiser, Mrs. Irene Salgado, wife of the Acting Director.

The financial position of the Club has not been sound enough to run the entire activities of the Club. At present the annual grant of the Board is Rs. 500 and an increase to this grant is nevertheless essential in the furtherance of the Club's activities.

Liaison between the Institute and the following social welfare organisations have been maintained throughout the year in the role of promoting sound personal relationships within employees of the Institute.

Medical Aid Fund

Personnel at the end of the year 1957 :

Dr. M. L. M. Salgado, Chairman.
Mr. S. C. Kahawita.
Mr. W. R. N. Nathanael.
Mr. F. H. B. Felix Silva, Secretary, and
Mr. M. M. Perera.

Eleven meetings were held during the year to consider applications for aid.

C. R. I. Co-operative Welfare Society

Personnel at the end of 1957 :

Mr. C. W. S. de Silva, President.
Mr. S. C. Kahawita, Vice-President.
Mr. O. D. J. Wanasinghe, Hony. Secretary.
Mr. G. W. M. Wijetunge, Hony. Treasurer.
Mr. F. H. B. Felix Silva.
Mr. L. R. N. H. Perera.
Mr. G. C. M. Goonesekera.
Mr. M. B. S. Kurera, and
Mr. P. R. Fernandopulle.

Thirteen Committee Meetings, four Emergency Committee Meetings and one General Meeting were held during the year.

C. R. I. Recreation Club

Personnel at the end of 1957 :

Dr. M. L. M. Salgado, President.
Mr. W. R. N. Nathanael, Vice-President.
Mr. F. H. B. Felix Silva, Hony. General Secretary.
Mr. G. W. M. Wijetunge, Hony. Treasurer.
Mr. V. Abeywardena, Hony. Cricket Secretary.
Mr. V. Vennayagam, Hony. Tennis Secretary.
Mr. R. Almeida, Hony. Volley Ball and Badminton Secretary.
Mr. L. R. N. H. Perera, Hony. Indoor Games and Library Secretary.
Mr. K. Santhirasegaram, Committee Member, and
Mr. K. C. de Pinto, Hony. Auditor.

Five Committee Meetings and two General Meetings were held during the year.

The Assistant Staff and Minor Staff Officers formed an Employees Union to promote and further the interests of the employees of the Institute in respect of their remuneration, prospects and privileges and generally their conditions of employment. The Coconut Research Board has recognised this Union and arrangements have been made to register it under the Trade Union Ordinance. The following office bearers were elected at its inaugural meeting:—

President	..	Mr. G. W. M. Wijetunge.
Vice-Presidents	..	Mr. T. Ganarajah.
	..	Mr. G. C. M. Goonesekera.
Joint Secretaries	..	Mr. F. H. B. Felix Silva.
	..	Mr. J. A. Cadelis.
Treasurer	..	Mr. G. Rajapakse.
Committee Member		Mr. M. M. Perera.
Hony. Auditor	..	Mr. M. B. S. Kurera.

F. H. B. Felix Silva,
Welfare Officer, Coconut Research Institute.

REPORT OF THE SOIL CHEMIST

I. Field Experiments

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

The 22nd year of this experiment was completed in November, 1957. The stepped up levels of potash were maintained as for the ninth manuring.

K_0	is now	K_1	—	0.75 lb. K_2O
K_1	is now	K_2	—	1.50 lb. K_2O
K_2	is now	K_3	—	2.25 lb. K_2O

The 12th biennial manuring of plot palms was carried out in November this year. Sediment poonac (5 per cent. nitrogen) was used in place of groundnut cake as the latter was not available.

The yield data for the main effects for 1957 are as given below :

TABLE 1

Nitrogen	*Lb. Copra acre*	*Calculated as %*	*Difference lb.*	*Copra out-turn nuts/candy*
N_0	1,633 ..	100 ..	— ..	1,238
N_1	1,666 ..	102 ..	+33 ..	1,274
N_2	1,551 ..	95 ..	−82 ..	1,310
P_0	1,612 ..	100 ..	— ..	1,238
P_1	1,627 ..	101 ..	+15 ..	1,277
P_2	1,610 ..	100 ..	−2 ..	1,306
K_0 (now K_1) ..	1,389 ..	100 ..	— ..	1,342
K_1 (now K_2) ..	1,688 ..	122 ..	+299 ..	1,242
K_2 (now K_3) ..	1,773 ..	128 ..	+384 ..	1,248

Significant difference P.05 = 116 lb./acre.

Given below is the table showing potash response for the manurial years 15–22.

TABLE 2

Manurial Year	*Year*	$K_1—K_0$	$K_2—K_0$
15	1950 ..	543 ..	711
16	1951 ..	664 ..	846
17	1952 ..	547 ..	799
18	1953 ..	321 ..	437
19	1954 ..	511 ..	714
20	1955 ..	321 ..	431
21	1956 ..	312 ..	417
22	1957 ..	299 ..	384

Note.—Potash levels were stepped up in 1951.

The table showing the yields according to potash levels for the years 1951–1957, are given below :

TABLE 3

Year	*Lb. Copra per Acre*			*Yield data of 300 Palms*
	K_0 K_1 *after 1951*	K_1 K_2 *after 1951*	K_2 K_3 *after 1951*	
1951 ..	1,398 ..	2,062 ..	2,244 ..	4,416
1952 ..	1,195 ..	1,742 ..	1,994 ..	4,571
1953 ..	1,267 ..	1,588 ..	1,704 ..	3,856
1954 ..	1,326 ..	1,837 ..	2,040 ..	4,117
1955 ..	1,851 ..	2,172 ..	2,282 ..	4,841
1956 ..	1,406 ..	1,718 ..	1,823 ..	4,595
1957 ..	1,389 ..	1,688 ..	1,773 ..	—

Table 4 below gives average yields for period of 6 years before and after stepping up K levels of manuring (i.e., 1951).

TABLE 4

6 Year Period	*Average Yield—Lb. Copra/Acre*		
	K_0 K_1 *after 1951*	K_1 K_2 *after 1951*	K_2 K_3 *after 1951*
1946–1951 ..	1,233 ..	1,690 ..	1,840
1952–1957 ..	1,406 ..	1,796 ..	1,936
Increase in crop average ..	+ 173 ..	+ 106 ..	+ 96

TABLE 4 (a)

Period	K_1—K_0		K_2—K_0
1946–1951 (K_1—K_0) ..	457	(K_2—K_0)	607
1952–1957 (K_2—K_1) ..	390	(K_3—K_1)	530

Table 4 clearly indicates a definite crop increase for various treatment levels of K with increased responses at the lower levels in spite of possible interactions due to unfavourable weather during 1956 and 1957.

The mean yields in 1957 (lb. copra per acre) for the various treatment combinations are given in the two-way table 5 below.

It will be observed that the treatment combination K_2–P_1 (N ?) gives the highest yield. In 1956 the yields follow a similar pattern.

TABLE 5

	N_0	N_1	N_2	*K—Total*
K_0 (now K_1) ..	1,434	1,440	1,292	1,389
K_1 (now K_2) ..	1,710	1,769	1,585	1,688
K_2 (now K_3) ..	1,754	1,790	1,775	1,773
N Total ..	1,633	1,666	1,551	1,616

	P_0	P_1	P_2	*K—Total*
K_0 (now K_1) ..	1,395	1,358	1,413	1,389
K_1 (now K_2) ..	1,680	1,666	1,717	1,688
K_2 (now K_3) ..	1,762	1,855	1,701	1,773
P Total ..	1,612	1,627	1,610	1,616

	P_0	P_1	P_2	*N—Total*
N_0 ..	1,528	1,765	1,605	1,633
N_1 ..	1,693	1,564	1,741	1,666
N_2 ..	1,615	1,551	1,486	1,551
P Total ..	1,612	1,627	1,610	1,616

(ii) MANURIAL × CULTIVATION EXPERIMENT (RATMALAGARA RESEARCH STATION)

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

K_0 = No potash
K_1 = 1 lb. K_2O/palm
K_2 = 2 lb. K_2O/palm

× { P_0 = No Phosphoric acid
P_1 = 1 lb. Phosphoric acid per palm

× { C_0 = No ploughing
C = Ploughing once in 2 years at the time of manuring

All plots are given a basic application of 3 lb. sulphate of ammonia per palm. The first biennial application of manure was carried out in June, 1943. The fourteenth year of this experiment was concluded in June, 1957.

The yield data for the main effects from the second year onwards are summarised in table 6.

TABLE 6

K. P. C. Manurial × Cultivation Experiment—Ratmalagara Estate

(Lb. Copra per Acre)

Treatments	2nd Year 1944–45	3rd Year 1945–46	4th Year 1946–47	5th Year 1947–48	6th Year 1948–49	7th Year 1949–50	8th Year 1950–51	9th Year 1951–52	10th Year 1952–53	11th Year 1953–54	12th Year 1954–55	13th Year 1955–56	14th Year 1956–57
K_0	1,771	1,691	1,415	1,841	1,438	1,342	1,631	1,978	1,663	1,827	1,883	1,664	1,569
K_1	1,935	1,674	1,395	1,842	1,466	1,327	1,677	1,957	1,684	1,924	2,011	1,726	1,600
K_2	1,893	1,738	1,492	1,975	1,589	1,449	1,760	2,167*	1,813	2,006	2,044	1,886*	1,785*
Sig. difference P.05	194	152	181	215	161	173	202	123	200	264	185	197	118
P_0	1,794	1,625	1,276	1,711	1,353	1,095	1,487	1,798	1,434	1,574	1,582	1,505	1,291
P_1	1,938	1,777	1,592	2,061	1,643*	1,651†	1,891†	2,270†	2,006†	2,264†	2,377†	2,012†	2,011†
C_0	1,783	1,615	1,372	1,851	1,450	1,320	1,654	2,020	1,708	1,942	1,977	1,744	1,609
C	1,949*	1,787	1,496	1,921	1,547	1,426	1,725	2,048	1,732	1,896	1,981	1,773	1,693
Sig. difference P.05	158	123	149	176	131	145	165	151	163	216	151	241	136

* Significant difference P.05

† Significant difference P.01

Potash Response

There was a significant response to potash at the higher level in the 9th (189 lb. copra/acre), 13th (222 lbs. copra/acre), 14th (216 lbs. copra/acre) years.

Phosphate Response

The significant response to phosphate is continuing to be maintained with the value of 720 lb. per acre for 1956–1957, reaching a peak, i.e., 1·39 candies/acre/annum (vide diagram 1). This is an increase over the last year's Fig. of 507 lb. per acre.

Year	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*	*11th*	*12th*	*13th*	*14th*
Copra lb./acre	144	152	316	350	290	556	404	472	572	690	795	507	720

The 8th biennial manuring of this experiment was carried out in May, 1957.

(iii) 3 × 3 × 3 N.P.K. MANURIAL EXPERIMENT ON YOUNG PALMS (RATMALAGARA ESTATE)

The ninth annual manuring was carried out in November, 1957, the manures being applied for the first time in semi-circular trenches.

The basic rates of manuring were increased from 1 lb. to 1½ lb./palm., viz :—

Nitrogen	(N_1)	—1½ lb. sulphate of ammonia per palm
Phosphoric acid	(P_1)	—1½ lb. saphos phosphate per palm
Potash	(K_1)	—1½ lb. muriate of potash (60%) per palm

(*a*) *Palms in Flower.*—Up to the end of December, 1957, there were 849 palms in flower out of a total of 972 palms. The distribution is shown below (in table 7) according to the main effects.

TABLE 7

Palms in Flower

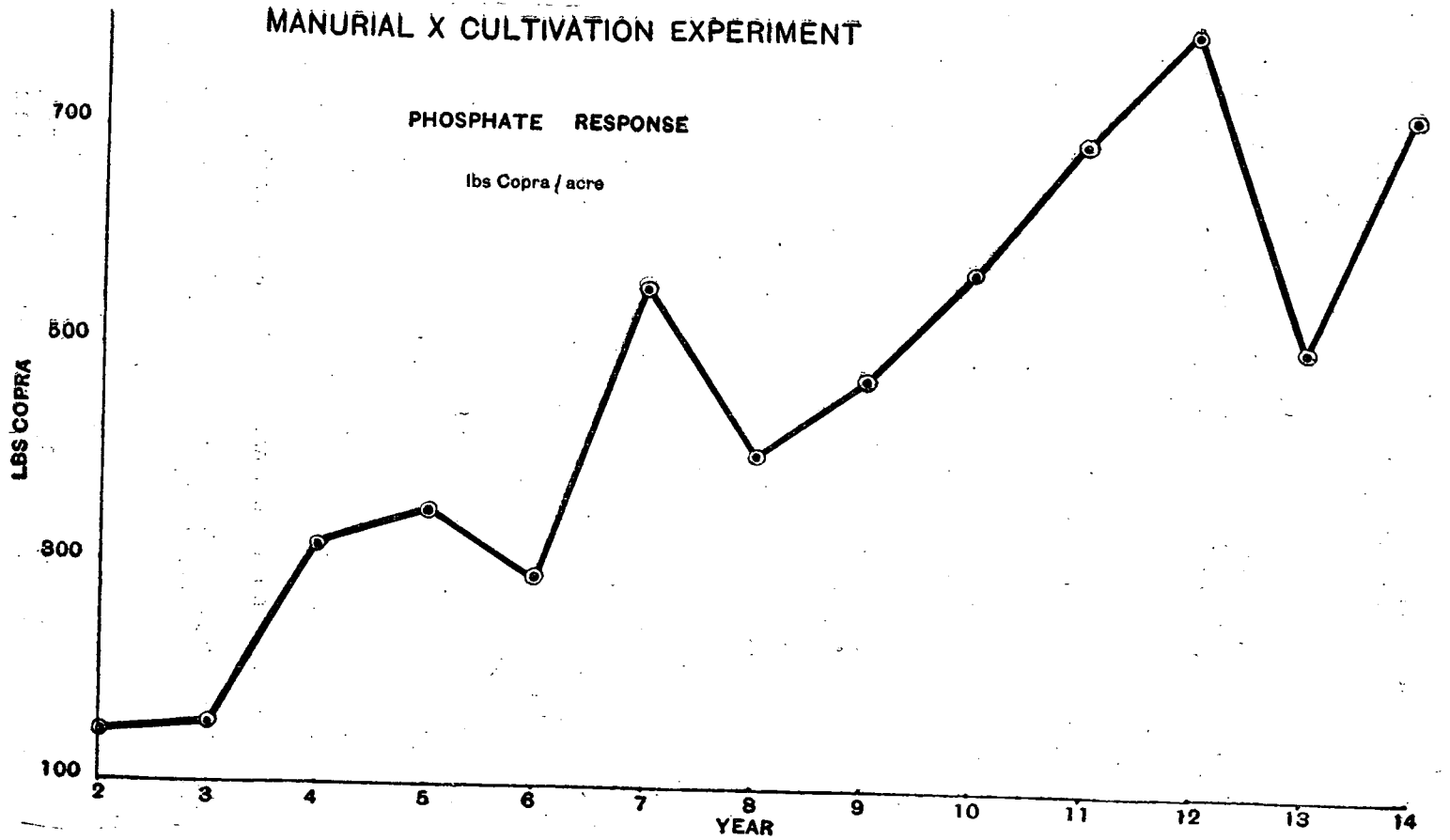
N_0	284	P_0	237	K_0	274
N_1	292	P_1	306	K_1	274
N_2	273	P_2	306	K_2	301

Phosphate manuring continues to show a marked effect on flowering.

(*b*) *Yield of nuts.*—The distribution of nuts of the plot palms are shown below according to the main effects (table 8).

TABLE 8

N_0	5,050	P_0	2,665	K_0	5,962
N_1	7,160	P_1	8,581	K_1	6,226
N_2	7,589	P_2	8,553	K_2	7,611


MANURIAL X CULTIVATION EXPERIMENT
PHOSPHATE RESPONSE
lbs Copra / acre
LBS COPRA
700
500
300
100
2
3
4
5
6
7
8
9
10
11
12
13
14
YEAR

(*c*) *Yield of copra.*—The distribution of copra for the main effects is given below (Table 9).

TABLE 9

N_0	2,477	P_0	1,310	K_0	2,793
N_1	3,482	P_1	4,121	K_1	3,004
N_2	3,525	P_2	4,053	K_2	3,687

Here again the effect of phosphate is particularly striking.

(*d*) *Helminthosporium incurvatum.*—The incidence of this fungus attack which was noticed annually after each manuring is now on the *decrease*, probably due to increasing ability of the palms to resist the attack as they grow.

I. Co-operative Manurial Experiments

(I) MANURIAL EXPERIMENT ON UNDER-PLANTED YOUNG PALMS (LETCHEMY ESTATE, NATTANDIYA)

This experiment was commenced in 1940 on under-planted young palms put out in October, 1939. The treatments are (*a*) cover Vs. no cover, (*b*) O, NK and NPK in five randomised blocks of 6 plots each.

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

At the end of 1957 there were 480 palms in flower out of a total of 540 palms, making the percentage in flower 89.

The following is the distribution of palms in flower according to treatments :—

TABLE 10

	O	*NK*	*NPK*
No cover ..	82 ..	77 ..	85
Cover ..	79 ..	74 ..	83
	161	151	168

The following tables give data concerning (*a*) palms in flower, (*b*) the yield of nuts, (*c*) yield of copra, (*d*) copra out-turns for years 1945–1957.

TABLE 11

Year	*Palms in Flower*				*Yield of Nuts*			
	O	*NK*	*NPK*	*Total*	*O*	*NK*	*NPK*	*Total*
1945 ..	— ..	— ..	1 ..	1 ..	— ..	— ..	— ..	—
1946 ..	12 ..	16 ..	12 ..	40 ..	— ..	— ..	15 ..	15
1947 ..	43 ..	49 ..	41 ..	133 ..	92 ..	87 ..	191 ..	370
1948 ..	68 ..	77 ..	75 ..	220 ..	325 ..	628 ..	656 ..	1,649
1949 ..	99 ..	97 ..	117 ..	313 ..	864 ..	1,030 ..	1,785 ..	4,279
1950 ..	119 ..	120 ..	135 ..	374 ..	976 ..	1,638 ..	2,091 ..	4,705
1951 ..	132 ..	124 ..	146 ..	402 ..	1,618 ..	2,559 ..	3,379 ..	7,556
1952 ..	136 ..	130 ..	154 ..	418 ..	2,424 ..	3,526 ..	4,556 ..	10,506
1953 ..	148 ..	136 ..	161 ..	464 ..	2,661 ..	4,302 ..	5,876 ..	12,839
1954 ..	153 ..	141 ..	164 ..	458 ..	4,822 ..	6,976 ..	10,345 ..	22,143
1955 ..	157 ..	145 ..	165 ..	467 ..	6,847 ..	8,373 ..	11,719 ..	26,939
1956 ..	159 ..	150 ..	167 ..	476 ..	6,979 ..	7,594 ..	10,744 ..	25,317
1957 ..	161 ..	151 ..	168 ..	480 ..	8,844 ..	9,197 ..	12,746 ..	30,787

TABLE 12

Year	Yield of Copra			Total Copra out-turn (nuts/candy)			
1945 ..	— ..	— ..	— ..	— ..	— ..	— ..	—
1946 ..	— ..	— ..	11 ..	11 ..	— ..	— ..	764
1947 ..	44 ..	45 ..	120 ..	209 ..	1,171 ..	1,083 ..	821
1948 ..	111 ..	281 ..	272 ..	664 ..	1,175 ..	1,158 ..	945
1949 ..	269 ..	497 ..	605 ..	1,371 ..	1,122 ..	1,084 ..	1,051
1950 ..	501 ..	878 ..	1,158 ..	2,537 ..	1,091 ..	1,045 ..	1,011
1951 ..	819 ..	1,417 ..	1,912 ..	4,148 ..	1,106 ..	1,011 ..	990
1952 ..	1,117 ..	1,846 ..	2,519 ..	5,482 ..	1,215 ..	1,070 ..	1,013
1953 ..	1,262 ..	2,159 ..	3,030 ..	6,451 ..	1,181 ..	1,116 ..	1,086
1954 ..	2,465 ..	5,771 ..	5,852 ..	12,088 ..	1,096 ..	1,035 ..	990
1955 ..	3,494 ..	4,496 ..	6,627 ..	14,617 ..	1,097 ..	1,043 ..	990
1956 ..	3,802 ..	4,168 ..	6,156 ..	14,126 ..	1,028 ..	1,020 ..	997
1957 ..	4,468 ..	4,519 ..	6,416 ..	15,403 ..	1,108 ..	1,140 ..	1,112

It is to be noted that the various treatments have shown considerable increase in crop following increased basic manuring in 1954 by way of an increased all round application of the following mixtures per palm (including palms of the control plots).

THE EFFECT OF PHOSPHATE MANURING SHOULD BE NOTED IN THE YIELD DATA FOR COPRA.

Basic Mixture :

1½ lbs. sulphate of ammonia

1 lb. Saphos phosphate

1½ lbs. Muriate of potash 60 per cent.

(II) MANURIAL EXPERIMENT ON METHODS OF APPLICATION OF MANURE (MARANDAWILA GROUP, BINGIRIYA)

This experiment is of the un-replicated 3×3×3 factorial design and consists of all combinations of N. P. and K. applied in the following way :—

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

The first biennial application of manures was carried out in June, 1949.

The yield data distributed according to treatments are given below for the various years commencing M II (viz. 1950/51).

TABLE 13

(Yield adjusted by Co-variance analysis) lb. Copra/Acre

	M II 2nd Year 1950–51	*M III* 3rd Year 1951–52	*M IV* 4th Year 1952–53	*M V* 5th Year 1953–54	*M VI* 6th Year 1954–55	*M VII* 7th Year 1955–56	*M VIII* 8th Year 1956–57
N_o	1,917	1,493	1,436	1,337	1,934	1,958	1,785
N_c	1,927	1,561	1,563	1,496	2,145	2,091	1,794
N_b	1,835	1,538	1,500	1,476	2,064	2,135	1,825
P_o	1,833	1,416	1,400	1,343	1,901	1,851	1,600
P_c	1,907	1,575	1,560	1,491	2,132	2,163	1,894
P_b	1,941	1,600	1,539	1,476	2,111	2,170	1,909
K_o	1,814	1,482	1,401	1,408	1,874	1,913	1,665
K_c	1,938	1,472	1,528	1,418	2,116	2,099	1,829
K_b	1,929	1,639	1,570	1,484	2,154	2,171	1,909
Sig. Dif. P.05	83	217	141	403	342	220	259

HERE TOO THE MOST SIGNIFICANT FEATURES ARE THE RESPONSES TO (*a*) phosphate and (*b*) Potash. *There is however no significant difference between circular* vs. *broadcast manuring* as shown in Table 14 below.

It may also be noted that in the VIIth year however K_b K_c, i.e., potash broadcast gives a better response than potash applied in circular trenches.

TABLE 14

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

(III) MANURIAL EXPERIMENT ON ORGANICS vs. INORGANICS (MARANDAWILA GROUP, BINGIRIYA).

Premanurial records are being continued from April, 1957.

(IV) MANURIAL TRIALS ON YELLOWING PALMS

(*a*) Walgama Estate, Rukmale Aturugiriya.

(*b*) Mattegoda Estate, Polgasowita.

These trials commenced in 1956 (vide annual report for 1956 for further particulars) are being continued.

The first manuring at Walgama with NPK supplemented with Dolomite and Magnesium sulphate was carried out in early 1957.

It is premature to report results of these experiments.

Besides observations of the foliage (recorded by permanent colour photographs) individual yield records of the groups of palms comprising various treatments have been continued, as also determinations of potash, phosphate, Ca and Mg in the nut water.

2. LABORATORY INVESTIGATIONS

The Laboratory investigations for the year include :

(I) *Analysis of samples of soils for the Agronomist involving :*

(*a*) The determination of available and exchangeable potash,

(*b*) Determination of ammoniacal nitrogen,

(*c*) Mechanical analysis of soils prior to and after use in pots, and

(*d*) Determination of pentosan/lignin on fibre dust samples.

(II) Further studies were carried out on soils from crown jungles which were undertaken for survey with a view to recommending their suitability or otherwise for growing coconuts.

TABLE 15

Estimation of Soil Nitrogen in Marichukkaddi and Dambakotarayaya Soil Samples

Locality	*Layer*	*Total Nitrogen (p.p.m.)*	*Ammoniacal Nitrogen (p.p.m.)*	*Nitrate Nitrogen (p.p.m.)*
Marichukkaddi (Mannar District)	Top	270·1	5·88	0·75
Marichukkaddi (Mannar District)	Sub	267·4	7·06	0·60
Dambakotarayaya (Wellawaya)	Top	1,128·4	11·77	2·20

(III) Chemical Analysis were carried out on :

(*a*) Red soils from the crown jungles of—

(i) Sirambiadi and Karadipowal in the Puttalam District

(ii) From Pallansena in the Negombo District.

(*b*) Soils from a site near the Bathalagoda Tank.

(*c*) Soils from Isolated Seed Garden, Ambakelle.

TABLE 16

ANALYSIS OF SOME COCONUT SOILS

(a) Mechanical Analysis (b) Total Exchangeable bases, Exchangeable Calcium and Magnesium (c) C/N Ratios

		MECHANICAL ANALYSIS					CHEMICAL ANALYSIS							
Locality	*Layer*	*Coarse sand* %	*Fine sand* (%)	*Silt* (%)	*Clay* (%)	*pH*	*Total Exchange bases (m.E. %)*	*Exchangeable Calcium (m.E.%)*	*Exchangeable Magnesium (m.E. %)*	*"Available" (Trong) P_2O_5 (ppm.)*	*Total Nitrogen (ppm.)*	*Organic Carbon (ppm.)*	*C/N*
I. S. G. Ambakelle	0″—12″	80·6	13·5	0·5	6·9	4·80	1·37	0·690	0·502	Not determined	250	2430	9·7
Do.	12″—21″	71·7	19·8	0·5	9·8	4·28	0·93	0·575	0·393	do.	258	1500	5·8
Do.	21″—51″	71·5	18·9	0·2	12·6	4·23	0·89	0·556	0·328	do.	36	510	14·2
Do.	51″—93″	51·8	10·1	2·2	37·4	—	—	—	—	do.	30	780	26·0
Do.	93″–118″	54·5	12·4	9·3	23·0	—	—	—	—	do.	30	Not determined	—
Ambakelle (Jungle)	0″— 9″	80·6	14·2	1·8	5·1	5·89	1·89	1·188	0·590	do.	252	4140	16·4
Do.	9″—18″	74·9	18·2	2·1	8·3	5·35	1·13	0·786	0·408	do.	146	2460	16·9
Do.	18″—30″	75·3	17·3	2·0	9·0	4·86	0·70	0·297	0·357	do.	132	1770	13·4
Pallansena	0″— 9″	Not Determined				6·04	1·00	0·412	Not determined	do.	279	2580	9·2
Do.	9″—18″	do.				5·58	0·80	0·422	do.	do.	153	1500	9·8
Do.	18″—30″	do.				5·44	0·76	0·383	do.	do.		Not determined	
Do.	30″—42″	do.				5·38	0·82	0·460	do.	do.	—	do.	
Do.	42″—54″	do.					Not determined	—	do.	do.	167	660	4·0
Do.	54″—60″	do.					do.	—	do.	do.	159	600	3·8
Sriambiadi (Jungle)	0″— 9″	do.				7·91	3·35	2·256	0·400	49·5	26	4200	61·5
Do.	9″—18″	do.				7·71	2·60	1·510	0·473	43·5	152	2620	17·2
Karadipowal (Jungle)	0″— 9″	do.				6·54	1·38	1·242	Not determined	50·0	210	3000	14·9
Do.	9″—18″	do.				5·42	1·37	0·650	do.	50·0	26	2580	99·2
Do.	18″—30″	do.				5·54	1·70	0·946	do.	47·0	204	2790	13·7
Do.	30″—42″	do.				—	—	—	do.	51·5	97	1560	16·1
Battalagoda (near tank)	0″— 9″	do.				6·94	7·07	5·124	1·958	71·0	941	9100	9·7
Do.	9″—18″	do.				6·54	7·37	5·592	2·330	68·5	829	6300	7·9
Do.	18″—30″	do.				6·28	7·32	5·870	1·667	79·1		Not determined	

(IV) A sample of Red Moss (Gracilaria confervoides) from the Trincomalee District was analysed to assess its manurial value with respect to N, P & K.

TABLE 17

Nitrogen, Potash and Phosphoric Acid in the sample of red moss

Nitrogen ..	.. 2·05 %
Potash (as K_2O) ..	.. 0·4 %
Phosphoric Acid (as P_2O_5)	.. 0·19 %
Ash ..	.. 9·1 %

P_2O_5 Determinations :

(*a*) Available P_2O_5 (Truog) on 216 samples of soils from plots of the N. P. K. Experiment at Bandirippuwa Estate were carried out.

The mean values of available P_2O_5 for the P_0, P_1 and P_2 plots are given in the Table below :—

TABLE 18

Mean available P_2O_5 Content of N. P. K. Plot Samples

Treatments	*Mean P_2O_5 (p. p. m.)*			
	**M. C. T. Samples*	**M. C. S. Samples*	**R. T. Samples*	**R. S. Samples*
P_0 ..	46·9	35·9	31·8	28·0
P_1 ..	436·5	95·9	118·9	28·0
P_2 ..	1,048·6	279·2	227·6	170·2

*M. C. T. = Manure Circle Top Soil
*M. C. S. = ,, ,, Sub Soil
*R. T. = Rows Top Soil
*R. S. = Rows Sub Soil

TABLE 19

(V) *Mechanical analysis of soils from Beligama :*

Locality	*Layer*	*Coarse Sand (%)*	*Fine Sand (%)*	*Silt (%)*	*Clay (%)*
Beligama ..	0 – 9″ ..	45·4 ..	21·9 ..	9·9 ..	21·6
Do. ..	9″–18″ ..	41·7 ..	21·5 ..	9·1 ..	29·0
Do. ..	18″–30″ ..	42·7 ..	14·8 ..	9·6 ..	33·6
Do. ..	30″–42″ ..	37·9 ..	13·1 ..	6·6 ..	41·1
Do. ..	42″–54″ ..	37·7 ..	13·4 ..	5·9 ..	43·0

(VI) *Nut Water Analysis :*

Studies on use of nut water analysis as a means of assessing the phosphate and potash status of coconut soils was studied.

With this in view, in addition to routine analyses carried out on nut water samples from plots of the manurial experiments of the Soil Chemist Division block samples from the following private estates were analysed :—

(*a*) Kendagamuwa Estate, Madipola (Matale District)

(*b*) Beligama Estate on the Kurunegala-Dambulla Road

(*c*) Kumbaloluwa Estate, Veyangoda.

The mean values for P_2O_5 contents are given below :

TABLE 20

Nut Water Analysis—P_2O_5 Estimation

Kendagamuwa Estate		*Beligama Estate*		*Kumbaloluwa Estate*	
Block No.	P_2O_5 *(mg/litre)*	*Block No.*	P_2O_5 *(mg/litre)*	*Block No.*	P_2O_5 *(mg/litre)*
1	258	1	159	1	235
2	228	2	197	4	210
3	242	3	223	6	257·5
4	239				

On the basis of the *critical values* for nut water phosphate these should be indicative of phosphate status of the soil *vis-a-vis* response to phosphate manuring ; these soils are adequately supplied with soil phosphates (critical value of 111 ppm) based on the values for (3 × 2 × 2) manurial experiment at Ratmalagara and the N. P. K. 3 × 3 × 3 manurial experiment at Bandirippuwa (vide 1956 Annual Report, Sessional Paper VI—1958, pages 19–20).

These soils should be either supplied with ample reserves of phosphate from native reserve minerals and/or from the reserves of phosphate added as manure.

In the soil at Kumbaloluwa Estate no doubt the high phosphatic status should be due to reserves from added phosphates (vide the results of the Co-operative Manurial Experiment at Kumbaloluwa. Annual Report 1948, Sessional Paper XXII —1950 pages 10, 11 and 12 and Leaflet No. 12.) *

V. NALLIAH,
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REPORT OF THE CHEMIST

I. Technological Work

(A) CHANGES IN SUGARS DURING FERMENTATION OF TODDY

In continuation of the fermentation studies on coconut toddy, the changes in the sugars of the sap when collected with and without anti-ferments were investigated. Though the behaviour of coconut toddy (collected under different conditions) during fermentation has already been studied, no observations are available on the changes in the sugars themselves. In order to study this subject, the sap collected in accordance with the following three methods was examined :—

Method (T). Where the sap is collected as in current industrial practice. In this method of collection the toddy is drawn in the same earthenware pot day after day, and is never cleaned out or substituted during the eight months tapping season. This being so, there is always a rich culture of yeasts and bacteria in the form of

* " Annual Report for 1948 (loc cit), last para : " It will be seen that the omission of phosphoric acid from NPK plots has not caused a decline in the yield of these plots. The reserves of available phosphate from 3 biennial applications have been sufficient and although the last application of phosphoric acid was in 1943 the reserves have been sufficient for a period of 5 years.

At the same time the addition of Phosphoric acid to the NK plots (and that a small application of 2 lbs. saphos phosphate equivalent to 0·6 lbs. phosphoric acid per palm) confirm the marked response, previously indicated.

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

a slime on the inner surface of the pots. Under these conditions, it can very well be imagined how fermentation would set in spontaneously no sooner the sap drips into the pots. As the vessels are never sterilized, and as no antiferments of any kind are employed the obvious result is that the sap is always lowered from the palm in the form of *toddy* (and *not* sweet toddy) in a state of active fermentation. Under these conditions very wide fluctuations in composition can also be anticipated.

Method (*ST*). In this method of tapping no antiferments or preservatives of any kind were placed in the collection vessels. After each tapping however the pots are washed and cleaned out with a stiff wire brush, allowed to drain and then the inside flame sterilized. This was done by directing the flame of a Bunsen burner over the inside. The sap collected this way may be described as *sweet toddy*.

Method (*STV*). The only difference between this and (ST) is that after flame sterilization, a small quantity of powdered bark from the plant *Vateria acuminata* (Sinhalese ' Hal ') was placed in the pots before they were attached to the spathes. Otherwise the details of washing, brushing out and sterilization were the same for both (ST) and (STV). It has been found that the optimum quantity of Vateria bark for use is about 3 to 5 grammes for every litre of sap that is anticipated to flow. It has been found safer to err on the higher side as an excess is not deleterious.

The addition of the bark does not in any way arrest, inhibit or prevent fermentation, but presumably the tannins in the bark are definitely effectual in retarding fermentation for about 3 hours, from the time the sap is lowered from the palms.

The sap which is collected this way is also a true *sweet toddy*, but it has certain unmistakeable physical properties which make it rather different from (ST).

Analyses for the principal components were done on typical representative samples of (T), (ST), and (STV), at 3 hour intervals up to a period of 48 hours from the time of collection. Thereafter, analyses were done after 72 hours (3 days), 168 hours (1 week) and 672 hours (4 weeks) respectively on all the samples. The results obtained on typical samples representative of (T), (ST) and (STV) are charted in Tables I to III. Reducing sugars before and after inversion were estimated by the Lane and Eynon titration method, and the reducing sugars were calculated as " Invert Sugar " and the non-reducing sugars as sucrose.

It will be seen from the data presented, that the initial concentrations of total sugars (made up of invert sugar and sucrose) in (T), (ST) and (STV), are 9·58, 15·23 and 16·47 grammes per 100 ml., of the sap respectively. On the basis of stoichiometric yields, the theoretical recoveries of ethyl alcohol from sucrose and invert sugar should be as follows :—

100 grammes sucrose = 53·8341 grammes of ethyl alcohol and 100 grammes Invert sugar = 51·1423 grammes of ethyl alcohol.

TABLE I

Changes in the Sugars and other Constituents of Coconut Toddy (T) during Fermentation

1. Studies on a bulked sample of sap collected from 6 tall palms at Bandirippuwa which flowed between 4 p.m., and 7 a.m. collected in unsterilized earthenware pots (not washed or cleaned up at any stage). Volume Taken—2,250 ml. in a measuring cylinder (3″ diam. × 22.5″ high). *Rainfall*—(previous 48 hours)—nil.

1	2	3	4		5	6	7	8	9	10 Sugars (Fermentable Organic Solids)				11 Non-Fermentable Organic Solids	
Time of Analysis	No. of Hours since Collection	pH	Density 30°C / 30°C	Density 30°C / 4°C	% Acidity (as acetic) G/100 ml.	% Alcohol (V/V)	% Total Solids G/100 ml.	% Sulphated Ash G/100 ml.	% Tot. Organic Solids (ie., tot. Solids less Ash) G/100 ml.	Reducing Sugars Calc. as invert Sugar G/100 ml.	Non-reducing Sugars calculated as Sucrose G/100 ml.	Total Sugars G/100 ml.	Total Sugars as % of Tot. Organic Solids	G/100 ml. by difference	As % of Total Organic Solids
7 a.m.	nil	below 4·0	1·0446	1·0408	0·29	2·9	12·99	0·47	12·52	3·11	6·47	9·58	76·5	2·94	23·5
10 a.m.	3	below 4·0	1·0386	1·0342	0·32	3·5	11·84	0·46	11·38	3·43	4·56	7·99	70·2	3·39	29·8
1 p.m.	6	below 4·0	1·0330	1·0283	0·39	4·3	10·52	0·45	10·07	3·48	3·89	7·37	73·2	2·70	26·8
4 p.m.	9	below 4·0	1·0275	1·0229	0·39	4·9	9·23	0·45	8·78	3·58	2·83	6·41	73·0	2·37	27·0
7 p.m.	12	below 4·0	1·0232	1·0189	0·45	5·6	8·12	0·46	7·66	3·61	1·64	5·25	68·5	2·41	31·5
10 p.m.	15	below 4·0	1·0195	1·0155	0·47	6·2	7·19	0·42	6·77	3·44	1·01	4·55	65·7	2·32	34·3
1 a.m.	18	below 4·0	1·0164	1·0123	0·49	6·6	6·56	0·43	6·13	3·03	0·83	3·86	63·0	2·27	37·0
4 a.m.	21	below 4·0	1·0132	1·0091	0·51	6·9	5·93	0·42	5·51	2·62	0·64	3·26	59·2	2·25	40·8
7 a.m.	24	below 4·0	1·0103	1·0064	0·53	7·3	5·19	0·41	4·78	2·25	0·41	2·66	55·6	2·12	44·4
10 a.m.	27	below 4·0	1·0076	1·0036	0·53	7·5	4·71	0·40	4·31	1·72	0·35	2·07	48·0	2·24	52·0
1 p.m.	30	below 4·0	1·0061	1·0011	0·53	7·9	4·41	0·40	4·01	1·31	0·28	1·59	39·7	2·42	60·3
4 p.m.	33	below 4·0	1·0058	1·0007	0·59	8·1	4·09	0·49	0·67	1·03	0·25	1·28	34·9	2·39	65·1
7 p.m.	36	below 4·0	1·0031	0·9990	0·59	8·1	3·80	0·39	3·41	0·88	0·23	1·11	32·6	2·30	67·4
10 p.m.	39	below 4·0	1·0025	0·9986	0·59	8·1	3·08	0·41	2·67	0·74	0·14	0·88	33·0	1·79	67·0
1 a.m.	42	below 4·0	1·0019	0·9980	0·61	8·1	3·08	0·42	2·66	0·63	0·13	0·76	28·6	1·90	71·4
4 a.m.	45	below 4·0	1·0013	0·9974	0·63	8·2	3·07	0·41	2·66	0·52	0·12	0·64	24·1	2·02	75·9
7 a.m.	48	below 4·0	1·0007	0·9969	0·65	8·2	3·07	0·42	2·65	0·41	0·11	0·52	19·6	2·13	80·4
7 a.m.	72	below 4·0	1·0000	0·9965	0·68	8·2	2·84	0·42	2·42	0·24	0·10	0·34	14·0	2·08	86·0
7 a.m.	168 (1 week)	below 4·0	0·9993	0·9954	0·78	7·9	2·56	0·43	2·13	0·12	Trace	0·12	5·6	2·01	94·4
7 a.m.	672 (4 weeks)	below 4·0	0·9996	0·9954	0·93	7·5	2·59	0·43	2·16	Trace	Trace	Trace	Trace	2·16	100·0

TABLE II

Changes in the Sugars and other Constituents of Coconut Sweet Toddy (ST) during Fermentation

II. Studies on a bulked sample of sap collected from 6 tall palms at Bandirippuwa which flowed between 4 p.m. and 7 a.m., collected in sterilized earthenware pots. *Volume taken* 2,250 ml. in a measuring cylinder (3″ diam. × 22·5″ high). *Rainfall* (previous 48 hours)—nil.

1	2	3	4		5	6	7	8	9	10 Sugars (Fermentable Organic Solids)				11 Non-Fermentable Organic Solids	
Time of Analysis	*No. of Hours since Collection*	*pH*	*Density* 30°C/3°C	*Density* 30°C/4°C	*% Acidity (as acetic) G/100 ml.*	*% Alcohol (V/V)*	*% Total Solids G/100 ml.*	*% Sulphated Ash G/100 ml.*	*% Tot. Organic Solids (ie., tot. Solids) less Ash. G/100 ml*	*Reducing Sugars Calc. as invert Sugar G/100 ml.*	*Non-reducing Sugars calculated as Sucrose G/100 ml.*	*Total Sugars G/100 ml.*	*Total Sugars as % of Tot. Organic Solids*	*G/100 by difference*	*As % of Total Organic Solids*
7 a.m.	nil	below 4·0	1·0683	1·0645	0·21	0·0	18·60	0·46	18·14	2·05	13·18	15·23	84·0	2·91	16·0
10 a.m.	3	below 4·0	1·0668	1·0625	0·35	Trace	18·13	0·45	17·68	3·67	10·84	14·51	82·1	3·17	17·9
1 p.m.	6	below 4·0	1·0634	1·0587	0·52	0·2	17·32	0·47	16·85	5·87	7·66	13·53	80·3	3·32	19·7
4 p.m.	9	below 4·0	1·0551	1·0501	0·59	0·7	15·65	0·47	15·18	7·93	3·99	11·92	78·5	3·26	21·5
7 p.m.	12	below 4·0	1·0441	1·0391	0·66	2·2	13·00	0·46	12·54	6·63	1·89	8·52	67·9	4·02	32·1
10 p.m.	15	below 4·0	1·0300	1·0251	0·73	4·1	9·80	0·48	9·32	4·22	1·33	5·55	59·5	3·77	40·5
1 a.m.	18	below 4·0	1·0259	1·0214	0·75	4·7	8·82	0·45	8·37	3·31	1·16	4·47	53·4	3·90	46·6
4 a.m.	21	below 4·0	1·0218	1·0178	0·76	5·3	7·81	0·44	7·37	2·40	0·98	3·38	45·9	3·99	54·1
7 a.m.	24	below 4·0	1·0207	1·0168	0·83	5·3	7·56	0·47	7·09	2·12	0·95	3·07	43·3	4·02	56·7
10 a.m.	27	below 4·0	1·0194	1·0152	0·83	5·4	7·24	0·46	6·78	1·99	0·82	2·81	41·4	3·97	58·6
1 p.m.	30	below 4·0	1·0182	1·0138	0·76	5·5	6·97	0·46	6·51	1·70	0·79	2·49	38·2	4·02	61·8
4 p.m.	33	below 4·0	1·0172	1·0126	0·76	5·6	6·84	0·45	6·39	1·64	0·62	2·26	35·4	4·13	64·6
7 p.m.	36	below 4·0	1·0162	1·0118	0·73	5·7	6·53	0·47	6·06	1·43	0·57	2·00	33·0	4·06	67·0
10 p.m.	39	below 4·0	1·0151	1·0109	0·73	5·7	6·05	0·46	5·59	1·21	0·49	1·70	30·4	3·89	69·6
1 a.m.	42	below 4·0	1·0141	1·0098	0·73	5·8	5·86	0·45	5·41	1·04	0·44	1·48	27·4	3·93	72·6
4 a.m.	45	below 4·0	1·0132	1·0089	0·73	5·8	5·77	0·47	5·30	0·91	0·39	1·30	24·5	4·00	75·5
7 a.m.	48	below 4·0	1·0121	1·0080	0·73	5·9	5·60	0·46	5·14	0·78	0·34	1·12	21·8	4·02	78·2
7 p.m.	60	below 4·0	1·0097	1·0055	0·76	6·1	5·18	0·47	4·71	0·30	0·30	0·60	12·7	4·11	87·3
7 a.m.	72	below 4·0	1·0092	1·0053	0·79	6·0	4·92	0·49	4·43	0·18	0·27	0·45	10·2	3·98	89·8
7 a.m.	96	below 4·0	1·0090	1·0051	0·98	5·5	4·81	0·48	4·33	0·10	0·23	0·33	7·6	4·00	92·4
7 a.m.	168 (1 week)	below 4·0	1·0116	1·0078	1·18	4·2	4·86	0·49	4·37	Trace	0·15	0·15	3·4	4·22	96·6
7 a.m.	672 (4 weeks)	below 4·0	1·0201	1·0163	2·62	0·3	4·66	0·50	4·16	Trace	Trace	Trace	Trace	4·16	100·0

TABLE III

Changes in the Sugars and other Constituents of Coconut Sweet Toddy (STV) during Fermentation

III. Studies on a bulked sample of sap collected from 6 tall palms at Bandirippuwa which flowed between 4 p.m. and 7 a.m., collected in earthenware pots, sterilized by flaming and smoking and adding " Vateria " bark. *Volume taken*—2,250 ml. in measuring cylinder (3″ diameter × 22·5″ high). *Rainfall* (previous 48 hours)—nil.

1	2	3	4		5	6	7	8	9	10				11	
Time of Analysis	*No. of Hours since Collection*	*pH*	*Density* 30°C / 30°C	*Density* 30°C / 4°C	*Per cent Acidity (as acetic) G/100 ml.*	*Per cent Alcohol (V/V)*	*Per cent Total Solids G/100 ml.*	*Per cent Sulphated Ash G/100 ml.*	*Per cent Tot. Organic Solids (i.e. total Solids less Ash) G/100 ml.*	*Sugars Fermentable Organic Solids)* Reducing Sugars alc-culated as invert Sugar G/100 ml.	Non-reducing Sugars calculated as Sucrose G/100 ml.	Total Sugars G/100 ml.	Total Sugars as of Total Organic Solids	*Non-Fermentable Organic Solids* G/100m (by difference)	As of Total Organic Solids
7 a.m.	—	7·0–7·5	1·0721	1·0682	Trace	0·0	19·04	0·54	18·50	0·52	15·95	16·47	89·0	2·03	11·0
10 a.m.	3	7·0–7·5	1·0718	1·0678	0·05	Trace	18·93	0·49	18·44	0·55	15·82	16·37	88·8	2·07	11·2
1 p.m.	6	5·5	1·0713	1·0667	0·05	0·1	18·84	0·52	18·32	0·99	15·26	16·25	88·7	2·07	11·3
4 p.m.	9	5·0–5·5	1·0690	1·0644	0·09	0·3	18·30	0·47	17·83	1·52	14·28	15·80	88·6	2·03	11·4
7 p.m.	12	4·0	1·0643	1·0596	0·15	0·5	17·36	0·52	16·84	2·47	12·34	14·81	87·9	2·03	12·1
10 p.m.	15	below 4·0	1·0484	1·0438	0·24	2·8	14·66	0·50	14·16	3·75	8·43	12·18	86·0	1·98	14·0
1 a.m.	18	below 4·0	1·0328	1·0279	0·24	5·0	10·83	0·50	10·33	4·26	3·94	8·20	79·4	2·13	20·6
4 a.m.	21	below 4·0	1·0153	1·0107	0·24	7·1	6·72	0·50	6·22	2·94	0·98	3·92	63·0	2·30	37·0
7 a.m.	24	below 4·0	1·0034	0·995	0·24	8·7	4·20	0·45	3·75	0·90	0·65	1·55	41·3	2·20	58·7
10 a.m.	27	below 4·0	1·0013	0·9975	0·24	9·1	3·54	0·46	3·08	0·59	0·52	1·11	36·0	1·97	64·0
1 p.m.	30	below 4·0	1·0004	0·9961	0·24	9·3	3·22	0·45	2·97	0·40	0·31	0·71	23·9	2·26	76·1
4 p.m.	33	below 4·0	0·9996	0·9953	0·24	9·4	3·21	0·43	2·78	0·32	0·21	0·53	19·1	2·25	80·9
7 p.m.	36	below 4·0	0·9987	0·9945	0·24	9·5	3·15	0·44	2·71	0·28	0·16	0·44	16·2	2·27	83.8
10 p.m.	39	below 4·0	0·9985	0·9945	0·24	9·6	3·09	0·44	2·65	0·19	0·14	0·33	12·5	2·32	87·5
1 a.m.	42	below 4·0	0·9984	0·9944	0·24	9·6	3·05	0·44	2·61	0·16	0·13	0·29	11·1	2·32	88·9
4 a.m.	45	below 4·0	0·9983	0·9944	0·24	9·5	2·98	0·40	2·58	0·14	0·12	0·26	10·1	2·32	89·9
7 a.m.	48	below 4·0	0·9983	0·9944	0·24	9·5	2·85	0·40	2·45	0·13	0·11	0·24	9·8	2·21	90·2
7 a.m.	72	below 4·0	0·9980	0·9938	0·24	9·4	2·71	0·42	2·29	0·13	Trace	0·13	5·7	2·16	94·3
7 a.m.	168 (1 week)	below 4·0	0·9979	0·9937	0·24	9·1	2·52	0·43	2·09	Trace	Trace	Trace	Trace	2·09	100·0
7a.m.	672 (4 weeks)	below 4·0	0·9982	0·9943	0·65	8·5	2·57	0·44	2·13	Trace	Trace	Trace	Trace	2·13	100·00

The density of absolute alcohol at 30°C being 0·78075, the following theoretical alcohol yields should be possible from the sugars present at the time of collection in the samples of (T), (ST) and (STV) :—

Sample	*% Sucrose (G/100 ml.)*	*% Invert Sugar (G/100 ml.)*	*Theoretical Yield of Alcohol from Total Sugars*		
				W/W	*V/V*
(T)	6·47	3·11	(3·48 + 1·59)	= 5·07	6·49
(ST)	13·18	2·05	(7·10 + 1·05)	= 8·15	10·44
(STV)	15·95	0·52	(8·59 + 0·27)	= 8·86	11·35

It will be seen from the data, that in the present samples the actual maximum recoveries of alcohol by volume were (8·2—2·9)=5·3% for (T), 6·1% for (ST), and 9·6% for (STV). The fermentation efficiencies expressed as percentages of the theoretical yields for (T), (ST) and (STV) will thus be found to work out to 81·7, 58·4 and 84·6% respectively.

In controlled fermentations with other raw materials using pure strains of yeast, alcohol recoveries under the most favourable conditions could be rarely expected to exceed 95% of the theoretical but about 90% could be reckoned as a satisfactory recovery. In the present studies, considering the fact that self (natural) fermentation is involved, it is worthy of note that (STV) alone, with an efficiency of 84·6% approaches the figures obtained with other raw materials. It should be pointed out that the figure of 81·7% for (T) which comes next is misleading because it applies only to the alcohol recovery during the period of fermentation in the laboratory. It is needless to mention that the overall efficiency would actually be considerably lower than (STV) because of known evaporation losses on the palm-top prior to the time of initial analyses in the laboratory. Regarding (ST) of course, it obviously gives an inefficient and unsatisfactory self-fermentation with an alcohol recovery of only 58·4% of the theoretical. It is likely that under these conditions a preponderence of acetic acid bacteria reduces the efficiency of yeast fermentation.

(B) COMMERCIAL VINEGAR GENERATORS

It can be reported that the 50-gallon vinegar "generator" which was used for pilot plant work (installed by Messrs. M. E. Cooray and Sons, Wadduwa), and the the two commercial vinegar generators installed by Messrs. M. J. Salgado and Son Panadura, worked with smooth efficiency during the year.

Ten test charges were put through the first two commercial vinegar generators after they had been seeded and were in smooth operation. Five of these test charges (*a*) were put through the very first commercial generator installed using the best samples of acetifying toddy available at the factory prepared according to current practice.

The second lot of five test charges (*b*) were put through the second generator installed, using samples of acetifying toddy which had undergone alcoholization in a 100-gallon new type conical vat.

All ten charges were completely acetified. In the case of (*a*) the overall acetification efficiency was 79·6% and in (*b*) it was 80·1% both falling within the usual range of 76–84% for the "Generator Process". Regarding the rates of acetification the overall figures for (*a*) and (*b*) were found to be 37·3 hours and 36·9 hours respectively per gramme of alcohol, which is also of the usual order.

(C) ESTER, OXIDATION AND IODINE VALUES OF COCONUT TODDY VINEGAR

From past experience it could be said that determinations of total solids, ash, phosphates and nitrogen have only limited diagnostic value in the differentiation of various kinds of vinegar. Previous works on the analytical characteristics of

coconut toddy vinegar has however revealed that the potash content of the finished vinegar may be regarded as a somewhat useful characteristic for the identification of coconut vinegar.

The detection of the degree of fortification or adulteration of a vinegar with synthetic acetic acid is however quite a different problem and falls in an altogether different category. The above data would in fact be valueless for the quantitative evaluation of the extent of adulteration of coconut vinegar with synthetic acid. For this purpose it is felt that the determination of oxidation, iodine and ester values would be definitely useful.

For the purpose of evolving a sensitive quantitative technique for the detection of fortification of coconut toddy vinegar with synthetic acetic acid, some preliminary studies have been made during the year. Sixteen bottled samples of locally manufactured coconut toddy vinegar were examined in order to determine the general range of fluctuations of oxidation, iodine and ester values.

The analytical results obtained in these studies are charted in Table IV. As no general definitions of these terms appear to have been agreed upon, it should be possible to comprehend the exact meanings of these values (implied in the present context) from the following definitions :—

Oxidation Value.—The number of milli-litres of 0·01 N. potassium permanganate used by 100 ml. of vinegar in 30 minutes at 30°C.

Iodine Value.—The number of milli-litres of 0·01 N. Iodine absorbed by 100 ml. of vinegar in 15 minutes at 30°C.

Ester Value.—The number of milli-litres of 0·01 N. potassium hydroxide required to saponify the esters contained in 100 ml. of vinegar, the saponification being carried out by heating under reflux on a sand bath for 2 hours.

For the determination of oxidation and iodine values 60 ml. of the sample was mixed with 15 mls. of water in a distilling flask and the mixture was distilled slowly until exactly 60 ml. of the distillate were collected. For each estimation 25 ml. of the distillate was used. For the determination of ester value 100 ml. of vinegar were distilled slowly until 30 ml. of distillate were collected and the estimation was carried out on this volume.

TABLE IV

(Oxidation, Iodine and Ester Values on Coconut Toddy Vinegar)

1 *Sample*	*2* *Oxidation Value*	*3* *Iodine Value*	*4* *Ester Value*
1	367·2	268·8	39·2
2	375·2	294·4	84·6
3	379·2	238·4	62·6
4	364·8	270·4	63·0
5	365·6	226·4	14·4
6	369·6	345·6	17·0
7	341·6	153·6	11·0
8	366·4	186·4	18·4
9	368·0	217·6	18·4
10	378·4	136·0	14·4
11	373·6	400·0	—
12	396·0	420·0	30·8
13	403·2	201·6	32·6
14	411·2	439·2	19·0
15	381·6	372·0	26·8
Mean	376·1	278·0	32·3
Range	341·6 to 411·2	136·0 to 439·2	11·0 to 84·6
Standard Deviation	17·16	97·32	22·48
Coefficient of (%) Variation	4·56	35·01	69·60

The results show that the oxidation value with a coefficient of variation of only 4·56% is likely to be the most favourable index for the detection of adulteration. The iodine and ester values would also doubtless be useful, but they appear to be far more variable with coefficients of 35·01% and 69·6% respectively. The value of determining these indices will however be evident when we compare the average values for the 15 genuine samples, with the following figures obtained on an artificial vinegar :—

Index	*Genuine Coconut Vinegar*	*Artificial Vinegar*
Oxidation value	376·1	244·8
Iodine value	278·0	32·0
Ester value ..	32·3	6·2

These new tests when taken together are sufficiently interesting to warrant further investigation, as they are likely to greatly simplify differentiation and also prove definitely useful in diagnosis.

(D) ANALYTICAL COMPOSITION OF TODDY MYCODERMA

The results of analytical studies on coconut toddy yeast have been reported previously. Similar studies were carried out during the year, on three samples of dried mycoderma recovered from acetifying coconut toddy. The zooglocal mat of mycoderma (" mother of vinegar ") which forms a mucinous skin on the surface of acetifying toddy is actually extra-cellular bacterial cellulose encapsulating the cells of the acetic acid bacteria. The samples analysed were accumulated by bulking the cellulosic membrane from the surface of acetifying toddy stored in inverted bell jars. Three lots collected at different times during the year were partially dried down by solar heat and then to complete dryness in the oven at 105°C. The dried material was carefully powdered and analysed for nitrogen, phosphorus, potassium, calcium and magnesium in the usual way. The analytical results are summarised in Table V. (See page 29.)

It is proposed to examine some more samples of mycoderma in order to work out more reliable average figures for the various constituents. The present figures by themselves are not without interest and particularly so because of the high ash and potash contents which are noteworthy.

Table VI gives a comparison of the data obtained in these studies on toddy mycoderma and the average figures for coconut toddy yeast reported previously.

TABLE VI

Comparative Analytical Data on Toddy Yeast and Mycoderma
(Percentages on the Dry Basis)

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Sample	*% Sulphated Ash*	*% Nitrogen (as N)*	*% Protein (N × 6·25)*	*% Phosphorus (as P_2O_5)*	*% Potash (as K_2O)*	*% Calcium (as CaO)*	*% Magnesium (as MgO)*
Yeast ..	5·40	7·64	47·75	2·75	1·32	0·030	0·150
Mycoderma ..	16·61	1·40	8·75	0·570	5·96	0·101	0·143

The figures are self explanatory and speak for themselves. Toddy mycoderma is comparatively poor in protein and phosphorus, but is very rich in potash. In comparison with yeast, it contains a higher percentage of calcium. The magnesium contents of yeast and mycoderma however are of the same order.

TABLE V

(Analyitcal data on Toddy Mycoderma)

1	*2*	*3*		*4*		*5*		*6*		*7*		*8*	
Sample	% *Moisture*	% *Sulphated Ash*		% *Nitrogen (as N)*		% *Phosphorus (as P_2O_5)*		% *Potash (as K_2O)*		% *Calcium (as Ca)*		% *Magnesium (as Mg)*	
		Wet	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*
A	16·10	10·06	11·99	1·02	1·21	0·47	0·56	3·21	3·82	0·058	0·069	0·062	0·074
B	8·04	16·50	17·94	1·51	1·64	0·27	0·30	5·85	6·35	—	—	—	—
C	13·70	17·17	19·90	1·17	1·35	0·72	0·84	6·66	7·72	0·064	0·074	0·085	0·098
Mean	12·61	14·58	16·61	1·23	1·40	0·49	0·57	5·24	5·96	0·061	0·072	0·074	0·086

Even as the process of alcoholization is dependent on the activity of yeasts, similarly the acetification process is contingent on the mycoderma. The protein requirements of yeast are high and within limits higher fermentation efficiencies could be induced by fortification of the raw material ("gyle") with nitrogenous compounds. On the basis of the present observations, it seems a reasonable assumption that fortification of toddy vinegar stock with potash salts may increase acetification efficiency. It is no doubt known that coconut toddy by itself is a rich source of potash salts, but whether or not this is adequate for an optimum "rate" and "efficiency" of acetification is uncertain, though doubtless an interesting speculation, which could only be established on the basis of further investigation.

II. Plant Chemistry

(A) Preliminary qualitative studies on the possibility of growing coconut seedlings under controlled conditions have shown that both *typica* and *nana* varieties can be grown very satisfactorily in sand cultures using the intermittent flowing technique. It was further demonstrated that both these varieties could be grown satisfactorily in sand cultures even if deprived of the reserves of food material in the husk and "stone". This is a vital point, in view of the fact that the availability of known reserves in the fruit components can disguise or mask the uptake of added nutrients in sand culture techniques, and also confuse the interpretation of results.

(B) As a preliminary to the projected sand culture trials for growing coconut seedlings under controlled conditions, a simple *ad hoc* germination experiment has been laid down towards the end of November. Eight hundred and fifty average size coconuts have been planted out in well manured beds in the Botanist's nursery at Bandirippuwa.

The purpose of the experiment is to ascertain quantitatively the mineral reserves in the fruit components and also the changes in the composition of the leaves of the seedlings when germinated under the usual conditions with the fruit intact. It is proposed to uproot lots of 50 seedlings, at predetermined intervals and examine the vegetative and foliar tissues for both the macro and some of the micro-nutrients.

For the sand culture experiment proper, it is hoped to be able to plant seedlings without the husk and "stone", the ultimate object of the experiment being to use any visual symptoms and the chemical composition of the vegetative tissues for the diagnosis of the faulty mineral nutrition of the palm itself. It is imperative therefore that before doing this factual evidence is required to establish that even when the seedlings are planted without the food reserves in the fruit, the composition of the vegetative tissues is not significantly altered, nor the accuracy of any correlations drawn between treatments and chemical composition vitiated in any way in the sand culture experiment.

If the deprivation of the food reserves in the nut does happen to affect the future chemical composition of the tissues (as sometimes is the case with herbaceous annuals) then it would become necessary to plant the entire seedling with the fruit components intact. Whatever the findings, it is abundantly clear that it is important to get a reliable estimate of the mineral reserves in the fruit which are available to the plant, in order to interpret the results of the main sand culture experiment, whether or not the seedlings are planted with the fruit components.

(C) CHEMICAL EXAMINATION OF COCONUT APICAL BUDS

At a future date it is hoped to be able to make a complete study of the distribution of the essential macro and micro-nutrient elements in the crown and suspensory elements of the coconut palm.

On the basis of physiological concepts, it is a legitimate assumption that a rich supply of all the essential mineral nutrients would be directed towards all the active meristematic regions of the coconut palm. The coconut apical bud or " heart " would doubtless be a seat of high metabolic and meristematic activity, and consequently two composite samples (representative of tender leaflets, leaf-petioles, and primordia of the floral components) collected from two different healthy palms at Bandirippuwa were analysed for the macro-nutrients during the year. A tabular summary of the results is charted in Table VII. Being healthy palms, a high concentration (as anticipated) of nutrients (particularly nitrogen and potassium) in this apical meristem of the palm is a noteworthy feature.

(For table VII see page 32.)

The accumulation of information of this nature is considered valuable, as such quantitative data are invariably useful pointers in diagnostic work, and could very well prove faithful reflections of the nutrient status of the palm itself.

Previous samples examined in this laboratory were analysed only for nitrogen and potash and it is hoped that an extended study embracing both the macro and micro elements would become possible as samples become available in future. However, on the basis of the results so far accumulated one interesting observation is worthy of mention. The tabular summary VIII of the complete data accumulated for the nitrogen and potash contents of samples of coconut apical buds analysed so far indicate that with a coefficient of variation of 42·6% potash shows very wide fluctuations in comparison with nitrogen with a coefficient of 16·1%. It is therefore a reasonable assumption that the concentration of potassium in the bud is likely to prove a sensitive index of the *current* potash status of the palm, even if it is the result of induction or nutrient interactions.

TABLE VIII

Nitrogen and Potash Contents (Dry Basis) of Coconut Apical Buds

1 Sample No.	*2* % *Nitrogen* (*as N*)	*3* % *Protein* ($N \times 6{\cdot}25$)	*4* % *Potash* (*as* K_2O)	*5* *Remarks*
1	3·3	20·6	1·20	
2	3·4	21·2	4·48	
3	5·0	31·2	0·68	
4	4·2	26·2	3·12	
5	3·7	23·1	0·70	
6	4·1	25·6	3·70	Previous
7	3·5	21·9	2·92	Samples
8	3·2	20·0	2·76	(12)
9	3·4	21·2	3·04	
10	3·1	19·4	3·94	
11	—	—	2·41	
12	—	—	3·69	
13	3·0	18·8	4·04	Present
14	3·2	20·0	3·18	Samples (2)
Mean	3·6	22·4	2·85	—
Standard Deviation	0·579	3·599	1·214	—
Coefficient of Variation (%)	16·1	16·1	42·6	—

The present observation lends support to a further point reported earlier in relation to studies on coconut toddy, namely that potassium being a very mobile element showed the widest fluctuations in concentration among all the nutrients examined in the sap.

The growth of a plant (or in this case the coconut palm) is directly related only to the nutrients that are absorbed and enter the plant, and not directly to concentrations of nutrients in the soil. However, under certain conditions of balanced nutrition, what enters the plant can bear a relation to what is in the soil and hence indirectly, correlations between growth and soil nutrient status are also sometimes possible.

TABLE VII

Analytical Data on Coconut Apical Buds (Composite Samples)

1	*2*	*3*		*4*		*5*		*6*		*7*		*8*	
Sample No.	*% Moisture*	*% Sulphated Ash*		*% Nitrogen (as N)*		*% Phosphorus (as P_2O_5)*		*% Potash (as K_2O)*		*% Calcium (as Ca)*		*% Magnesium (as Mg)*	
		Wet	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*
1	5·10	12·36	13·02	2·82	2·98	1·35	1·41	3·83	4·04	—	—	—	—
2	5·03	10·68	11·25	3·06	3·23	1·30	1·37	3·02	3·18	0·202	0·212	0·479	0·505
Mean	5·06	11·52	12·14	2·94	3·10	1·32	1·39	3·42	3·61	0·202	0·212	0·479	0·505

It could thus be stated, that the technique of diagnostic plant analysis has interesting possibilities in relevance to studies on the nutrition of the coconut palm. The preselection of sensitive and appropriate plant parts suitable for the purpose would however need to be worked out on the basis of careful study. The present observation with the apical buds is useful in this respect.

(D) PHASEOLUS AUREUS AS AN INDICATOR OF NUTRIENT UPTAKE

Preliminary investigations on the pulse Phaseolus aureus (green gram) have given ample evidence of its potentialities as an indicator of nutrient uptake in chemical methods of diagnostic plant analysis. The seed germinates within 48 hours from sowing and the plant itself has the over-riding advantage in that it completes its vegetative and reproductive cycles within a period of 4 to 6 weeks. The plant has also so far been found not susceptible to attack by pests or pathogenic organisms.

Preliminary studies on the growth performance and life cycles of two strains of the plant have been made in sand cultures. The indigenous variety with its vigorous growth and early flowering habit was found to have definite advantages for the present purpose, over the imported chinese strain which produced larger seeds.

It is considered that this plant would be very valuable for studies in a complementary role to the projected sand culture experiments on coconut seedlings as quick results (whether on an exploratory or confirmatory basis) could readily be obtained.

It is now an established fact that the chemical composition of a plant does reflect its nutritional status, the adequacy of its nutrient supplies, and the probability of its response to increased supplies.

Table IX gives a summary of the results obtained on both strains of the plant studied, which illustrate the changes in the wet weights and dry matter during progressive stages of germination. The plants were grown in sand cultures in Mitscherlich, pots, using the complete nutrient solution (already tried out and found suitable) and the intermittent flowing technique. These quantitative growth studies are of course being followed up by chemical analysis of the vegetative tissues sampled during these investigations with a view to the assessment of mineral uptake (under conditions of optimum mineral nutrition) as reflected in the nutrient composition of the plant.

For Table IX see page 32

Though daily records (based on the weights of 25 seedlings) were kept on the changes in the moisture and dry matter of the plants, the figures summarised in Table IX represent the averages for 7-day periods, which reflect the progressive changes satisfactorily. The figures in column (6) show that there is a loss of dry matter in both strains during the first week after germination. This is probably to be accounted partly by the fact that the seed coat drops off during the course of the first few days of germination, and partly due to the catabolic breakdown of reserves in the seed with consequent loss of dry matter. The increase in size of the seedling during incipient germination is therefore essentially a swelling up process due to the absorption of moisture, without any corresponding accretion of dry matter or plant material. The figures in this column are fairly conclusive that the local variety though grown from smaller seeds (with less dry matter) is definitely more vigorous in growth which is a decided advantage for its application as an indicator plant. There is also the further advantage that it comes into flower earlier and also completes its life cycle in a shorter period. The next experiment with this plant would be directed towards the determination of the chemical composition characteristic for each particular deficiency, using the same sand culture technique.

(*e*) In connection with an inquiry on yellowing of foliage (associated with substandard performance) of coconut palms, leaf analyses were done on healthy and weak palms on an estate in the Galle District, with parallel analysis of the soil.

TABLE IX

Growth changes in two strains of Phaseolus aureus when grown in sand cultures with complete nutrients.

1	2	3		4		5		6		7
STAGE	*No. of Days from sowing*	*% Moisture*		*Wet Weight (seed, seedling or plant)*		*Dry matter (seed, seedling or plant)*		*% Increase (or decrease) of dry matter over dry weight of seed*		*REMARKS*
		Chinese	*Local*	*Chinese*	*Local*	*Chinese*	*Local*	*Chinese*	*Local*	
I	nil	12·1	10·9	0·0456	0·0312	0·0400	0·0278	—	—	Seed before sowing
II to VIII	1 to 7	86·2	85·5	0·2542	0·1594	0·0290	0·0176	27·5 (decrease)	36·7 (decrease)	Av. of daily figures from 1-7 days after sowing
IX to XV	8 to 14	90·0	90·0	0·7339	0·6270	0·0744	0·0633	86·0 (increase)	127·7 (increase)	Av. of daily figures from 8-14 days from sowing
XVI to XXII	15 to 21	85·8	86·3	1·0737	1·2258	0·1528	0·1679	282·0 (increase)	504·0 (increase)	Av. of daily figures from 15-21 days from sowing
XXIII to XXIX	22 to 28	82·0	85·3	2·1073	2·2274	0·3767	0·3288	841·8 (increase)	1082·7 (increase)	Av. of daily figures from 22-28 days from sowing
XXX to XXXV (C) XXX to XXXII (L)	29 to 34 29 to 31	84·0	83·1	3·0946	3·5886	0·4710	0·6104	1077·5 (increase)	2095·7 (increase)	Av. of daily figures from 29-34 days for (C) and (29-31) days for (L) from sowing

C=Chinese Variety. L=Local Variety.

Six palms each representative of the good and the weak ones growing on the particular field under investigation, were selected for drawing the bulk leaf samples. Twelve leaflets (six on either side of the rachis) were taken from a single frond occupying a mid-way position in the crown of each of the palms sampled. The leaf blades were separated from the midribs and they were analysed separately, for nitrogen, phosphorus, potassium, calcium and magnesium. The results are summerised in Table X.

TABLE X

Results of Foliar Analysis

1	*2*				*3*			
Constituent %	*Leaf Blade*				*Midrib*			
	* *Healthy*		† *Weak*		* *Healthy*		† *Weak*	
	Wet	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*
Nitrogen (as N)	1·63	1·71	1·78	1·86	0·32	0·33	0·33	0·34
Phosphorus (as P_2O_5)	0·27	0·28	0·30	0·32	0·103	0·107	0·111	0·116
Potassium (as K_2O)	1·14	1·19	1·17	1·22	0·56	0·58	0·27	0·28
Calcium (as Ca)	0·121	0·126	0·106	0·111	0·032	0·034	0·022	0·023
Magnesium (as Mg)	0·040	0·042	0·029	0·031	0·026	0·027	0·018	0·019
Moisture	4·32		4·27		3·62		3·72	

* Bulked samples from 6 healthy palms.

† Bulked samples from 6 weak palms.

The soil samples were drawn at 5 depths, namely 0-9″, 9″ to 18″, 18″ to 27″, 27″ to 36″ and 36″ to 45″, and were analysed for total, ammoniacal and nitrate nitrogen, total and available phosphorus, total exchangeable bases, total exchangeable potash exchangeable calcium and exchangeable mangesium.

The soil was actually sampled by bulking separately the borings from the various depths, collected from 36 different locations on the field under study, and subsampling the bulks by the quartering technique. The ultimate samples taken for analysis were of course powdered and sieved in the usual manner. The analytical results are charted in Table XI.

(For Table XI see page 34)

Workers on the technique of foliar analysis for the diagnosis of mineral deficiencies in crops employ various methods for the interpretation of results. There is for example the principle of critical levels which is based on the assumption that plants will respond to applications of fertilizers when the concentrations of nutrients in their tissues fall below certain levels. Other workers consider intensity factors based on nutrient ratios, as an indication of the nutritional status of the crop. There is again the recognition of "optimal and normal leaf composition" forming the basis for diagnosis, whereby deviations from the norm are reckoned to be characteristic with regard to the nature and degree of the deficiency. Whichever method is employed it is abundantly clear that a key of interpretation is an essential pre-requisite for each particular crop.

In the absence of any predetermined "index values" for the coconut palm, the present figures are useful in giving only indications if at all, of any obvious differences between the healthy and the weak palms. The analytical results for the various components are all of a comparable order except for the potash in the midribs (Table X column 3) where the figure for the weak palms is about 50 per cent. lower than that for the healthy palms. Excluding the possibility of any experiment. a error in analysis and on the assumption that this difference is outside the normal range of fluctuations (i.e. the norm), it is reasonable to conclude that this difference should signify something, and could very well be the result of single or multiple factors or the interaction of different factors.

TABLE XI

Results of Soil Analysis

Sample (Depth)	*2*	*3*			*4*		*5*	*6*	*7*	*8*
		Nitrogen			*Phosphorus*					
	pH	*Total %*	*Ammoniacal %*	*Nitrate *p.p.m.*	*Total p.p.m.*	*Available p.p.m.*	*Total Exchangeable Bases (ME%) †*	*Total Exchangeable Potash (ME%)*	*Exchangeable Calcium (ME%)*	*Exchangeable Magnesium (ME%)*
0– 9″	5·0–5·5	0·115	0·004	59·5	569	22·4	2·70	0·30	2·10	0·54
9″–18″	4·5–5·0	0·310	0·003	43·5	131·7	30·4	2·20	0·33	1·23	0·16
18″–27″	5·5–6·0	0·372	0·002	177·5	592	19·6	3·80	1·74	1·65	0·63
27″–36″	5·0–5·5	0·079	0·002	32·5	667	14·6	1·40	0·22	1·10	0·31
36″–45″	5·5	0·067	0·004	61·3	450	Trace	2·65	0·31	2·08	1·01

* p.p.m.=parts per million.

ME% †= Milligramme-equivalent per 100 gms. soil.

In a crop like the coconut, with its extensive rooting zone, a direct correlation could not necessarily be drawn between the nutrient status of the soil and that of the palm. The figures in table XI, column 6, for total exchangeable potash show that in the horizons down to a depth of 45" there is an adequate, if not high concentration of potassium, viz, 0·22 to 1·74 Milligramme-equivalents per 100 grms. soil. About 0·05–0·15 M.E. per cent. may perhaps be regarded as a satisfactory range for the potash status of a soil. The exchangeable potash, in the soil under study, therefore offers no direct explanation for the differences in the potash contents of the midribs.

On the basis of these facts, it is an obvious conclusion that no straightforward interpretations or inferences are possible, with our present state of knowledge. The results obtained in this study are however a useful record for future reference, when basic information on the chemical status of the coconut palm based on certain fundamental studies to be projected becomes available.

III. Miscellaneous Work

(*a*) Analyses and reports were made on—

1. A sample of copra sent by the Superintendent of Mary Mount Estate, Narammala, for moisture and oil contents.
2. Three samples of copra sent by the Superintendent, Andigama Estate, for moisture contents.
3. A sample of copra sent by a mill owner for moisture content.
4. Two samples of copra and two samples of poonac sent by a mill owner were examined for moisture and oil contents. Moisture, Free fatty acid and specific gravities were also done on two samples of coconut oil received from the same source.
5. A sample of burnt limestone sent by the Superintendent, Halgashena Estate, for calcium and magnesium contents.
6. Two samples of Mill Floor Scrapings sent by a mill owner were examined for the fertilizer elements.
7. Two samples of Desiccated Coconut sent by the Ceylon Coconut Industries for moisture content.
8. A sample of sediment poonac sent by the Superintendent, Dispensary Estate, for nitrogen contents.
9. Two samples of coconut oil for Free Fatty Acids. Six samples of poonac for moisture and oil contents. All samples were received from the Haldanduwana Mills.
10. Eleven samples of coir fibre sent by the Ceylon Coconut Industries for moisture contents.

(*b*) The following analytical investigations have been carried out during the year for the Division of Agronomy :—

1. Potash contents of two samples of plant tissue.
2. Total and cyanamide nitrogens on a sample of deteriorated calcium cyanamide.
3. Potash and Phosphorus contents on a sample of rain water.
4. Crude Protein, Crude Fibre, Calcium and phosphorus on 5 samples of grass.
5. Potash and phosphorus contents of 12 samples—of grass.
6. N. P. K. Ca and Mg estimations on two samples of coir dust one from retted husks and the other from dry milled husks.

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REPORT OF THE BOTANIST

Hybridization Work

A number of first generation progenies of crosses between selected varieties and forms of coconut have been planted in the field since 1950. The first lot included crosses between *typica* (ordinary Ceylon tall variety), *nana* (dwarf variety) and King coconut, while the subsequent plantings included crossings between San Ramon and Bodiri, besides the above types.

From the 1950 planting, *typica* × *nana* appears to be the best cross in that the F_1 palms are vigorous, early flowering and high-yielding. The F_1 of *typica* × King coconut is also vigorous, but is of little economic importance as the incidence of premature nut fall is heavy owing to the presence of long bunch stalks. Further, the copra tends to be rather thin. The progenies of King coconut × *nana* are not very desirable in that they exhibit periodicity in bearing and are less drought tolerant than the *typica*.

Typica × *nana*

Notes on the performance of the first generation palms (F_1) of tall × dwarf have been given in the Annual Reports for 1955 and 1956. All the palms were in bearing in 1957 and the yields gathered are given in Table 1.

TABLE I

Yield of typica × nana F_1 Palms in 1957

Cross	No. of Progenies	Mean per Progeny: Nuts	Weight of husked nuts (lb.)	Weight per nut (lb.)
360 × 1713	4	96	128·6	1·34
218 × 1713	5	93	150·1	1·61
360 × 1712	5	104	158·7	1·52
273 × 2646	1	119	168·5	1·42
139 × 2646	4	60	81·3	1·35
778 × D	3	54	50·7	0·94
Mean	—	86	122·7	1·43

Considering that the above data are for seven year old palms, a mean yield of 86 nuts per palm is very satisfactory. All the nuts harvested were bulked and turned into copra: total yield of copra was 6·55 cwt. composed of 94·1 per cent. No. 1 quality, 3·9 per cent. No. 2 and 2·0 per cent. No. 3. Copra per nut was 6·2 ozs. (approximately). *If these figures are calculated on an acre basis, say on a density of 70 palms to the acre, the equivalent yield is 6020 nuts or 20·84 cwt. of copra per acre.* The F_1 palms of *typica* × dwarf appear to be of considerable economic importance in that they are early bearing and high-yielding.

It is apparent from Table 1 that there is considerable variation both in yield of nuts and weight per husked-nut of the progenies between the different paired crosses. Presumably, certain pairs combine well to give a higher yield than other combinations.

In order to study the performance of the hybrids in the major coconut growing areas, 240 tall × dwarf seedlings and 80 tall variety seedlings were issued for planting in November to five estates spread over Puttalam, Chilaw, Kurunegala and Matara districts.

Further during the year tall × dwarf paired crosses were continued on selected palms at Bandirippuwa, Ratmalagara, Letchemy and Kirimetiyana Estates and 5724 female flowers have been pollinated. Nuts would be ripe for harvesting in late 1958.

Typica × *typica*.—In 1949, a few preliminary crosses were done in pairs between selected high-yielding tall variety (*typica*) palms, largely to study techniques in pollination. A few nuts were harvested and 10 seedlings were planted in November 1950 in the same field where the *typica* × dwarf seedlings have been planted. At the end of the seventh year *i.e.* 1957, 8 out of the 10 plants were in bearing and their yields are indicated in Table 2.

TABLE 2

Mean Yield of Typica × Typica F_1 Palms

	6th Year (1956)	*7th Year (1957)*
Nuts per palm	22·3	52·1
Weight per husked-nut (lb.)	1·60	1·34
Calculated yield of nuts per acre on a basis of 70 palms	1,561	3,647

It is interesting to compare the yields of *typica* × *nana* and *typica* × *typica* F_2 palms (Tables 1 and 2) : the former have given 68 and 86 nuts per palm in the 6th and 7th years respectively, whereas the latter palms have given only 22 and 52 nuts respectively during the same years under the same environmental conditions.

Paired crosses between selected high-yielding *typica* palms have been done on a large scale from 1954 to 1957 and a summary of this work is given in Table 3. The percentage setting represents the total number of nuts harvested in relation to the total number of female flowers pollinated. It is seen that under artificial pollination, setting has varied between 24 and 28 per cent., which is lower than under natural pollination. This difference is largely due to the artificial conditions in which the female flowers are placed inside the pollination bag. The temperature inside the pollination bag is 5 to 10°C more than the atmospheric temperature towards early afternoon. The decrease in setting with artificial pollination is presumably due to the high temperature within the bag.

TABLE 3

Crosses done between typica palms

Station	*1954*		*1955*		*1956*		*1957*
	*	†	*	†	*	†	*
Achchitotam ..	5,558	1,250	7,271	1,784	8,610	2,081	3,852
Bandirippuwa ..	3,533	1,022	4,081	751	6,422	1,678	2,827
Duncannawa ..	3,659	1,363	3,655	1,179	3,502	1,101	—
Letchemy ..	—	—	—	—	7,110	1,989	5,929
Ratmalagara ..	—	—	—	—	1,477	347	3,639
Total ..	12,750	3,635	15,007	3,714	27,121	7,197	16,247
Per cent. setting ..	—	28·1	—	24·7	—	26·5	—

* Number of female flowers pollinated.
† Number of nuts harvested.

Coconut Seed Garden—Selected progenies of *typica* × *typica* crosses have been planted in the Seed Garden. 1,217 seedlings were planted in November, 1957. The area planted to date is as follows :—

Field	*Planted*	*No. of Seedlings*
Neerawiya 1 ..	December 55 and June 56 ..	330
Neerawiya 2 ..	November 56 ..	416
Neerawiya 3 ..	November 56 ..	341
Neerawiya 4 ..	November 56 ..	750
Neerawiya 5 ..	November 57 ..	1,217
	Total ..	3,054

King Coconut × *Dwarf*.—The King Coconut female parent has apricot red nuts, the dwarf male parent green nuts and their F_1 palms have reddish brown nuts. The nuts of the F_1 palms are small in size, husked-nut weight is low and bearing is periodical *i.e.* in alternate years the yield of nuts is low (Table 4). The habit of the F_1 palms are more like the dwarf parent with slender stems and short internodes. They are less hardier than the *typica* palms and are more susceptible to pests and diseases.

TABLE 4

Yield of King Coconut × Dwarf F_1 palms

Cross	Progeny No.	1954		1955		1956		1957		Mean per Year	
		Nuts	Weight	Nuts	Weight	Nuts	Weight	Nuts	Weight	Nuts	Weight
1717 × 2706 ..	31..	117..	132·0..	10..	27·0..	173..	155·5..	47..	52·0..	87..	91·6
	32..	134..	169·8..	73..	112·5..	99..	102·5..	109..	149·8..	104..	133·7
	34..	159..	160·3..	68..	85·3..	111..	115·3..	132..	149·8..	118..	127·7
1495 × 2706 ..	35..	177..	151·0..	60..	78·3..	182..	176·3..	62..	90·3..	120..	123·9
Mean ..	..	147..	153·3..	53..	75·8..	141..	137·4..	88..	110·5..	107..	119·2

In the above table weight refers to the total weight of husked-nuts (in lb.). Considering the nut size and the periodicity in bearing, these hybrid palms appear to be unsuitable for cultivation on a commercial scale.

Other Crosses.—There are three coconut palms known in Ceylon that propagate vegetatively by the production of suckers from the bole of the palm. One palm had 45 suckers, while in the other two there were not more than 6 suckers on each due to heavy cattle damage. Suckers separated from the bole were planted at Bandirippuwa : two of them have got established, but growth is exceedingly slow.

In order to study the nature of inheritance of the suckering habit, pollen collected from the suckering palms were used in crossing selected dwarf (*nana*) and tall (*typica*) variety palms as female parents.

Storage of Coconut Pollen.—The practice hitherto has been to collect pollen from the spikelets of the coconut inflorescences in the laboratory and store them in vials in a dessicator with 43·4 per cent. Sulphuric acid at room temperature. With this method, about 50 per cent. of the pollen grains remain viable on the 15th day of storage. Particularly in doing inbreeding work and making maximum use of the elite palms, it was found necessary to store pollen over a longer period and trials were undertaken accordingly.

A satisfactory method worked out is as follows :—Small quantities of pollen from *typica* palms collected in the usual way were introduced into pieces of glass tubing about 6 inches long (external diameter 3—4 m.m., wall thickness less than 0·5 m.m.) sealed at one end. The tubes containing pollen were hermetically sealed after leaving them in a dessicator containing 43·4 per cent. Sulphuric acid for 2 to 3 hours. The sealed samples were left in a refrigerator (temperature 3—6°C). Viability scorings of a few samples stored in this manner and germinated in a sugar-gelatine medium are given below :

Sample No.	Date of Collection	Date tested	Period of Storage (Days)	Per cent. Germination
39/56 ..	29.12.56 ..	15. 6.57 ..	170 ..	62·8
S—42 ..	30. 4.57 ..	31.12.57 ..	246 ..	73·8
S—44 ..	3. 5.57 ..	27.12.57 ..	238 ..	56·9
S—45 ..	7. 5.57 ..	26.12.57 ..	233 ..	28·3
S—52 ..	9. 5.57 ..	16.12.57 ..	221 ..	60·2

Three of the above samples of pollen stored for over 7 months have shown viability of over 56 per cent. In the fourth sample only 28 per cent. of the grains were viable. In sample S-42, after storage for over 8 months, 73 per cent. of the pollen grains were viable. Pollen grains from sample 39/56 were used for pollination after the germination tests and 4 out of the 8 female flowers pollinated are developing into fruits.

Replantation

A field trial was initiated in 1950 to study the relative merits of three methods of under-planting senile coconut plantations, *viz.* (*a*) *New Clearing* type—planting after the removal of the old stand of palms completely, (*b*) *Gradual thinning*—under planting and removing the old stand of palms gradually, about 20 per cent of the old stand was removed during the first year and thereafter 10 per cent every year, (*c*) *No thinning*—underplanting without removal of the old palms ; the latter to be removed during the initial stages of bearing of the young palms.

Selected seedlings were planted in May, 1950 with 25 plants per plot and 7 replications. The density of the old stand of palms was 64 palms (approx.) to the acre.

A preliminary report on the progress of this experiment was given in the Annual Report for 1954 and summarised data of an analysis of variance are presented below.

Leaf Production. The number of fully grown leaves produced per plant each year is given in Table 5. The treatment and the years × treatment variances are highly significant ($P = <0{\cdot}01$), apparently the latter variance is mainly due to the higher rate of yearly leaf production as the plants grow in age rather than to climatic causes.

TABLE 5

Mean number of leaves produced per 100 plants

Treatment	*Year after Transplantation*					
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*
New clearing ..	432	659	722	878	1,121	1,119
Gradual thinning	412	607	652	755	944	964
No thinning ..	416	594	628	693	818	832

Critical difference between treatments each year 31·3.

The pattern of yearly leaf production in the young palms during the first six years is related to the treatment type. In the first year after planting, leaf production was practically the same for all the treatments. Probably, the effect of the thinning of the old palms would not have been felt then. From the second to the sixth years. the young palms in the new clearing type of treatment have produced significantly more leaves than those in either of the other two treatments. The young palms in the gradually thinning treatment have produced significantly more leaves than those in the no thinning type from the fourth year onwards ; during the second and third years the differences were in favour of the former treatment, but they were not statistically significant. Thus as far as leaf production of the young palm is concerned, the three systems of underplanting can be placed in the following order of merit ; (i) new clearing, (ii) gradual thinning and (iii) no thinning.

Flowering Period. The flowering period of a palm has been taken as the period from the date of transplanting a seedling to the date when the first spathe is visible on the young palm. The percentage of palms in flower, cumulative for each year, are given in Table 6.

TABLE 6

Percentage of palms in flower

Treatment	*5th Year*	*6th Year*	*7th Year*
New clearing ..	12·0	44·0	63·3
Gradual thinning	3·4	25·1	45·1
No thinning ..	1·7	12·0	26·3

The variance ratios are 5·66, 7·07 and 6·69 for the 5th, 6th and 7th years respectively. The first and the third ratios are significant at P = 0·05 and the second at P = <0·01. Thus the treatment had an effect on the flowering period and total thinning of the old palms has promoted early flowering of the young palms. Underplanting without the removal of the old palms has considerably retarded flowering of the young palms. With respect to early flowering, the three systems of underplanting can be placed in the following order of merit : (i) new clearing, (ii) gradual thinning and (iii) no thinning.

Yield of nuts. The yield of nuts during the sixth (1955/56) and seventh years has followed the flowering pattern (Table 7).

TABLE 7

Yield of Nuts

Sixth Year	*New Clearing*	*Gradual Thinning*	*No Thinning*
Total No. of nuts for all the plots (175 palms)	85	52	0
Nuts per acre	32	19	0
Weight per husked-nut (lb.)	2·07	1·61	0
Seventh Year			
Total No. of nuts for all the plots (175 palms)	1,008	410	129
Nuts per acre	373	152	48
Weight per husked-nut (lb.)	1·94	1·59	1·85

The main purpose of this trial is to find out an economical method of replanting senile plantations whereby the bearing age of the young palm is not unduly delayed, and its potential yield not retarded due to the presence of the old stand of palms. From the data presented so far on the three systems of replanting, it is clear that underplanting leaving the old stand of palms completely is detrimental to the growth of the young plants—leaf production has been poor and flowering has been considerably delayed. Consequently this system of replanting could be altogether discouraged. Out of the two remaining systems, new clearing type has shown better results than the gradual thinning type. Yet it is necessary to collect further information regarding the yield of palms, before we could ascertain which system is superior to the other.

Planting Techniques

Size of Seed Hole. A field experiment was initiated in November, 1955 to study relationship, if any, between the size of the seed-hole used to plant a coconut seedling and the growth of the seedling. Four seed-hole types have been tried out : *viz.* (*a*) 1 × 1 × 1 ft. (1 cu. ft.), (*b*) post-hole borer type (6 cu. ft.), (*c*) 3 × 3 × 3ft. (27 cu. ft.) and (*d*) cruciform (81 cu. ft.). Description of the seed-hole types is given in the Annual Report for 1955. The design of the experiment is simple randomisation with 9 plants per plot and 6 replications.

The following characters were scored in November, 1957, *i.e.*, at the end of the second year : (*a*) number of leaves produced per plant during the year, (*b*) height of the plant *i.e.* maximum vertical length from the base of ' stem ' to the apex of an extended leaf and (*c*) girth of base of plant. The data were treated to an analysis of variance and the mean values are presented in Table 8.

TABLE 8

Mean Measurements per plant at the end of the second year

Type of Seed-hole	*Leaf (Number)*	*Girth of Base (Inches)*	*Height (Feet)*
1 × 1 × 1 ft.	7·1	15·6	9·6
Post hole borer	7·5	18·0	9·7
3 × 3 × 3 ft.	7·7	22·8	11·4
Cruciform	7·6	22·8	11·1
Critical difference	—	1·8	0·6

The differences between the treatments with respect to leaf production are not significant, whereas the differences regarding the other two characters are highly significant (P. = <0·01). The plants in the 3 × 3 × 3 ft. and cruciform seed-holes have shown better growth in the second year, both in girth of base and height over the plants in the other treatment, but the differences between themselves are negligible, although the cruciform seed-hole is thrice the volume of the 3 × 3 × 3 ft. type.

Depth of Planting. A field trial was laid down in November 1956 to study relationships, if any, between depth of planting a coconut seedling and growth of the palm. Four treatments, 6, 12, 18 and 24 inches deep planting are being tried out. Design is randomisation with 9 plants per plot and five replications.

The same characters as those scored for the previous experiment were taken at the end of the first year (1957) and their summary is presented in Table 9.

TABLE 9

Mean Measurements per plant at the end of the first year

Treatment	*Leaf Number*	*Girth of Base (Inches)*	*Height (Feet)*
6 in. deep planting	6·5	11·0	6·6
12 in. deep planting	6·2	10·8	6·5
18 in. deep planting	6·4	11·6	6·6
24 in. deep planting	6·2	11·1	6·7

Differences between treatments with respect to the characters listed above are not statistically significant. Thus, during the first year, the growth of the palms have been practically the same in all the four treatments.

Hedge Planting. The observation plots of this new system of planting have completed one year.

Miscellaneous

Latin Square Experiment. A detailed report on this experiment designed to test 3 methods of seed selection and 2 methods of seedling selection was given in the Annual Report for 1956. The yields that were recorded during the year are given below :—

	Nuts per Acre			
	Seedlings selected		*Seedlings unselected*	
Seednuts from high-yielding mother palms	A	3,794	B	3,094
Seednuts from low-yielding palms	C	3,693	D	3,684
Heap nuts	E	3,604	F	3,289

Mother Palms. Six estates were visited during the year for selection of mother palms and sufficient palms for purposes of yield recording were found only on one estate. Yield recording of selected high-yielding palms at Bandirippuwa and Letchemy estates was continued.

Personal. Mr. C. A. Wickramasuriya, Research Assistant was transferred to the Advisory Division in December. Mr. W. P. B. Fernando was appointed Technical Assistant in August. Mr. S. Edirisinghe, Nursery Attendent, was promoted Conductor, Seed Garden.

Publications. A paper on " Correlations between seed-nut, seedling and adult palm characters in Coconuts " has been submitted for publication.

D. V. LIYANAGE,
Botanist, Coconut Research Institute.

Lunuwila,
March 12, 1958

REPORT OF THE CROP PROTECTION DIVISION

A. Experimental Work

1. LABORATORY EXPERIMENTS

(i) ORYCTES RHINOCEROS

(*a*) *Life Cycle Studies.* A special technique was worked out to rear this insect from egg to adult. Earlier attempts to breed cultures of this insect failed but the technique has been so perfected now that the insect could be reared successfully during all stages of development. In this technique the moisture requirements of *Oryctes* were met and also a way of getting rid of parasites in the breeding material. In the technique the following methods are noteworthy.

(*a*) Eggs were laid in frass medium.

(*b*) Coconut leaf petiole was found better than sugar cane as adult feeding material.

(*c*) Larvae were reared in fresh cow-dung, sun dried and moistened to the correct level.

(*d*) Pupation was allowed in a mixture of cow-dung and soil.

(*e*) Adults were reared in beakers, provided with pieces of leaf petiole as food material.

Several cultures of the insect were reared from egg to adult. The following information was obtained :—

(1) Incubation period 10 days (average). Range 8–12 days.
(2) 1st Instar—16·8 days (average). Range 13-22 days.
(3) 2nd Instar—18·3 days (average) . Range 16-21 days.
(4) 3rd Instar—87·3 days (average). Range 72-103 days.
(5) Pre-pupal period 6·3 days (average) . Range 4-8 days.
(6) Pupal period 18·1 days (average). Range 16-21 days.
(7) Adult period is 89 days (average).
(8) One generation of *Oryctes* takes about 245 days.
(9) Sex ratio is 1 male to 3 females.

In this study, an egg parasite was found. It was identified by the British Museum as *Parasitus heliocopridis*. The Metarrhizium fungus was also found active in some cultures.

(*b*) *Phototaxic responses of Oryctes.*—An apparatus was constructed to cage a number of beetles in a wooden box which had three compartments. The beetles were placed in the centre compartment. They could enter the compartments on either side through trap doors. The side compartments were lit by means of two-lamps emitting lights of equal intensity. The lamps were made to shine through 40 × 40 c.m. glass filters. One compartment was supplied with illumination through ground glass. This was a control treatment. The other compartment was supplied with different filters of the colours given below.

Daylight blu	Dark green
Dark blue	Light red
Light neutral	Light green
Purple	Day neutral
Dark red	Yellow
Orange	

Lamps were switched on every alternate 24 hour period. Beetle counts were taken in all the compartments at the end of 24 hours of illumination with every filter. Several rounds of observations were made. The data was analysed statistically. The findings are as follows

1. The Red and Purple are significantly better than all other colours; the Red being relatively more reliable than purple because the purple is based on fewer numbers.
2. There is no significant differenc between Red and Purple.
3. The other five colours, viz. Yellow, Blue, Neutral, Orange and Green do not differ significantly among themselves.
4. The sex difference is highly significant i.e. female more than males, are attracted to all colours as against ground glass.
5. Sex into colour interaction is not significant (not the sightest indication).

This means that there is no sex bias towards particular colours.

(c) *Moisture requirements in feeding medium of Oryctes.* In the life cycle studies of the Black Beetle, it was revealed that moisture was an important factor in the development of the various stages. An experiment was initiated to determine the optimum moisture content in the breeding material at various stages from egg to pupa.

Cow-dung was the medium for larval breeding. Sun-dried cow-dung was moistened so that the samples had a moisture content of 10 ; 15; 20 ; 30 ; 40 ; 50 ; 60 ; 65 ; 70 and 80 per cent. Five eggs were introduced into each trough.

The results were obtained as follows :—

Eggs.

In 80% (moisture content)—20% of the eggs hatched out—one larva which hatched out died due to high moisture content.
70%—40% of eggs hatched out 20% larvae died before reaching 2nd instar.
65%—80% of eggs hatched out. Only 20% larvae reached the 2nd instar and died.
60%—80% of the eggs hatched out. Of these 20% larvae died and others reached adult stage.
50%—80% eggs hatched out. All larvae reached adult stage.
40%—80% eggs hatched out. All larvae reached adult stage.
30%—80% eggs hatched out. All larvae reached adult stage.
20%—All eggs hatched out and all larvae reached adult stage.
15%—80% of eggs hatched out larvae yet in 3rd instar.
10%—None hatched out.

Larvae of 1st Instar

In 80%—20% of larvae which reached this stage died before reaching 2nd instar.
70%—40% of larvae reached this stage but died before reaching 2nd instar.
65%—20% of larvae reached this stage and survived through the first instar.
60%—25% of larvae died and 75% survived in 1st instar.
50%—80% larvae reached and all of them passed through 1st instar.
40%—80% larvae reached and all of them passed through 1st instar.
30%—80% larvae reached and all of them passed through 1st instar.
20%—100% larvae reached and all of them passed through 1st instar.
15%—80% larvae reached and all of them passed through 1st instar.
10%—(No larvae reached 1st Instar stage).

Larvae of 2nd Instar.

80%—No larvae reached 2nd Instar stage.
70%—No larvae reached 2nd Instar stage.

65%—20% of larvae reached 2nd instar—but died.
60%—60% larvae reached 2nd instar stage and survived.
50%—80% larvae reached 2nd instar and all survived.
40%—80% larvae reached 2nd instar and all survived.
30%—80% larvae reached 2nd instar and all survived.
20%—100% larvae reached 2nd instar and all survived.
15%—80% larvae reached 2nd instar stage and survived.
10%—No larvae reached 2nd instar stage.

Larvae of 3rd Instar.

80%—No larvae reached 3rd instar stage.
70%—No larvae reached 3rd instar stage.
65%—No larvae reached 3rd instar stage.
60%—60% of larvae reached 3rd instar stage and all survived.
50%—80% of larvae reached 3rd instar and all survived.
40%—80% of larvae reached 3rd instar and all survived.
30%—80% of larvae reached 3rd instar and all survived.
20%—100% of larvae reached 3rd instar and all survived.
15%—80% larvae reached 3rd instar stage and all survived.
10%—No larvae reached 3rd instar stage.

Pre-pupal stage.

80%—No larvae reached this stage.
70%—No larvae reached this stage.
65%—(20% larvae still in 3rd instar).
60%—60% larvae reached pre-pupal stage and survived.
50%—80% larvae reached pre-pupal stage and survived.
40%—80% larvae reached pre-pupal stage and survived.
30%—80% larvae reached pre-pupal stage and survived.
20%—100% larvae reached pre-pupal stage and survived.
15%—(80% larvae still in 3rd instar stage).
10%—No larvae reached pre-pupal stage.

Adult Stage.

80%—None reached adult stage.
70%—None reached adult stage.
65%—(One larva still in 3rd instar).
60%—60% larvae reached adult stage.
50%—80% larvae reached adult stage.
40%—80% larvae reached adult stage.
30%—80% larvae reached adult stage.
20%—100% larvae reached adult stage.
15%—(80% larvae still in 3rd instar stage).
10%—No larvae reached adult stage.

These observations indicate that moisture levels of 15%–60% in the hatching and feeding medium of larvae is the range of moisture that is favourable for the survival of all stages of *Oryctes* from egg to adult emergence.

Extreme wetness or dryness is unfavourable for the successful completion of the life cycle of *Oryctes*.

(ii) *Rhyncophorus ferrugineus.*

(*a*) *Life Cycle studies.*—A technique was developed to rear this insect from egg to adult. In the earlier stages the larvae thrive best on coconut bud. Older larvae

were provided with pieces of leaf petiole in which they made cocoons and pupated. The pupa required moisture for successful emergence of adult. With several cultures under study, the following information was obtained.

1. Incubation period of egg—2 days (average)
2. Percentage hatching—68·6 days (average)
3. Percentage fertility—60.
4. Duration of 1st instar—2 days (average)
5. Duration of 2nd instar—1 day (average)
6. Duration of 3rd instar—1 day (average)
7. Duration of 4th instar—2 days (average)
8. Duration of 5th instar—2 days (average)
9. Duration of 6th instar—9 days (average)
10. Duration of 7th instar—12 days (average)
11. Duration of 8th instar—13 days (average)
12. Pre-pupal period—3 days (average)
13. Pupal period—9 days (average)
14. Oviposition takes place 6—7 days after emergence.
15. A single female lays about 185 eggs.
16. Adult period is about 56 days.
17. One generation takes about 116 days.
18. Sex ratio is 1 male to 2 females.

It is noteworthy that there was a marked absence of natural control in this insect pest.

(*b*) *Comparative toxicity tests as an aid in selecting an insecticide for the control of Rhyncophorus ferrugineus.*—In the absence of a means of natural control against this pest, it was decided that a series of laboratory trials be conducted with available systemic insecticides. Pyrenone was also selected for the trials.

Method.—Pieces of leaf stalk 4″ long and 1½″ square at the ends were soaked for 4 hours' duration in three dilutions of each insecticide. Prior to soaking a hole is bored on the side of the piece of leaf petiole to introduce a single larva. Five pieces of treated leaf petiole with five larvae, one in each, constituted one treatment. These were kept on a glass sheet and covered with a bell-jar. A control treatment was set up with five larvae and five pieces of leaf petiole, soaked in water for 4 hours. Observations were taken every 24 hours. Every alternate day the larvae were put in untreated pieces of leaf petiole. (This was done to study such effects that in the palm when treated larvae may move on from a treated area to an untreated portion of the palm.) A single trial lasted for seven days. The results were obtained as follows :—

Schradan was tried at concentrations

0·5%—20% kill in 7 days
0·2%—No kill in 7 days
0·1%—No kill in 7 days

These doses were increased

1·0%—20% kill in 7 days
1·5%—20% kill in 7 days

Systox was started at 1%, 2% and 3% concentrations

1%—100% kill in 2 days
2%—100% kill in 3 days
3%—100% kill in 3 days

The concentrations were lowered

0·75%—I00% kill in 4 days
0·50%—100% kill in 4 days
0·25%—100% kill in 4 days

The concentrations were further lowered

0·01%—100% kill in 5 days
0·015%—100% kill in 3 days
0·02%—100% kill in 3 days

The concentrations were still lowered

0·025%—100% kill in 5 days
0·0125%—100% kill in 5 days

Dipterex—The following concentrations were tried :—

0·05%—100% kill in 3 days
0·025%—100% kill in 6 days
0·0125%—100% kill in 6 days

Follidol

0·05%—100% kill in 3 days
0·025%—80% kill in 7 days
0·0125%—80% kill in 7 days

Chlorothion

0·05%—No kill in 7 days
0·025%—No kill
0·0125%—No kill

Dimefox

0·05%—40% kill in 7 days
0·025%—40% kill in 7 days
0·0125%—No kill in 7 days

Pybuthrin

0·05%—100% kill in 5 days
0·025%—100% kill in 5 days
0·0125%—100% kill in 5 days

Pyrenone

0·05%—100% kill in 1 day
0·025%—100% kill in 1 day
0·0125%—100% kill in 1 day

2. FIELD EXPERIMENTS

1. *Insecticide trials for the control of Black Beetles.*—This experiment was commenced last year. The purpose is to determine the relative efficacy of 8 insecticides at three levels, by axil placement to control attacks of Black beetle.

Treatments—

1. D. D. T. 50% W. P.
2. B. H. C. 6·5% γ W. P.
3. Hexidole 10% B. H. C.
4. B. H. C. 1·3% γ
5. Didimac 10% D. D. T.

6. B. H. C. 0·65% δ
7. Dieldrin 2%
8. Aldrin 2½%

Levels—1. — 1 : 3 (insecticide diluted with sand)
2. — 1 : 6
3. — 1 : 9

Design.—A randomized block design consisting of 3 blocks—two of which contain 24 plots to each of which is assigned at random one of 24 treatments (viz. 8 treatments at 3 levels). There is also a third block with 16 plots to each of which is assigned at random one of 16 treatments(viz. 8 treatments at the two extreme levels).

Each one of these treatment plots had a control plot adjacent to it. The experiment was carried out with palms in the under-plantation (with the kind permission of the Botanist). Observations of beetle attack were kept daily.

The experimental area in general had a low incidence of beetle attack. Since it is known that significance varies inversely with the numbers of beetles, the result from this experiment cannot be recommended. The experimental area is not however ideally suited because of the paucity of beetle numbers. However, the results were analysed with a view of narrowing down the selection of insecticides for a future trial. The conclusions of the analysis are given below :—

1. The treatments in general were significantly better than the controls.
2. The following three treatments are outstanding in the order given.
   (*a*) Dieldrin dust 2½%
   (*b*) B. H. C. 6·5 δ isomer
   (*c*) Didimac 10 % D. D. T.
3. The period of effectiveness of the insecticides mentioned above was 50 days or more. Therefore in general, use of these insecticides can be expected to give the desired effect of repelling beetles for a period of at least one month.

2. *Adult beetle traps using Breeding materials.*—An apparatus was constructed in tin to cage a number of beetles in a cylinder. They were free to fly about inside this large compartment. Through holes at the bottom they could enter tubes leading to pots containing different breeding material. Control pots contained only strips of filter paper. These pots were moved from one position to the adjacent one every day. Pots were examined every day and the number of beetles found in each pot was noted. Thirty beetles were used. Dead ones were replaced from time to time. Pieces of leaf petioles were provided for feeding. The first round of 12 pots was set up as follows :—

1. Cattle manure—top 6″ (ex cattle shed)
2. Control—only strips of filter paper
3. Cattle manure 6″—12″
4. Control
5. Cattle manure 12″—18″
6. Control
7. Cattle manure 18″—24″
8. Control
9. Cattle manure (12″—18″)+1 lb. Molasses.
10. Control
11. Cattle manure (12″—18″)+Coconut Meal+1 lb. Molasses.
12. Control.

The largest number of beetles were collected from treatment No. 11. The treatments which gave good beetle collections were selected for the 2nd round which was set up as follows :—

1. Cattle manure 6″—12″ (ex cattle shed)
2. Control
3. Control
4. Cattle manure 18″—24″
5. Control
6. Control
7. Cattle manure (12″—18″)+1 lb. Molasses
8. Control
9. Control
10. Cattle manure (12″—18″)+1 lb. Molasses +1 lb. Coconut Meal
11. Control
12. Control

In this trial, treatment No. 12 gave the best collections of beetles.

The second stage of the experiment was then initiated using cattle manure, Molasses, Coconut Meal and Meat Meal. The treatments were set up as follows :—

1. Cattle manure (4 lb.)+Molasses ½ bottle+Meat meal. (4 lb.) mixed together
2. Control—Strips of filter paper only
3. Control— do.
4. Coconut Meal (8 lb.)+Molasses ½ bottle
5. Control
6. Control
7. Meat meal (8 lb.)+Molasses ½ bottle
8. Control
9. Control
10. Coconut Meal (4 lb.)+Meat meal (4 lb.)
11. Control
12. Control.

In this trial rain interferred severely. Beetle collections in the treatment pots were poor. The pots and the apparatus was covered with cadjan. Yet the total beetle collections did not warrant any conclusions. The trial was suspended until next year.

3. *Termite Control Experiment.*—These experiments were initiated last year at Walpita and Kurunegala Nurseries. Seed-beds were treated in alternate rows with the following insecticides :—

Didimac 10% D. D. T.
Peylortox 25 lb. D. D. T. per imp. gal.
Gammexane 0·65% & B. H. C.
Gammexane 1·30% & B. H. C.
Hexidole Dust 810. 1·30% & B. H. C.
Aldrin Dust 2½% Aldrin
Aldrin 2—24% Aldrin
Aldrin M. O.—30% Aldrin
Dieldrin Dust—2% Dieldrin
Dleldrex 15—18·6% Dieldrin
Dieldrin M. O. 15% Dieldrin
Intox 8—70% Chlordane
Chlordox—10 lb. Chlordane per gallon
P. D. C. B.—para dichloro benzene.

Monthly observations were done in the treated plots. At the time of rejections of non-germinations careful observations were made to note down termite attacked

nuts in all the beds. Observations were continued as the seedlings grew, and after the rejection of poor seedlings the treatments for Post Emergence was done. The applications were done on alternate rows. The dilutions were made in water. The following insecticides were used :—

D. D. T. 50% W. D. P.—3·7 gms/treatment
Gammexane 6·5% W. D. P. 2·8 gms/treatment
Gammexane 6·5% W. D. P. 3·2 gms/treatment
Gammexane 5·4 gms/treatment
Aldrex 2—1c.c./treatment
Dieldrex 15·1 c.c./treatment
Psylortox 2 c.c./treatment
Aldrin M. O. 30% Aldrin 4·3 c.c./treatment
Aldrex 2—24% Aldrin 2 c.c./treatment
Dieldrex 15—2 c.c./treatment
Intox 8—8 c.c./treatment
Chlordox—2 c.c./treatment

Further observations were noted when the seedlings were uprooted for issue. The results of the data obtained from pre-planting treatments were studied. Insecticides such as—

Psyslortox
Hexidole dust
Aldrex 2
Aldrin 30% M.O.
Dieldrin 15%
Dieldrex 15
Intox 8

are effective in controling termites in nurseries. Repeat treatments will be necessary if one hundred per cent prevention of termite damage is required. Repetition of treatment need be carried out every twelve to fourteen weeks or at shorter intervals.

The data of the Post-Emergence trials are yet to be analysed. Yet from casual reference it can be stated that a high percentage of protection has been afforded to seedlings by these treatments.

B.—Pest Control Service

A severe attack of black beetle on young palms was reported fron Hikkaduwa. An inspection revealed the immediate necessity of treating these palms against the ravages of this pest. A spraying was undertaken and the palms were treated with Dieldrex Extra–The Hyper-miocover Sprayer and the Addison rocker sprayer were used. All possible breeding places were also treated. A single application was not found satisfactory. Repeated treatments were necessary and the pest was checked. The plantation is still under observation.

Equipment for the Canadian gifted Van was ordered from Moffart Virtue Ltd., Australia. After much correspondence with the several manufacturers overseas, this Australian firm was able to offer the best equipment suited for our purpose.

C. Advisory Work

(i) *Visits.*—Advisory visits to estates were made when the Advisory Officers required the assistance of this Division. Pest and Disease insidences that were serious were—

(*a*) Black beetle in Galle & Kurunegala districts.
(*b*) Pestalozzia palmarum in Kurunegala & Negombo districts.
(*c*) Stem bleeding in Kurunegala & Chilaw districts.

Yellowing of palms from Padukka District and Hikkaduwa District was reported, but on inspection they were found to be not due to either pests or diseases.

(II) Correspondence—A large number of letters regarding pests and diseases control advice were received and answered. The major pests reported in these letters were :—

Black beetle
Red Weevil
Coconut scale
Termintes
Bud root
Pestalozzia and
Stem bleeding.

Of less importance, the following were brought to our notice ;—

Coconut caterpillar
Rats
Bats.

D. Extension Work

With the expansion of work in the Division more requirements by way of Chemicals Equipment and Buildings were needed. Laboratory chemicals and equipment were ordered and got down from overseas.

Following the results of the laboratory light trap experiment, a field light trap was designed and two pieces of this equipment were constructed under a special order.

The work on the Insectary was begun according to the plan and specifications drawn up earlier. A close supervision was kept, as the work progressed.

E. Circuits and Field Trips

Visits were made by Officers in the Division to Experimental Plots at Kurunegala (Termite control) Walpita (Termite control) and Hikkaduwa (Black beetle control). The Crop Protection Officer visited the Eastern Province to investigate the problems of Nephantis serinopa and afforded advisory assistance.

F. Administration and Staff

The Division recruited two Officers. Mr. Piyasena Subasinghe B.Sc. Agr. (Madras) was appointed Technical Assistant. Mr. S. W. Gunasekera was appointed as Driver/Attendant.

G. Scientific Papers Advisory Leaflets and Talks

The following Scientific papers were prepared for publication :—

(*a*) " The Rhinoceros beetle (*Oryctes rhinoceros* L). in Ceylon " by Hilary F. Goonewardene—Part I—Introduction, Distribution and Life History.
(*b*) " The Rhinoceros beetle (*Oryctes rhinoceros* L) in Ceylon " by Hilary F. Goonewardene Part II—Phototaxic responses of (*Oryctes rhinoceros* L)
(*c*) " The Red Palm Weevil (*Rhyncophorous ferrugineus*) in Ceylon by Hilary F. Goonewardene and M. S. Velu. Part I—Introduction, Distribution and Life History.

The Crop Protection Officer delivered an address to the Planters' Association Kurunegala, on the Research Work that is being carried out in the Division.

At a monthly Research Conference, the Crop Protection Officer gave a talk of work done in the Division describing the experiments, methods and purposes.

Lunuwila,
12th February, 1958.

HILARY F. GOONEWARDENE,
Crop Protection Officer

REPORT OF THE DIVISION OF AGRONOMY

A. Introduction

Mr. T. B. Paltridge, who in 1955, initiated this Division was released from his Colombo Plan assignment in August this year before the completion of his 3 year period. During this period he built up a laboratory for studies on nutrient status of soils by the bio-assay method and trained the necessary staff to carry on the work after his departure.

In the field of pasture research, Mr. Paltridge met with serious limitations. The main limiting factor was land. Added to this was the unusual drought condition experienced, and the short time at his disposal. However with his long experience of pasture research, he laid out a few small experiments based on which, more elaborate experiments could be laid once land is made available.

On his departure the research assistant of the Division was appointed Acting Agronomist. The temporary female Laboratory Assistants were made permanent as Technical Assistants as from 1st January, 1957.

B. Studies on Nutrient Status of Soils

During the year, studies on the nutrient status of three soil types were undertaken, and the preliminary results were published.

The primary objective of these studies has been to determine the nutrient status of selected soils, typical of comparatively large areas, with a view to more effective use of fertilizers of coconuts, and to correction of nutrient deficiencies that might be a limiting factor in the growth and selection of desirable pasture plants.

On any one type of soil, samples were taken from twenty to thirty different places, and they were thoroughly mixed to provide uniform material for use in a series of experiments.

The investigation has used a technique of bio-assay where species known to require soils of high fertility are grown in pots with and without mineral nutrient or combination of nutrients, and their effect measured in terms of the yeild. (dry weight) of plant material produced in every pot.

While all plants (including coconuts) do not require the same nutrients in the same proportions, those experiments should give a general picture of local soil fertility problem, and it is at least highly probable that if a rapidly growing plant with high fertility requirements shows no deficiency of any nutrient, then that nutrient is unlikely to be a limiting factor in the growth of coconuts.

The experiments were conducted in a "Phytosolarium", which was a building $20' \times 60'$ made with all aluminium frame work and covered with an envelope of 'cascalite'. "Polythene" pots with no drainage holes were used and double distilled water was used for watering.

(i) LATERITIC SOILS ON BANDIRIPPUWA ESTATE.

This soil is typical of a large area, in Ceylon. Three major varieties were recognised namely—lateritic gravel, laterite loam and lateritic sand.

The data from these experiments have shown that the three soils are essentially similar in their nutrient status. This similarity was evident from a changing pattern of relative yeilds which was common to all three soils. The pattern of responses in "Lateritic Gravel", "Laterite Loam" and "Lateritic Sand" in that order—showed some inportant in differences in the magnitude of relative yeilds, together with a progressive deficiency of calcium. There was also some suggestion of a decreasing capacity for potassium fixation. All the soils showed an acute deficiency of nitrogen.

In the gravel relative yields for the P_O treatments rose to a maximum value of 70 ; Calcium deficiency was not apparent until the fourth harvest (ie. after 150 days); and relative yields for the K_O treatments fell sharply to zero at 150 days.

In the loam relative yeilds for the P_O treatments rose to a maximum value of 125 ; Calcium deficiency was evident after the second harvest (i.e. after 100 days) and relative yields for the K_O treatments held at more than 75 for approximately 81 days.

In the sand relative yields for the P_O treatments did exceed a mean value of 64= 5·8 for the second and third harvests, but there was evidence of further improvement in the fourth harvest, Calcium deficiency was evident after the first harvest (i.e. after only 50 days). Relative yields for the K_O treatments fell less rapidly.

Assuming that all three soils are derived from the one or similar parent material it would appear that the "Lateritic Loam" represents the highest stage of development (i.e. the most fertile soil) and the "Lateritic sand", a leached or a degraded deriative there from.

Experiments to determine the optimum dosage of the deficient nutrients are in progress. The data so far obtained indicate that the initial requirements of all three types would be similar.

(ii) CINNAMON SAND ON HORREKELLY ESTATE.

This soil was selected as one of the poorest coconut soils in Ceylon, typical of large areas along the Western Coasts.

Approximately 5 cwt/acre ammonium sulphate of 3 cwt/acre ammonium nitrate have been sufficient to meet all requirements for the establishment and early growth of grasses and legumes ;but small and frequent applications have to be made to maintain satisfactory growth.

Highest yields from phosphatic fertilizers were obtained with applications of cwt/acre $N_a H_2 P_{O\,3} 2H_2 O$ and there was no evidence of any advantage from still higher rates of application.

The optimal dose of potassium would be about 6 cwt. $K_{O\,2} S_{O\,4}$ or 5 cwt. KCl. Calcium is required at the rate of 10 cwt./acre. A peculiar feature of these experiments is that of a deficiency of K, Ca. or N—alone was responsible for the death of a great many plants, indicating that on this soil a balanced mixture of nutrients is essential, and a use of unbalanced fertilizer mixture could do considerable harm.

Magnesium applied at 1½ cwt./acre $MgSO_4 . 7H_2O$ increased yields significantly Sulphur applied at 123 lb./acre increased yields by 1200%.

Of the trace elements only Boron had a significant effect, where 6 lb./acre Borax increased yields of *Medicago sativa* by 275%. Copper also increased yields but it does not appear to be a factor of economic importance at the present time.

(III) THE FOREST SOIL AT AMBAKELLE

This is a light sandy soil usually about 5 feet in depth overlying rounded pebbles indicating that it is an aluvial deposit. The preliminary experiments showed that it is deficient in N, P. and K. Addition of Ca. as $CaCO_3$ effected the yield in the latter stages of growth (increase of 17% after 137 days). There was no deficiency of other nutrients.

Experiments carried out to determine the optimum dosage of the deficient nutrients were complicated by the N. treatments where all levels (1½ cwt./acre) to 10 cwt./acre of $(NH_4)_2SO_4$ showed symptoms of nitrogen deficiency three weeks after application. This confirms the results obtained with other soils that nitrogenous fertilizers should be applied in small and frequent doses.

Experiments are in progress to determine the optimum dosage of P. and K. with N. as basal dressing applied at 2½ cwt./acre $(NH_4)_2SO_4$ prior to each harvest.

(IV) THE MANURIAL VALUE OF FIBRE DUST

Two types of fibre dusts are available as by-product from the fibre industry. One obtained from the dry process and called " Dry dust " and the other " Retted dust ". These have the major nutrients as follows :—

	D/Dust	*R/Dust*
N. %	0·49 ..	0·46 (Dry basis)
P. %	0·13 ..	0·05
K. %	2·39 ..	0·68
Ca. %	0·15 ..	0·16
Mg. %	0·18 ..	0·17

Experiments are in progress to determine the extra nutrient requirements of plants growing on Cinnamon Sand mixed with different proportions of the D/dust. In a preliminary experiment with equal volumes of Cinnamon sand and D/dust it was found that N. added at 10 cwt./acre NH_4NO_3 gave an increase in yield of 1 : 100. There was also significant response to K. and Mg. applied at 3 cwt. K_2SO_4 and $1\frac{1}{2}$ $MgSO_4.7H_2O$ respectively, but the K.Mg. interaction was not significant. The absence of a significant positive K.Mg. interaction suggests a common factor, namely " S ", as the essential limiting nutrient.

Experiments are now in progress to determine the effect of N. as NH_4NO_3 and $(NH_4)_2SO_4$ in combination with other nurtients such as K.Mg. Ca. (as $CaCO_3$) and ($CaSO_4$) and S.

C. Pasture studies

All pasture experiments reported in C.P.57/57 by the Agronomist have been planted and most of them are being grazed.

(I) COMPARISON OF FOUR GRASSES AT B/E

In this experiment the *Paspalum commersonii* plot is not ready for grazing. However, the animals are being grazed in the other plots and during the period that they should go into the *Paspalum* plot they are being kept with the rest of the herd.

(II) GRAZING TRIAL AT R/E

This experiment is planted and will probably be grazed from April, next year (1958). The design which was very flexible is being examined by the Biometrician with a view to replicate the treatments and to include a control plot. In all experiments the data as recommended by Mr. Paltridge (C.P.57/57) and approved by the Board are being maintained. It is too early to comment on the data so far obtained.

D. Animal Husbandry

Up to the end of this year Cattle, Pigs and Poultry were being maintained at the nstitute. It was decided to close down experiments with Pigs and Poultry.

Cattle

The herd strength was as follows :—

Type	*Bandirippuwa*	*Ratmalagara*	*Total*
Cows ..	19 ..	20 ..	39
Heifers ..	13 ..	21 ..	34
Bull Calves ..	18 ..	7 ..	25
Studds ..	2 ..	2 ..	4
Total ..	51	50	101

The dairy produce were as follows :—

	Bandirippuwa	*Ratmalagara*	*Total*
Milk (pints) ..	19,345 ..	13,917 ..	33,262
Ghee (bottles) ..	— ..	122 ..	122
Farm Yard Manure (Tons)	19 ..	20 ..	39

The daily excess milk was delivered to the Milk Board.

On the instructions of Professor S. C. Harland, six cows were artificially inseminated with Fresian Semen. Of these only one animal conceived and gave birth to a heifer calf in November with birth weight 42 lbs.

Rectal temperatures of 12 Sinhala cows and 6 cross breds were recorded twice daily for the entire year. It was found that the co-efficient of heat tolerance in Sinhala animals was adversely affected by inrcease in humidity, while in the case of European crosses high atmospheric temperature affected it adversely. The work is in progress.

K. SANTHIRASEGARAM,
Acting Agronomist, Coconut Research Institute.

REPORT OF THE BIOMETRICIAN

Statistics

As usual, this Division actively co-operated with all research divisions of the Institute in the design of experiments, and the analysis and interpretation of experimental data.

The year 1957 was notable for the unusual demand for statistical help by the various divisions. With the establishment of the two new divisions of Agronomy and Crop Protection, and also the keen interest shown by other Research Officers in studying data which have been accumulating for some time, this division had to put up a strenuous effort to cope up with the demand.

Agri-Meteorology

1. The Meteorological stations at Bandirippuwa and Ratmalagara Estates were maintained satisfactorily.

2. The detailed analysis with regard to the relationship between rainfall and crops was continued. However this work is at present a sort of fill-gap between work in the Research Divisions and due to heavy demands this year from the Research Divisions, this work received little attention during the year.

Publications

The following are now under publication :—

1. "Rainfall, Crops and Exports 1957, and Crop Prospects for 1958".

2. "A comparative study of the effectiveness of Insecticides as repellants of adult Oryctes"—(with Mr. H.F.Goonewardene as Senior Author).

3. "Correlations between seed-nut, seedling and adult palm characters in Coconut" (with Dr.D.V.Liyanage as Senior Author).

V. ABEYWARDENA,
Biometrician, Coconut Research Institute.

REPORT OF THE PUBLIC RELATIONS OFFICER

1. Exhibitions

The Institute participated in the Agricultural and Industrial Exhibition conducted by the Kegalu Vidyalaya, on 9th and 10th June, 1957.

2. Conferences

The following talks were delivered and discussions followed at Research Conferences held at the Institute :—

(i) " Assessment of Manurial Needs of the Coconut Palm " by Dr. M. L. M. Salgado.

(ii) " Some observations on Nutrient Status of the Bandirippuwa Soil " by Mr. T. B. Paltridge.

(iii) " The Use of Coconut Toddy as a Fermentation Substrate " by Mr. W. R. N Nathanael.

(iv) " A Selection Experiment with Seednuts, Seedlings and Adult Palm Characters " by Dr. D. V. Liyanage.

(v) " The Management of Coconut Estates with particular reference to the Soil " by Mr. C. A. Wickramasuriya.

(vi) " Some Notes on the Management of Coconut Estates " by Mr. T. B. Paltridge.

(vii) " Difficulties of Field Experimentation with Hevea Brasiliensis " by Mr. D. C. Constable, Agronomist of the Rubber Research Institute of Ceylon.

(viii) " The Present Cultural and Manurial Practices " by Mr. P. D. L. Fernando.

(ix) " Heat Tolerance in Cattle " by Mr. G. C. M. Goonesekera.

(x) " Experimental Methods persently employed in the Crop Protection Division " by Mr. Hilary Goonewardene.

3. Training Courses

The Second Training Course for newly appointed Advisory Field Officers of the Coconut Research Institute, Coconut Inspectors of the Coconut Rehabilitation Department and Supervisors of Commercial Crops of the Land Commissioners Department, that commenced in December 1956, terminated on Januray 9, 1957.

Four Overseers of Commercial Crops selected for appointment by the Land Commissioners Department were given a training of one month during August, 1957.

4. Publications

Vol. VII Nos. 1/2, Nos. 3/4 and Volume VIII Nos. 1/2 of the Ceylon Coconut Quarterly were printed and published during the year.

5. Pol Pawath

The increase in circulation of this Sinhalese Journal was very satisfactory. At the end of 1956, it had a circulation of 8,000 copies whereas at the middle of 1957, it rose to above 14,000 copies. Judging by the requests that flow in every day it is felt that the present number of copies printed should be raised to 15,000 copies almost immediately.

6. Bulletins

Five new Bulletins were added to the list of publications during the year.

BULLETIN No. 11

" Studies on the Nutrient Status of Some Coconut Soils in Ceylon "—The Lateritic soils on Bandirippuwa Estate—by T. B. Paltridge and K. Santhirasegaram.

BULLETIN No. 12

Studies on the Nutrient Status of some Coconut Soils in Ceylon—The Cinnamon Sand on Horrekelly Estate—by T. B. Paltridge and K. Santhirasegaram.

BULLETIN No. 13

Studies on the nutrient status of some Coconut Soils in Ceylon. The Lateritic Soils on Bandirippuwa Estate—by T. B. Paltridge and K. Santhirasegaram.

ULLETIN No. 14

Studies on the nutrient status of some Coconut Soils in Ceylon. The Forest Soil at Ambakelle by T. B. Paltridge and Beryl Salmond.

BULLETIN No. 15

The Improvement of the Coconut Palm by breeding and Selection by Professor S. C. Harland, F.R.S.

7. Visitors

105 Visitors have signed the Visitors register, during the year.

Among distinguished visitors were a party of officials of the Food and Agriculturas Organization, who attended a conference of the Organization, held in Colombol A party of 32 visitors from the World Assembly of Youth were among the visitor. of the year.

Mr. Y. Fremond, Head of Coconut Division of the Research Institute for Fats and Oils (I. R. H. O.) Paris, spent five days at the Institute.

8. Presentation of Coconut Products

Muhandiram H. V. R. Ratnaweera presented two caskets made of coconut shell in August, 1957. Sir Wilfred de Soysa was also present on this occasion.

A total of 1,160 black and white photographs and 114 colour photographs were supplied to the various research Divisions of the Institute during this year.

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

REPORT OF THE PLANTING DIVISION

Staff

Planting Officer	..	Mr. P. D. Laurence Fernando
Asst. Planting Officer	..	Mr. C. W. S. de Silva
Shorthand-typist	..	E. M. S. Fernando
Clerk-typist	..	P. G. Jayawardena
Field Assistants (Snr.)	..	J. A. Cadelis
		A. J. P. Fernando (Head Office)
		C. H. de Alwis (Wilpotha)
		Ernest de Silva (Ibbagamuwa)
		H. W. Fernando (Walpita)
		V. de Paul Fernando (Mullativu)
		J. L. D. Fernando (Koggala)
		D. P. Jayamanne (Madampe)
Nursery Attendants	..	H. W. Bandusena (Madampe)
		B. M. Jayanayake (Madampe)
		A. Sivapragasam (Handapangala)
		A. M. K. Mohamed (Mullativu)
		B. D. G. Weerasooriya (Labuduwa)
		R. B. Wewelpola (Walpita)
		Y. V. Sirisena (Ibbagamuwa)
		H. Banneheka (Mampuri)
		K. J. N. Fernando (Hettipola)
		M. S. Marikkar (Kilinochchi)
		D. L. Karunanayake (Kalawewa)
		D. L. G. Dharmadasa (Hiriwadunna)
		K. W. Kithsiri (Head Office)
		D. C. Karunasekera (Koggala)
		E. Thangavelu (Mylambavelly)
		S. L. Sumanasiri (Wilpotha)
		K. B. Cyril Fernando (Ibbagamuwa)
		K. Edmund Perera (Head Office)

2 Lorry drivers, 1 Relief Driver and 2 cleaners.

Recruitments—Nil

Promotions—Nil

Resignations—Mr. K. B. Cyril Fernando resigned from the post of Nursery Attendant in April, 1957.

Nurseries

Seed-nuts—1,775,865 seed-nuts were planted in the nurseries during the year. The distribution of seed-nuts in the nurseries is as follows :—

Ratmalagara	..	174,150
Eraminigolla	..	60,000
Kurunegala	..	347,700
Walpita	..	158,825
St. Anne's	..	68,600
Labuduwa	..	31,665
Hettipola	..	60,000
Chankaladi	..	76,000
Kalawewa	..	76,500
Dematawela	..	104,000
Wilpotha	..	354,990
Kilinochchi	..	84,250
Mullaittivu	..	98,850
Koggala	..	80,335
Total	..	1,775,865

Seedlings

The demand for seedlings exceeded the available supply and orders for 1,009,489 seedlings were accepted for the year 1957 for both planting seasons.

The distribution of seedlings from the nurseries is as follows :—

Dematawela	82,257
Koggala	48,627
Ratmalagara	99,321
Hettipola	44,412
Kurunegala	185,816
Wilpotha	152,022
St. Anne's	53,900
Eraminigolla ..	47,631
Walpita	75,613
Labuduwa	14,055
Kalawewa	50,390
Kilinochchi	66,635
Alampil	61,565
Chankaladi	27,245
Total ..	1,009,489

Inspections

The nurseries were inspected by P. O., A. P. O. and S. F. A., as follows :—

Nurseries	*P. O. No. Visits for the Year*	*A. P. O. No. Visits for the Year*	*S. F. A. No. Visits for the Year*
Kilinochchi and Alampil ..	4 ..	3 ..	5
St. Anne's and Wilpotha ..	6 ..	10 ..	10
Karawaddena and Kalawewa ..	7 ..	7 ..	10
Mylambavelly	4 ..	5 ..	3
Ratmalagara and Hettipola ..	3 ..	6 ..	9
Walpita and Eraminigolla ..	5 ..	7 ..	9
Labuduwa, Koggala and Dematawela ..	6 ..	4 ..	5

Expenditure

The details of expenditure for the year 1957 are as follows :—

	Rs.	*c.*
1. Depreciation reserve ..	18,819	81
2. Salaries	111,566	92
3. Seednuts purchases ..	361,509	82
4. Nursery maintenances ..	189,284	42
5. Nurseries travelling ..	24,074	96
6. Office up-keep	9,045	88
7. Loss on Fixed Assets ..	370	0
	714,671	81

P. D. L. FERNANDO,
Planting Officer.

Lunuwila, June 23, 1958.

REPORT ON THE ESTATES

Bandirippuwa Estate

Crop harvested during 1957

Crop	Nuts from Estate Area	Nuts from Research Area	Total	Average 1931 to 1956	1957 above or below average
I ..	63,416 ..	11,304 ..	74,720 ..	68,248 ..	+ 9·5
II ..	81,119 ..	14,445 ..	95,564 ..	107,684 ..	— 11·3
III ..	88,627 ..	16,899 ..	105,526 ..	130,406 ..	— 19·1
IV ..	83,845 ..	17,436 ..	101,281 ..	117,607 ..	— 13·9
V ..	71,138 ..	13,931 ..	85,069 ..	80,954 ..	+ 5·1
VI ..	40,764 ..	9,015 ..	49,779 ..	63,118 ..	— 21·1
Total ..	428,909	83,030	511,939	568,017	— 9·9

The nuts were disposed of as follows :—

	Nuts	
Sold on contract	67,671	
Sold to Plant. Division	68,130	
Sold for Research	2,675	
Research Nurseries	1,388	
Cured into copra	349,576	
Allow. to staff	18,773	
Empties	3,726	0·7 %
	511,939	

The 349, 576 nuts cured gave 258 candies, 438 pounds of copra and an out-turn of 1,350 nuts to a candy.

The revenue from Bandirippuwa Estate actually accruing in 1957 was—

	Revenue from Estate Management Crops in 1956				*Revenue from Research Management Crops in 1956*			
	Rs.	*c.*	*Rs.*	*c.*	*Rs.*	*c.*	*Rs.*	*c.*
Sale of nuts ..	6,459	93			—			
Sale of copra ..	739	78			1,275	10		
Sale of sundries ..	695	70			9	40	1,284	50
			7,895	41				

	Crops in 1957				*Crops in 1957*			
Sale of nuts ..	6,087	44			41	80		
Sale of copra ..	31,823	68			9,925	17		
Sale of sundries ..	3,673	0			—			
			41,584	12			9,966	97
			49,479	53			11,251	47

The Total Revenue for 1957 was Rs. 60,731.

SUNDRY DEBTORS AND CREDITORS ACCOUNT

Of the income accruing in 1957 and included in the above statement is Rs. 7,895·41 (Estate) and Rs. 1,284·50 (Research) from 1956 crops had been credited to the Estate Working Account for 1956 through sundry debtors account. The Estate Working Account for 1957 does not therefor include this sum.

The following accounts have been credited to the Estate Working Account on account of 1957 crops lying unsold at the end of the year :—

	1957 Crops (Estate) Rs. c.		*1957 Crops (Research)* Rs. c.
Sale of nuts ..	.. 20,014 17	Sale of nuts ..	452 35
Sale of copra ..	.. 1,725 46	Sale of copra ..	1,272 22
Sale of sundries	.. 3,094 0	Sale of sundries ..	—
	24,833 63		1,724 57

The expenditure for the year totalled, including depreciation of kiln to Rs. 36,249·04. The cost of production of nuts in the estate area (including) the depreciation of kiln (Rs. 486·89) is Rs. 84·51 per 1,000 nuts.

The Bandirippuwa Estate Working Account for the year 1957 thus shows a balance of Rs. 41,860·25.

D. F. WITHANA,
Superintendent, Bandirippuwa Estate.

ANNUAL REPORT, 1957

Ratmalagara Estate, Madampe

Crops Harvested in 1957

Group No.	*Estate Nuts*	*Research Nuts*	*Total*	*Average 1938–57*	*Above or below average per cent.*
1 ..	63,108 ..	33,234 ..	96,342 ..	44,650 ..	+ 116
2 ..	61,231 ..	36,970 ..	98,201 ..	56,050 ..	+ 75
3 ..	65,582 ..	38,395 ..	103,967 ..	67,270 ..	+ 55
4 ..	71,167 ..	39,904 ..	111,071 ..	67,924 ..	+ 64
5 ..	63,101 ..	36,421 ..	99,522 ..	57,025 ..	+ 75
6 ..	46,894 ..	24,719 ..	71,613 ..	42,993 ..	+ 67
	371,073	209,643	580,716	335,912	+ 75

Crops were disposed of as follows :—

	Nuts
Cured into copra	447,983
Sold on contract	80,503
Sold to Planting Division ..	29,400
Sold to Research	5,457
Issued to staff	7,092
Rejections	10,281
	580,716

The 447,983 nuts cured into copra produced 295 candies of copra equivalent to an out-turn of 1,358 nuts to a candy.

The revenue actually accruing during the year was.

Revenue from Estate Management—Revenue from Research Management.

Crops, 1956	Rs. c.	*Crops, 1956*	Rs. c.
Sale of nuts ..	9,808 87	Sale of copra ..	7,114 30
Sale of copra ..	9,975 17	Sale of nuts ..	783 22
Sale of sundries ..	426 42		7,897 52
Sale of rubber ..	126 62		
	20,337 8		

Crops, 1957	Rs. c.	*Research*	Rs. c.
Sale of copra ..	30,039 24	Sale of copra ..	14,341 34
Sale of nuts ..	524 31	Sale of nuts ..	970 25
Sale of sundries ..	3,548 11	Sundries ..	2,424 36
Rubber garden ..	197 6		
	34,308 72		17,735 95

Total Revenue for 1957 was Rs. 80,279·24.

SUNDRY DEBTORS AND CREDITORS

Of the income accruing 1957, and included in above statement is Rs. 20,337·08 (Estate) and Rs. 7,897·52 (Research) from 1956 crops that had been credited to Estate Working Account in 1957, through Sundry Debtors Account. The Estate Working Account for 1957 does not include this amount.

The following accounts have been credited to the Estate Working Account on account of 1957 crops lying unsold at the end of the year:—

1957 Crop (Estate)	Rs. c.	*1957 Crops Research*	Rs. c.
Sale of nuts ..	16,413 42	Sale of nuts ..	1,192 60
Sale of copra ..	3,896 82	Sale of copra ..	6,645 86
Estate sundries ..	945 20	Sundries ..	—
Rubber garden ..	249 23		
	21,504 67		7,838 46

The expenditure for the year including depreciation kilns totalled Rs. 33,151·70. The cost of production of nuts in estate area (including depreciation of kilns Rs. 511·64) was Rs. 89.34.

Ratmalagara Estate Working Account in 1957, thus shows a balance of Rs. 48,236·10.

H. J. F. PIERIS,
Superintendent, Ratamalagara Estate

March 11, 1959.

CIRCULATION PAPER No. 2/59

Coconut Research Institute

Coconut Research Board

THE AUDITOR-GENERAL'S REPORT ON THE ACCOUNTS OF THE COCONUT RESEARCH INSTITUTE FOR THE YEAR ENDED DECEMBER 31, 1957

The Balance Sheet as at December 31, 1957, and the connected Financial Statements (detailed below) were rendered for audit on June 13, 1958:—

(i) Revenue Account,
(ii) Working Accounts of—
  (*a*) Bandirippuwa Estate,
  (*b*) Ratmalagara Estate,
  (*c*) Animal Husbandry Division,
  (*d*) Planting Division (including Nurseries),

(*e*) Provident Fund,

(*f*) Medical Aid Fund, and

(iii) Summary of Fixed Assets and Vehicles.

These were returned for amendment on November 5, 1958, and the amended statements of accounts were received on November 21, 1958.

The amended accounts were examined and compared with the books kept by the Institute and found to be in order. My observations arising from the examination of the 1957 accounts of the Institute are set out below :

REVENUE ACCOUNT

REVENUE

2. (*a*) *Cess Collection—Rs. 917,100·20*

The corresponding collection for the previous year was Rs. 1,377,979·62. The decrease of Rs. 460,879·42 is attributed to the fall in exports of coconut products during 1957.

(*b*) *Interest—Rs. 97,682.56.* Interest on investments earned during the year under review amounted to Rs. 96,207·39, while the balance Rs. 1,475·17 represents the interests on advances to staff. The interest on investments for the previous year was Rs. 74,728·87. The increase of Rs. 22,953·69 was due to the following additional investments made during the year under review :—

	Rs.
(i) 3¼% Debentures—1976–1981 ..	350,000
(ii) 3¼% Ceylon Government Loan 1973–77 ..	550,000
(iii) 3% State Mortgage Bank Debentures ..	500,000

3. *Working Accounts—Profits from Estates—Rs. 90,367·91*

	Rs.	*c.*
(*a*) Bandirippuwa Estate ..	42,131	81
(*b*) Ratmalagara Estate ..	48,236	10

There was an increase of Rs. 5,019·99 in profits from Bandirippuwa Estate as compared with 1956, while there was a decrease of Rs. 2,319.43 from Ratmalagara Estate. The increase in profit at Bandirippuwa Estate was mainly due to 68,130 nuts being sold to the Planting Division as seed-nuts at the average price of Rs. 215 per 1,000 nuts in 1957 while only 10,000 seed-nuts were sold at Rs. 164 per 1,000 nuts in 1956.

The decrease in profit at Ratmalagara Estate was due to an increase in the average cost of production of copra from Rs. 96·97 per candy in 1956 to Rs. 126·68 per candy in 1957. The increase in the cost of production is attributed mainly to the decrease in the size of nuts at this estate during the year 1957 due to unfavourable weather conditions.

4. *Animal Husbandry Division—Loss Rs. 20,319.94*

During the pervious year the loss from this Division which is primarily concerned with research, and produce (Milk, ghee, pigs, &c.) which is sold to the Staff at nominal rates was Rs. 17,431.04.

The increase in loss during 1957 is explained by the Animal Husbandry Officer as follows :—

" (*a*) The amount of milk sold to staff increased in 1957 but they were still given the milk at concession rate of 25 cts. a pint. This has however been increased to 30 cts. a pint as from January 1, 1958,

(*b*) The inability to get rid of culled and unproductive animals due to them being in experimental plots,

(*c*) The comparatively high price paid for poonac during the year,* the severe drought conditions which tended to decrease milk yields and the reasons stated in para. (*b*) again tended to raise costs,

(*d*) With the increase in price of poonac, the sale of pigs came to a standstill as there was no market for pigs ".

* The price of poonac rose from Rs. 260·01 in 1956 to Rs. 379·25 in 1957, per ton.

5. *EXPENDITURE*

(*a*) *Salaries Rs. 274,461·71.* In this amount is included a fee of Rs. 2,000 paid to an expert in Agricultural Science for advice rendered to the Institute during the year under review.

(*b*) *Recreation and Co-operative Welfare Society—Rs. 2,000*

This amount includes, besides the Annual Grant of Rs. 500 given to the Recreation Club, a sum of Rs. 1,500 given to the Co-operative Welfare Society to meet the salaries of the Managerial Staff of the Canteen run by it.

According to information furnished by the Chief Administrative Officer of the Institute, the Co-operative Welfare Society (whose accounts are audited by the Co-operative Department Officers) made a net profit for 1957 of Rs. 2,346 which was disposed of as follows :—

Transfer to Reserve	..	10%
Dividend to shareholders	..	6%
Rebate on purchases and loans	..	84%

(*c*) *Incidental Expenses—Rs. 993·47*

This amount includes Rs. 34·83 paid to the Bank of Ceylon as interest on overdrafts on the current accounts of the Institute. These accounts were overdrawn on 34 occasions during the year under review. An explanation for overdrawing these accounts without the approval of the Board has not been furnished.

(*d*) *Planting Division—Nurseries Working Account—Excess of Revenue over Expenditure—Rs. 409,210·30*

The main sources of income of this account were the Government Grant of Rs. 850,000 received in March, 1957, from the Commissioner, Coconut Rehabilitation Scheme, and Rs. 308,548·13 being the proceeds of sale of seedlings. The expenditure on the nurseries amounted to Rs. 754,886·01 leaving an excess of income over expenditure of Rs. 409,210·30.

The average cost of raising a seedling by the Institute during 1957 was 65 cts. as compared with 63 cts. during 1956. On inquiry it was explained that the increase in the cost of production in 1957 was due to the increase in the average purchase price of seed-nuts from Rs. 164 per 1,000 in 1956 to Rs. 215 per 1,000 nuts in 1957.

The total number of seed-nuts planted during the year under review was 1,775,865 out of which 1,129,552 were sold.

5—J. N. B 13052 (4/59).

The seedlings were sold at a subsidised rate of 30 cts. each which was the same as in the previous year.

BALANCE SHEET

6. *Fixed Assets—Rs. 3,051,218·38*

(*a*) The above amount does not include the value of an International Station Waggon and an International Station Van and each valued approximately at Rs. 13,000 received from the Government of Canada under the "Colombo Plan". To my inquiry as to why these gifts were not brought into the accounts I was informed—

> "Neither have we shown the value of these in our accounts nor have we, reserved any depreciation as we have not estimated any expenses on these items under Capital".

I consider that valuable gifts of this nature should be recorded in the account books and disclosed in the Balance Sheet.

(*b*) As a result of my pointing out in para. 6 of the Audit Report on the Accounts for the year 1956, that the value of the Fixed Assets was over-stated, action was taken during the year to write-off Rs. 64,099·16 being the value of assets sold or scrapped in previous years as well as during 1957. A commencement was also made during the year to compile a Fixed Assets Register.

GENERAL

7. *Medical Aid Fund.* On my pointing out in para. 9 of the Audit Report on the accounts for the year 1956 that there was no provision for the establishment of a Medical Aid Fund in the Coconut Research Ordinance and the action should be taken to regularise the Fund, the Director stated that he was waiting to see what action, if any, would be taken by the Rubber Research Institute on a similar point raised by me on the accounts of that Institute. As appropriate action has since been taken by the Rubber Research Institute to regularise the establishment of its Medical Aid Fund, I suggest that similar action be taken early.

8. *Unauthorised Expenditure.* The expenditure exceeded the sanctioned estimates in several items—listed in Annex "A" of this Report. Though it has been repeatedly pointed out in the previous Audit Reports that the practice of incurring expenditure in excess of the provision in the annual estimates without the prior approval of the Board is irregular there has been no improvement in this respect.

A. WEERASINGHE.
Auditor-General.

Audit Office,
Colombo 7, January 28, 1959.

Coconut Research Institute—Net Revenue Account, 1957

Adjustments		*Rs.*	*c.*				*Rs.*	*c.*
Payments in 1957 on account of expenditure incurred previously		1,365	40	Balance as at December 31, 1956			1,015,468	73
Receipts received in previous year on account of 1957 revenue and credited to Revenue Account previously		112	50	Value of Assets written-off prior to 1957 transferred from Capital Outlay Account			24,465	68
Amounts received prior to 1957 to the credit of depreciation Reserve but incorrectly credited to Sundry Receipts ..		4,103	65					
Loss on Assets written-off prior to 1957 ..		4,489	37					
		10,070	92					
Less Revenue recovered in 1957 on account of previous years	340 55							
Reduction in value of average prices of manure stock ..	2,347 5	2,687	60			7,383	32	
						1,032,551	9	
						1,039,934	41				1,039,934	41
Contributions to Capital Outlay 1957						453,156	81	Adjusted balance brought down			1,032,551	9
Research Reserve						250,000	0	Transfer of Capital Outlay on assets written-off in 1957 ..			13,724	17
Balance as at December 31, 1957 ..						613,997	97	Excess of revenue over expenditure in 1957 transferred from Revenue Account			270,879	52
						1,317,154	78				1,317,154	78

Statement of Investments as at December 31, 1957

Investments	*Cost*		*Face Value*		*Middle Market Rate*	*Middle Market Value as at December 31, 1957*	
	Rs.	*c.*	*Rs.*	*c.*	*Rs.*	*Rs.*	*c.*
3% Sri Lanka Government Loan, 1969–74	2,000	0	2,000	0	99 97/8	1,997	0
3½% National Housing Debentures, 1969–71	450,000	0	450,000	0	105 15/16	476,718	0
3% National Housing Debentures, 1969–71	100,000	0	100,000	0	100	100,000	0
3¼% National Housing Debentures, 1976–81	350,000	0	350,000	0	100	350,000	0
2½% Ceylon Government National Development Loan, 1962–67	125,000	0	125,000	0	95 11/16	119,609	0
2½% Ceylon Government National Development Loan, 1962–1967	250,000	0	250,000	0	95 11/16	239,218	0
3¼% Ceylon Government Loan, 1975–80	750,000	0	750,000	0	100	750,000	0
3% Ceylon State Mortgage Bank, 1965–68	150,000	0	150,000	0	100 14/16	151,312	0
3% State Mortgage Bank	5,000	0	5,000	0	100	5,000	0
3% Ceylon Government Loan, 1966–71	150,000	0	150,000	0	100	150,000	0
3¼% Ceylon Government Loan, 1973–77	550,000	0	550,000	0	100	550,000	0
3% State Mortgage Bank	500,000	0	500,000	0	100	500,000	0
	3,382,000	0	3,382,000	0		3,393,854	0

COCONUT RESEARCH INSTITUTE REVENUE ACCOUNT, 1957

	Rs.	c.	Rs.	c.
Personal Emoluments :				
Salaries	274,461	71		
Living allowances	142,554	33		
Rent allowances	11,377	38		
Provident Fund, Bonus and Interest	58,385	26		
Medical Aid Boards Contributions	5,598	7		
Coconut allowances	2,938	34		
Recreation and Co-op. Welfare Society	2,000	0		
			497,315	9
Other Charges :				
Travelling Board Members	9,533	0		
Travelling Staff	60,721	67		
			70,254	67
Office :				
Stationery	9,538	32		
Postage	3,601	84		
Printing and advertising	7,107	18		
Legal expenses	21	0		
Cost of Audit	3,000	0		
Telephone rental	590	0		
Entertainment allowances	216	15		
Incidental expenses	993	47		
Debit Tax	1,819	5		
Workmen's Compensation Insurance	598	70		
Office upkeep	1,119	41		
Publicity and Ceylon Coconut Quar.	7,965	90		
			36,571	2
Laboratory and Library :				
Books and periodicals	13,727	15		
Laboratory upkeep	27,407	80		
			41,134	95
Buildings and Machinery upkeep :				
Upkeep of buildings	36,484	15		
Insurance	4,514	20		
Upkeep of electricity and water S.	22,085	47		
Upkeep of vehicles	10,120	67		
			73,204	49
Research :	Rs.	c.		
General R. I.	2,054	41		
Botanical R. II	19,047	16		
Less Sale of s'lings	1,264	50		
	17,782	66		
Soil Chemistry R. III	12,754	71		
Agrostology	17,050	33		
Crop protection	3,127	42		
			52,769	53
Reserves :				
Depreciation	68,281	44		
Overseas training	5,515	90		
			73,747	34
Depreciated value of assets written off in 1957			13,724	17
Excess of Revenue Over Expenditure			270,879	52
			1,129,600	78

	Rs.	c.	Rs.	c.
Government grant			30,000	0
Cess collection			917,100	20
Interest on investments			97,682	50
Charges to staff for electricity			2,122	10
Sale of publications			91	97
Sale of Ceylon Coconut quarterly			2,517	77
Sundry of Ceylon Coconut quarterly			10,038	12
Sundry receipts			10,038	12
Working Accounts :	Rs.	c.		
Bandirippuwa Estate	42,131	81		
Ratmalagara Estate	48,236	10		
	90,367	91		
Less Loss on animal husbandry working A/c	20,319	94		
			70,047	97
			1,129,600	78

Coconut Research Institute—Planting Division Nurseries Working Account, 1957

Expenditure	Rs. c.	Rs. c.	Income	Rs. c.
			Government grant	850,000 0
Seed-nuts Account :			Sale of seedlings	308,548 13
Cost of Seed-nuts		403,669 93	Sale of nuts in nurseries	5,201 48
Nurseries :			Sundry receipts	346 70
Maintenance, rent and transport	191,468 52			
Less Recoveries	2,478 9			
		188,990 43		
Workmen's Compensation Insurance		640 10		
Building upkeep		580 44		
Nurseries office		7,825 34		
Depreciation		16,996 39		
Personal Emoluments :				
Salaries	54,392 67			
Living allowances	39,068 78			
Rent allowances	4,801 92			
Provident Fund, bonus and interest	11,686 97			
Medical Aid Board's Contribution	1,616 58			
		111,566 92		
Travelling :				
Staff travelling		24,074 96		
Depreciation value of assets written-off		541 50		
Transferred to Net Revenue Account		409,210 30		
		1,164,096 31		1,164,096 31

Coconut Research Institute—Planting Division Net Revenue Account, 1957

Adjustment	*Rs.*	*c.*	*Rs.*	*c.*		*Rs.*	*c.*
Payments in 1957 on account of expenditure in previous years	50	0			Balance as at December 31, 1957	629,738	7
Loss on assets written-off prior to 1957	16,621	44			Value of assets written off prior to 1957 transferred from Capital Outlay Account	25,309	31
	16,671	44			*Adjustments*		
Less Revenue recovered in 1957 on account of 1956	30	0			Revenue recovered in 1957 on account of sale of seedlings in 1956	104,556	60
			16,641	44	Payments in 1956, on account of seed-nuts purchased for 1957, charged to 1956 Revenue Account	65,378	43
Balance carried forward			808,340	97			
			824,982	41		824,982	41
Contributions to Capital Outlay			41,882	81	Adjusted balance brought down	808,340	97
Balance as at 31st December, 1957			1,176,268	46	Value of assets written off in 1957 transferred from Capital Outlay Account	600	0
					Excess of revenue over expenditure in 1957 transferred from Nursery Working Account	409,210	30
			1,218,151	27		1,218,151	27

Coconut Research Institute—Medical Aid Fund Working Account

Expenditure	*Rs.*	*c.*	*Rs.*	*c.*	Income	*Rs.*	*c.*	*Rs.*	*c.*
Bills paid	7,707	68			Balance brought forward from 1956			10,198	30
Less refunds	30	0			Members contributions	7,545	78		
			7,677	68	Board's contributions	7,545	78		
Transferred to reserve	199	17	199	17		15,091	56		
Members contributions refunded	199	15	199	15	*Less refunds*	*Rs.*	*c.*		
Balance carried forward to 1958			17,143	68	Boards contributions	35	14		
					Members contributions	35	4		
						70	18		
								15,021	38
			25,219	68				25,219	68

Coconut Research Institute—Provident Fund Working Account

	Rs. c.		Rs. c.
To Payments	80,184 56	Balance brought forward from 1956	453,015 54
Balance carried forward to 1958	491,110 23	Board's bonus and interest 1957	62,650 23
		Officers' contributions 1957	55,629 2
	571,294 79		571,294 79

Coconut Research Institute—Animal Husbandry Working Account, 1957

Expenditure			Income		
	Rs. c.	Rs. c.		Rs. c.	Rs. c.
Upkeep of—			*Income from—*		
Cattle		21,403 70	Cattle	10,831 39	
Poultry		6,993 0	Poultry	2,091 26	
Pigs		3,665 35	Pigs	1,957 50	
Shows and Sheds		403 19			14,880 15
Depreciation		630 22	Transferred to Revenue Account ..		20,319 94
Personal Emoluments :					
Salaries	862 78				
Living allowances	1,086 70				
Provident Fund contribution and interest ..	147 15				
Medical Aid and Board's contribution ..	8 0				
		2,104 63			
		35,200 9			35,200 09

COCONUT RESEARCH INSTITUTE

Bandirippuwa Estate Working Account

Expenditure	Rs. c.	Rs. c.	Income	Rs. c.	Rs. c.
Estate Areas :			*Estate Areas :*		
General charges	19,244 42		Sale of copra	33,549 14	
Upkeep	7,325 87		Sale of nuts	26,101 61	
Cultivation	4,040 73		Sale of sundries	6,767 0	
Collection	5,151 13				66,417 75
		35,762 15	*Research Area :*		
Depreciation		215 33	Sale of copra	11,197 39	
Transferred to Revenue Account ..		42,131 81	Sale of nuts	494 15	
					11,691 54
		78,109 29			78,109 29

Rathmalagare Estate Working Account

Expenditure	Rs. c.	Rs. c.	Income	Rs. c.	Rs. c.
Estate Areas :			*Estate Area :*		
General charges	15,701 33		Sale of copra	33,936 06	
Upkeep	7,150 89		Sale of nuts	16,937 73	
Cultivation	5,530 66		Sale of sundries	4,493 31	
Collection	4,257 18				55,367 10
		32,640 06	*Research Area :*		
Depreciation		511 64	Sale of copra	20,987 20	
Transferred to Revenue Account ..		48,236 10	Sale of nuts	2,162 85	
			Sale of sundries	2,424 36	
					25,574 41
			Rubber Seed Garden :		
			Income	1,497 24	
			Less Expenditure	1,050 95	
					446 29
		81,387 80			81,387 80

THE COCONUT RESEARCH INSTITUTE OF CEYLON

Summary of Fixed Assets and Vehicles—December 31, 1957

			Cost at December 31, 1956	Additions 1957	Deduct Assets sold or scrapped and written off during 1957	Cost at December 31, 1957
			Rs. c.	Rs. c.	Rs. c.	Rs. c.
1.	Buildings		1,341,841 8	194,415 22	—	1,536,256 30
2.	Estates including improvements	Rs. c. 484,108 8				
	Add amount shown under machinery —1956	12,877 50				
			496,985 58	53,856 80	1,008 7	549,834 31
3.	Estate kilns		15,604 96	—	—	15,604 96
4.	Animal husbandry equipment and animals		7,888 7	—	2,580 0	5,308 7
5.	Laboratory equipment		336,661 29	111,743 31	419 0	447,985 60
6.	Photographic equipment		5,275 20	3,435 73	—	8,710 93
7.	Power plant		88,043 38	—	17,503 61	70,539 77
8.	Fences and wells		4,225 20	2,256 0	—	6,481 20
9.	Gas plant		8,221 77	—	—	8,221 77
10.	Museum		3,276 20	—	—	3,276 20
11.	Furniture—Bungalows		69,248 12	3,510 20	2,735 42	70,022 97
12.	Furniture—Office and office equipment		55,515 49	12,682 64	2,195 0	66,003 13
13.	Machinery	43,551 90				
	Less Amount transferred to Estates Improvement	12,877 50				
			30,674 40	1,003 60	2,548 80	29,129 20
	Institute vehicles		112,589 15	16,641 75	34,982 29	94,248 61
14.	Planting Division tools		13,362 8	11,220 67	126 97	24,455 78
15.	Electricity and water supply		30,855 95	80,362 69	—	111,218 64
16.	Crop protection equipment		—	3,911 1	—	3,911 1
17.	Library books		10 0	—	—	10 0
			2,620,277 92	495,039 62	64,099 16	3,051,218 38

ANNEX "A"

Statement of Excess Expenditure and Savings in 1957

Expenditure Items	Voted Amount per Estimate, 1957	Supplementary Votes as per Circu. Paper		Total	Amount spent as per Ledger	Excess Expenditure	Savings	Reasons for Variations
	Rs. c.	Rs. c.		Rs. c.	Rs. c.	Rs. c.	Rs. c.	
A. Capital :								
1. Lab. Equipment	94,477 0	459 0	C.P. 106/57	163,178 0	111,743 31		51,434 69	Goods not received on Overseas orders
		18,610 0	60/57					
		2,050 0	23/57					
		900 0	23/57					
		4,700 0	43/57					
		4,300 0	43/57					
		3,500 0	53/57					
		33,000 0	53/57					
		1,182 0	60/57					
2. Buildings :								
(*a*) Bandirippuwa	22,410 0	5,798 30	106/57	34,348 22	64,354 60	30,233 58		Expenditure incurred in completing building started previous year
		5,239 92	106/57		229 20			
		900 0	19/57					
(*b*) Ratmalagara (Token)	10 0	12,000 0	85/57	12,010 0	43,499 67	31,489 67		do.
(*c*) Planting Division	85,000 0	4,352 25	106/57	89,352 25	13,795 39		75,556 86	Have been charged this years Building Vote
(*d*) Ambakelle S. G.	50,800 0	3,341 10	106/57	56,761 6	63,888 53	7,127 47		
		2,619 96	106/57					
(*e*) Out stations	5,000 0	1,400 0	23/57	12,350 0	8,649 83		3,700 17	
		4,800 0	113/57					
		1,150 0	60/57					
3. Furniture :								
(*a*) Building furniture	11,200 0	3,600 0	53/57	14,800 0	3,510 20		11,289 80	No furniture has been bought for buildings not completed
(*b*) Office furniture	12,575 0	600 0	23/57	16,675 0	9,633 14		7,041 86	
		3,000 0	53/57					
		500 0	109/57					
(*c*) Office equipment		6,070 0	19/57	6,070 0	3,049 50		3,020 50	
4. Land	875,000 0	4,225 0	106/57	889,675 0	12,812 8		876,862 92	Arrangements for purchase could not be furnished this year
		10,450 0	125/57					

Expenditure Items	Voted Amount per Estimate, 1957	Supplementary Votes as per Circu. Paper	Total	Amount spent as per Ledger	Excess Expenditure	Savings	Reasons for Variations
	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	Rs. c.	
5. Improvements to estates :							
Bandirippuwa	4,100 0		4,100 0	3,949 80		150 20	
Ratmalagara	5,875 0		5,875 0	1,489 28		4,250 0	
	4,250 0		4,250 0			4,385 72	
Isolated seed garden	28,532 0		28,532 0	34,597 57	6,065 57		
Demonstration plots	2,000 0		2,000 0	—	—		
6. Elect. and water supply :							
Bandirippuwa	18,200 0	33,000 0 C.P. 19/57	51,200 0	62,229 23	11,029 23		Previous years work
Ratmalagara	17,000 0	8,000 0 60/57	25,000 0	18,133 46		6,866 54	carried on this year has been charged to
7. Machinery and vehicles	24,800 0		24,800 0	17,645 35		7,154 65	this years vote
8. Nursery fittings and equ.	10,000 0		10,000 0	11,220 67	1,220 67		
9. Photography equipment	17,912 0		17,912 0	3,435 73		14,476 27	Goods ordered but not
10. New well B/E				2,256 0			received within the year
11. Crop protection service		6,470 0 23/57	6,470 0	3,911 1		2,558 99	
B. Personal emoluments	617,923 0	53,500 0 113/57	671,423 0	617,288 20		54,134 80	Additional staff not recruited
C. Other charges :							
1. Travelling board memb.	7,000 0	1,200 0 126/57	8,200 0	9,533 0	1,333 0		
2. Travelling staff	92,650 0		92,650 0	60,721 67		31,928 33	do.
D. Office :							
1. Stationery, &c.	26,200 0	10,000 0 24/57	36,229 0	21,497 94		14,731 6	
		29 0 106/57					
2. Printing and advertising	7,000 0	2,100 0 53/57	14,100 0	7,107 18		6,992 82	
		3,500 0 60/57					
		1,500 0 125/57					
3. Publicity and C. C. Q.	11,000 0		11,000 0	7,695 90		3,034 10	

E. Lab. and library :																
1. Chemicals and glassware	..	37,015	0	..	935	0		60/57	..	37,950	0	..	27,407	80	..	10,542 20 .. Goods not received
2. Books and periodicals	..	10,225	0	..	4,995	0		53/57	..	15,220	0	..	13,727	15	..	1,492 85 within the year
F. Upkeep :																
1. Buildings	..	19,355	0	..	1,500	0		85/57	..	23,377	0	..	36,484	15	..	13,107 15 .. .. Rs. 13,963.70 estimated
					722	0		102/57								under Capital Expendi-
					800	0		53/57								has been met from this
					1,000	0		85/57								Vote
2. Insurance	..	6,500	0	..					..	6,500	0	..	4,514	20	..	.. 1,985 80
3. Running exp. elc. plants electricity and water supply	..	31,300	0	..					..	31,300	0	..	22,085	47	..	.. 9,214 53
4. Vehicles	..	6,500	0	..					..	6,500	0	..	10,120	67	..	3,620 67
G. Working accounts :																
1. Bandirippuwa	..	32,582	0	..					..	32,582	0	..	25,832	64	..	.. 6,249 36
2. Ratmalagara	..	23,925	0	..					..	23,925	0	..	26,698	86	..	2,773 86 ..
3. Nurseries	..	711,860	0	..					..	711,860	0	..	627,619	19	..	.. 84,240 81
4. Animal husbandry	..	38,728	0	..	685	0	C.P.	23/57	..	46,104	0	..	32,465	24	..	.. 13,638 76
					4,546	0		43/57								
					2,145	0		43/57								
H. Research :																
1. Chemist ..	..	8,000	0	..	1,835	0		23/57	..	9,835	0	..	2,054	41	..	.. 7,780 59
2. Botanist	..	26,880	0	..					..	26,880	0	..	19,047	16	..	.. 7,832 84 .. One Exp. postponed at
3. Soil chemist	..	20,500	0	..	355	0		60/57	..	20,855	0	..	12,754	71	..	.. 8,100 29 .. the request of the
4. Agronomist	..	12,680	0	..	2,500	0		67/57	..	16,080	0	..	16,799	73	..	719 73 Board
					900	0		43/57								
5. Crop protection	..	14,500	0	..					..	14,500	0	..	3,127	42	..	.. 11,372 58
6. Biometrician	..			..	250	0		67/57	..	250	0	..	250	60	..	0 60
I. Research funds :																
1. Passage ..	..	8,000	0	..					..	8,000	0	..	2,000	0	..	.. 6,000 0
2. Depreciation ..	..	35,010	0	..					..	35,010	0	..	86,585	2	..	51,575 2
3. Overseas training	..	Token		..												
4. Research ..	..	Token		..									5,515	90		
Total	..	3,094,474	0		281,214	53				3,375,688	53		160,306	23		160,296 22 1,348,022 49

Lunuwila,
January 31, 1959.

S. C. KAHAWITA,
Chief Administrative Officer,
Coconut Research Institute.

COCONUT RESEARCH INSTITUTE

Balance Sheet as at December 31, 1957

LIABILITIES

	Rs. c.	Rs. c.	Rs. c.
Capital Outlay :			
Institute as at December 31,1956	2,249,299 74		
Contributions during the year	453,156 81		
		2,702,456 55	
Planting Div. as at December 31, 1956 ..	370,978 18		
Contributions during the year	41,882 81		
		412,860 99	
		3,115,317 54	
Less Value of assets written off up to December 31, 1957 ..		64,099 16	
		3,051,218 38	
Research Reserve :			
Balance as at December 31, 1956 ..		965,000 0	
Additions during the year ..		250,000 0	
			1,215,000 0
STAFF FUNDS			
Provident Fund :			
Officers' contributions and interest ..		246,582 28	
Institute's bonus and interest ..		244,527 95	
		491,110 23	
Medical Aid Fund :			
Balance as at December 31, 1957	17,143 68		
Reserve under Rule 14 (2)	401 2		
		17,544 70	
			508,654 93
Depreciation Fund :			
Balance as at December 31, 1956 ..		274,775 24	
Additions during the year		86,585 2	
		361,360 26	

ASSETS

	Rs. c.	Rs. c.	Rs. c.
Fixed assets :			
Balance as at December 31, 1956 ..	2,620,277 92		
Additions during the year ..	495,039 62		
		3,115,317 54	
Less Value of assets written off..		64,099 16	
			3,051,218 38
Investments at Cost :			
Government and Government Guaranteed Stock ..	3,382,000 0*		
Savings Bank ..	1,242 28		
Savings certificates ..	26,500 0		
Fixed deposits ..	550,000 0		
			3,959,742 28
Current Assets :			
Less collections due in 1957.. ..		55,642 12	
Sundry debtors		155,449 28	
Payments in advance for seednuts and transp.		115,874 2	
Accrued interest on investments ..		40,365 12	
Transport loans		64,035 44	
General stores advance account ..		822 22	
Travelling advance		1,907 40	
Buddha Jayanti advance		4,290 10	
Manure advance		4,952 74	
			443,338 44
Cash in bank		358,022 42	
Cash in hand		10,002 50	
			368,024 92

Less Adjustments of assets written off up to December 31, 1957		24,619 3		
			336,741 23	
Current Provisions and Liabilities :				
Sundry creditors		69,793 5		
Security deposits		650 0		
Receipts in advance		850,000 0		
			920,443 5	
Net Revenue Account :				
Institute		613,997 97		
Planting division		1,176,268 46		
			1,790,266 43	
			7,822,324 2	7,822,324 2

Certified correct :

S. C. KAHAWITA,
Chief Administrative Officer,
Coconut Research Institute.

* Middle Market Value is Rs. 3,393,854.

The Accounts of the Coconut Research Institute for the year ended December 31, 1957, have been audited under my direction and I am of opinion, that the Balance Sheet and Financial Statements above set forth have been drawn up so as to present fairly the financial position of the Institute as at December 31, 1957, and the results of its operation for the year ended on that date.

Observations arising from the audit of these accounts are contained in my Report No. P-2(3) 13 of January 28, 1959, to the Chairman, Board of Management of the Coconut Research Institute.

Audit Office,
Colombo 7, January 28, 1959.

A. WEERASINGHE,
Auditor-General.