

UCLIST

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CEYLON COCONUT QUARTERLY

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ANNUAL REPORT OF THE COCONUT RESEARCH INSTITUTE FOR 1962

The present report is the 34th 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 1st 1962, the Coconut Research Board consisted of the following:—

Ex-officio Members:

The Director of Agriculture: Mr. A.V. Richards, M.Sc. (Calif.), B.Sc. (Lond.), Dip. Agric. (Cantab.), A.I.C.T.A. (Trinidad).

Finance Minister's Representative: Mr. G.M. Sparkes, C.C.S.

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

Chairman, Low Country Products' Association: Mr. Francis Amarasuriya.

Director, Coconut Research Institute: Dr. M.L.M. Salgado, Ph.D. (Cantab.).

Nominated Members: (for a period of 3 years)

Nominated by the Honourable Minister from Senators and Members of Parliament:

Mr. W.I. Hugh Fernando, M.P.

Mr. S.D.R. Jayaratne, M.P.

Nominated by the Planters' Association of Ceylon:

Mr. C.T. Van Geysel, J.P.

Mr. B. Warusavitharna.

Nominated by the Low Country Products' Association:

Senator T. Amarasuriya, O.B.E., (Chairman, Coconut Research Board)

Mr. C.A.M. de Silva.

Nominated by the Honourable Minister to represent the Small-Holders:

Mr. M.M. Kumarakulasingham

Mr. L.W.A. Fernando.

Mr. A.F. Samarasinghe replaced Mr. M.M. Kumarakulasingham as the Small-Holders representative on the Board in January, 1962.

Mr. Wijebahu Wijesinghe, M.P., replaced Mr. S.D.R. Jayaratne, M.P., in April, 1962.

Mr. C.A.M. de Silva was renominated to represent the Low Country Products' Association for a further period of three years.

Meetings.—Four meetings of the Coconut Research Board were held on 10th March, 9th June, 8th September and 8th December respectively.

Committees

Administration Committee (Personnel at 1st January, 1962):

- (1) Senator T. Amarasuriya, *O.B.E.*, (Chairman).
- (2) Mr. A.V. Richards.
- (3) Mr. B. Warusavithana.
- (4) Mr. C.A.M. de Silva.
- (5) Mr. B. Mahadeva.
- (6) Mr. W.I. Hugh Fernando, M.P.
- (7) Mr. G.M. Sparkes.
- (8) Dr. M.L.M. Salgado, Director, Coconut Research Institute.

The 37th, 38th, 39th and 40th meetings of the Administrative Committee were held on 26th January, 27th April, 27th July and 26th October respectively. A special meeting of the Administrative Committee was held on 6th May.

Estates and Experimental Committee (Personnel at 1st January, 1962):

- (1) Mr. M.M. Kumarakulasingham, (Chairman).
- (2) Mr. F. Amarasuriya.
- (3) Senator T. Amarasuriya, *O.B.E.*
- (4) Mr. B. Warusavithana.
- (5) Mr. S.D.R. Jayaratne, M.P.
- (6) Mr. C.T. Van Geysel, *J.P.*
- (7) Mr. A.V. Richards.
- (8) Dr. M.L.M. Salgado, Director, Coconut Research Institute.

Three Co-opted Members

- (1) Mr. E. Muttukumar.
- (2) Mr. R.H. de Mel.
- (3) Mr. X. Jobin.

The 39th, 40th, 41st and 42nd meetings of the Estates and Experimental Committee were held on 24th February, 26th May, 18th August and 20th October respectively.

Extension Committee (Personnel at 1st January, 1962):

- (1) Mr. C.T. Van Geysel, *J.P.*, (Chairman).
- (2) Mr. F. Amarasuriya.
- (3) Mr. C.A.M. de Silva.
- (4) Mr. B. Mahadeva.
- (5) Mr. M.M. Kumarakulasingham.
- (6) Mr. L.W.A. Fernando.
- (7) Dr. M.L.M. Salgado, Director, Coconut Research Institute.

The 32nd, 33rd and 34th meetings of the Extension Committee were held on 10th February, 11th August and 17th November respectively.

Editorial Committee (Personnel at 1st January, 1962):

- (1) Mr. M.M. Kumarakulasingham, (Chairman).
- (2) Mr. F. Amarasuriya.
- (3) Mr. S.D.R. Jayaratne, M.P.
- (4) Dr. M.L.M. Salgado, Director, C.R.I.
- (5) Dr. D.V. Liyanage.

The meetings were held on 11th August and 22nd October.

T. AMARASURIYA,
Chairman, Coconut Research Institute.

REPORT OF THE DIRECTOR

1. STAFF

The Staff of the Coconut Research Institute at the end of 1962 was as follows:

Administration Division

Director—Dr. M.L.M. Salgado, Ph.D. (Cantab.), B.Sc. (Lond.), Dip. Agric. (Cantab.).
Chief Administrative Officers and Secretary to the Board—Mr. S.C. Kahawita, B.Com. (Lond.).
Assistant Secretary—Mr. T.T.A.J.C. Samarasinghe, LL.B. (Ceylon).

Soil Chemistry Division

Soil Chemist—Dr. D.A. Nethsinghe, D.Phil. (Oxon.), B.Sc. (Ceylon), A.R.I.C.
Research Assistant—Mr. T.S. Balakrishnamurthi, B.Sc. (Ceylon).

Chemistry Division

Chemist—Dr. W.R.N. Nathanael, Ph.D. (Lond.), M.Sc. (Lond.), B.Sc. (Lond.), A.R.I.C.
Research Assistant—Vacant.

Botany Division

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

Agrostology Division

Agrostologist—Mr. K. Santhirasegeram, B.Sc. (Ceylon). (On overseas study leave).
Research Assistant—Mrs. N. Rajaratnam, B.Sc. (Ceylon).

Planting Division

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

Advisory Division

Chief Advisory Officer—Mr. C.A. Wickramasuriya, B.Sc. (Ceylon).

Crop Protection Division

Crop Protection Officer—Vacant.
Officer-in-Charge—Mr. J.K.F. Kirthisinghe.

Biometry

Biometrician—Mr. V. Abeywardena.

Research Assistant—(Statistics)—Mr. J.K.T. Fernando, B.Sc. (Ceylon).

The vacant post of Research Assistants to the Chemist and Botanist were advertised but could not be filled as suitable qualified candidates were not available.

2. MEETINGS

The Director attended the following meetings besides those of the Coconut Research Board and its Committees:—

- (i) Annual General Meeting of the Planters' Association of Ceylon.
- (ii) Meetings of the District Planters' Associations of Chilaw/Negombo and Kurunegala and one meeting of the Southern Province Association.
- (iii) Conference with Mr. K.V.R. Sastry, F.A.O. Statistician regarding the Pilot Survey of Coconuts.
- (iv) Annual Conference of Advisory Officers of the Institute.
- (v) Meetings of the Central Board of Agriculture.
- (vi) Meetings of the Animal Husbandry Sub-Committee of the Central Board of Agriculture.

3. RESEARCH CONFERENCES

The following subjects were discussed at Research Conferences held during the year:—

- (i) Dr. D.A. Nethsinghe, Soil Chemist, led a discussion on "Magnesium deficiency of coconuts".
- (ii) Dr. W.R.N. Nathanael, Chemist, led a discussion on "Some problems facing the desiccated coconut industry of Ceylon".
- (iii) Mr. V. Abeywardena, Biometrician, led a discussion on "Some problems in the interpretation of experimental data of young palms".

4. VISITORS

The Visitors during the year included the following:—

Dr. H.W.R. Scarpenseel of University of Bonn, Germany.

Mr. W.V.D. Pieris, FAO Coconut Improvement Officer.

Dr. Sivarajasingham, Assistant Chemist, Department of Agriculture, Peradeniya.

Dr. V.P. Rao, Entomologist, Commonwealth Institute of Biological Control, Bangalore.

Dr. Hall and Dr. Gibson of USOM.

Government Agent, Kurunegala.

Miss Lynden Moore of the University of Oxford.

Mr. P.C. Bansil of the Planning Secretariat, Colombo.

Prof. Walter Kubiena and Dr. Lorenz Schmidt of the University of Hamburg.

G. von Gontard, Potascheme, India.

Dr. Hamilton, Director, DSIRO, New Zealand.

Mr. K.V.R. Sastry, FAO Statistician.

5. TRAINEES

Mr. M.A. Hussain from East Pakistan was trained in copra curing and coconut cultivation at the Institute.

6. FIELD DAY

A Field Day for members of the Chilaw/Negombo Planters' Association was held at the Isolated Seed Garden.

7. PUBLICATIONS

The Director contributed the articles on "Coconuts in 1961" and "Activities of the Coconut Research Institute in 1961" to the Annual Report of the Planters' Association of Ceylon.

An article entitled "A Factorial Fertiliser Experiment on Coconuts" by T. Eden, J.C. Gower and M.L.M. Salgado was accepted for publication in the Empire Journal of Experimental Agriculture. (This has appeared in Vol. XXXI, No. 124).

8. NOTES ON REPORTS OF DIVISIONS

The following notes draw attention to points of interest relating to the detailed reports of the Technical and Extension work of the Institute.

Chemistry

In connection with the new sterilisation process to obviate Salmonella in DC, a study was made of the losses of dietary factors in the water and sterilisation waters. This has revealed that the losses in fat, protein, carbohydrates and minerals would be of the order of 6.9 lakhs of rupees per annum.

On the basis of the investigations carried out in the Chemistry Division, a new Vinegar Factory at Nainamadama employing the "Generator Process" went into successful production.

It was also found that a concentration of 2% common salt dissolved in the Vinegar completely averted the growth of mycodermal film in bottled vinegar.

Botany

The programme of work on breeding and selection of coconut palms was continued during the year. Now there is sufficient data available on an experimental basis to indicate that the hybrid palms *typica* × *pumila* are early bearing and high yielding.

A new Field Trial has been laid down at Pottukulama to test the following: (i) *Typica* × *pumila*; (ii) *typica* × *typica* and (iii) *typica* open pollinated.

13,679 artificially pollinated nuts of *typica* × *typica* where the male parent is a prepotent palm were harvested.

The Isolated Seed Garden has been making satisfactory progress and the yield per acre during the year was 4,174 nuts.

The three progeny trials at Marandawila, Walpita and Bandirippuwa were maintained during the year.

Soil Chemistry

In addition to Potash, Phosphate has also brought about a significant increase in copra yield in the NPK Experiment at Bandirippuwa. At Ratmalagara all three elements—N, P and K continued to show a significant response in yields in the experiment on young palms. These results confirm and strengthen the basis of our present fertiliser recommendations.

Incidence of mangesium deficiency has been observed in all major coconut growing areas—particularly in the latertic soils of the Southern, Western and North Western Provinces and Cinnamon soils of the Chilaw/Negombo area.

Agrostology

Assessment of soil nutrient status by the Pot Culture technique has been continued, as also the experiments on the growth of pastures under coconuts.

Crop Protection

As during the previous years there were two notable pest problems that demanded special attention. One was the Coconut Scale pest out-breaks and the other the premature decline of palms following "leaf scorch".

Red Weevil yet remained the most elusive and destructive pest on young plantations.

The project for the biological control of the Coconut Caterpillar, particularly in the Eastern Province worked effectively under the supervision of the Colombo Plan Entomologist.

Biometrics

Apart from the usual routine statistical work for the Research Divisions, work initiated included a series of biometrical studies pertinent to Coconut research.

These included problems such as the best quantitative expression of certain characters used in the analysis of research problems, the genetic and environmental components of the between palm variation in coconut yields, and studies on the biennial bearing tendency in coconut.

Soil Survey

Soil Surveys of the Melsiripura-Beligama area on the Nalanda one inch sheet and of Vanatavillu, North of Puttalam, comprising the Middle Class Colonisation Scheme were carried out.

General

Coconut Production reached a record in 1962, the estimated production being 2,993 million nuts for the Island. There is little doubt that these yields have resulted largely from the benefits of the Government Subsidised Manure Scheme which has been in operation since 1956.

That such yields have been realised confirm the soundness of the manurial and cultural recommendations made by the Coconut Research Institute based on sound experimental and scientific data.

Today, with the higher rates of application of manures there are estates which provide 5,000 nuts per acre per annum—yields unheard of a decade ago.

Unfortunately the financial situation of the Institute has not permitted expansion of its activities and it yet remains the Cinderella of the three Crop Research Institutes.

Fortunately the Government Grant for Advisory work was increased from one lakh to Rs. 300,000.

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

REPORT OF THE SOIL CHEMIST

SUMMARY

The seven major long term field experiments on manuring which were in progress during 1961 were continued in 1962. In addition to potash, phosphate has also brought about a significant increase in copra yields in the 3³ N.P.K. experiment at Bandirippuwa. At Ratmalagara, all three major elements—N, P and K continued to show a significant response in yields in the experiment on young palms. These results confirm and strengthen the basis of our present fertilizer recommendations.

During this year, our attention has been largely focussed on the problem of yellowing due to magnesium deficiency. The observation trials at Mattegoda and Walgama Estates in the Western Province have continued to show that yellow palms improve both in leaf colour and yields when treated with magnesium fertilisers. Incidence of magnesium deficiency has now been observed in all major coconut growing districts—particularly in the lateritic soils of the Southern, Western and North-Western Provinces and cinnamon sands of the Chilaw/Negombo area. Diagnosis by observation of the visual symptoms has been confirmed by leaf and soil analytical techniques developed in our laboratories.

The first field trial on coconuts using radioactive phosphorus to compare the relative efficiency of different methods of fertiliser placement was carried out on twelve year old bearing palms on a sandy loam soil. It was found that placement in a circular basin extending to 5 feet from the bole of the palm was superior to placement in the traditional circular trench or centres of squares.

Investigations on the "leaf scorch" problem in the Southern Province were extended to soil applications of trace elements and leaf analysis. No conclusive results have been obtained yet.

DETAILED REPORT

A. FIELD EXPERIMENTS

1. 3 × 3 × 3 N.P.K. Factorial Experiment (Bandirippuwa Estate)

(See C.R.I. Annual Report of 1949 and 1951 for details of treatment and design).

This experiment completed its 27th year in 1962. The main effects for 1962 are shown in Table I (a). In keeping with trends in the last few years, the increased weight of copra obtained from phosphate manuring has now reached statistical significance in its linear component. The potash response continued to be highly significant.

TABLE I (a)
Yield data for 1962—3³ N.P.K. Experiment, Bandirippuwa
(66 palms/acre)

Treatment	Lbs. Copra per acre	Nuts per acre	Calculated as %		Difference		Copra out-turn nuts/ per candy	Diff- rence in nuts/ per candy
			Copra	Nuts	lbs. Copra per acre	Nuts/ Acre		
N ₀ (0.0 lbs. N)	1,890	3,787	100	100	—	—	1,122	—
N ₁ (0.5 lbs. N)	1,940	3,971	103	105	+ 50	+ 184	1,146	+ 24
N ₂ (1 lb. N)	1,906	3,979	101	105	+ 16	+ 192	1,174	+ 52
P ₀ (0 lbs. P ₂ O ₅)	1,808	3,645	100	100	—	—	1,129	—
P ₁ (1 lb. P ₂ O ₅)	1,949	3,982	108	109	+ 141	+ 337	1,144	+ 15
P ₂ (2 lbs. P ₂ O ₅)	1,980	4,111	110	113	+ 172	+ 466	1,163	+ 34
K ₁ (0.75 lbs. K ₂ O)	1,653	3,579	100	100	—	—	1,212	—
K ₂ (1.5 lbs. K ₂ O)	1,962	3,946	119	110	+ 309***	377	1,126	- 86
K ₃ (2.25 lbs. K ₂ O)	2,121	4,213	128	118	+ 468***	634	1,112	-100

Significant difference P. 05 = 171 lbs. copra/acre.

***Significant at P. 001.

The mean yields in 1962 for the various treatment combinations are given in Table I (b).

TABLE I (b)

	N ₀	N ₁	N ₂	K—Total
K ₁	1,748	1,677	1,535	1,653
K ₂	1,919	1,981	1,986	1,962
K ₃	2,004	2,161	2,198	2,121
N—Total ..	1,890	1,940	1,906	1,912

	P ₀	P ₁	P ₂	K—Total
K ₁	1,519	1,689	1,752	1,653
K ₂	1,972	1,946	1,968	1,962
K ₃	1,934	2,210	2,218	2,121
P—Total ..	1,808	1,949	1,980	1,912

	P ₀	P ₁	P ₂	N—Total
N ⁰	1,772	1,935	1,752	1,890
N ₁	1,896	1,923	2,000	1,940
N ₂	1,756	1,989	1,974	1,906
P—Total ..	1,808	1,949	1,980	1,912

2. Manurial × Cultivation Experiment (Ratmalagara Estate)

(See C.R.I. Annual Report 1959 for details of treatment and design).

The 19th year of this experiment was concluded in June 1962. The yield data for the main effects in 1962 given in Table 2 showed a significant response to only phosphate. The phosphate response is higher than that recorded in any of the previous years.

Ploughing has not shown any significance this year. This is probably due to the fact that during the preceding year there has been good distribution of rainfall—the effect of ploughing being perhaps largely a matter of improving the moisture holding capacity of the soil.

TABLE II

Yield data for 1962—Manurial × Cultivation experiment, Ratmalagara
(60 palms per acre)

Treatment	Lbs. Copra/ acre	Calculated as %	Difference lbs. Copra/ acre	Copra out- turn nuts/ candy	Difference in nuts/ candy
P ₀	1,233	100	—	1,046	—
P	2,084	169	+ 851***	1,041	-5
C ₀	1,637	100	—	1,048	—
C	1,679	103	+ 42	1,039	-9

Significant difference P. 05 = 140 lbs. copra/acre

***Significant at P. 001

K ₀	1,549	100	—	1,070	—
K ₁	1,667	108	+ 118	1,046	-24
K ₂	1,758	113	+ 209	1,017	-53

3. 3 × 3 × 3 N.P.K. Experiment on Young Palms (Ratmalagara Estate)

(See C.R.I. Annual Report for 1959 for details of treatment and design).

The 14th year of this experiment was completed in 1962. The yield data for the main effects of N, P and K given in Table III (a) show that all three nutrients have had a highly significant effect in increasing copra yields. The annual application of a mixture of sulphate of ammonia, saphos phosphate and muriate of potash in equal proportions at 9 lbs. per palm has produced 87 nuts per palm in 1962, in contrast to 36 nuts per palm in the unmanured plots, and 64 nuts per palm on plots receiving 4½ lbs. fertiliser mixture.

The N × P interaction was also highly significant. The yield data for different treatment combinations are given in Table III (b) and III (c).

TABLE III (a)

Yield data for 1962—3⁸ N.P.K. Experiment on Young Palms Ratmalagara Estate

	<i>Lbs. Copra per acre</i>	<i>Calculated as %</i>	<i>Difference in lbs.</i>	<i>Nuts/acre</i>	<i>Calculated as %</i>	<i>Difference in nuts</i>	<i>Out-turn nuts/candy</i>	<i>Difference in nuts</i>
N ₀	1,622	100	—	2,726	100	—	941	—
N ₁	1,967	121	+ 345***	3,324	122	+ 598	946	+ 5
N ₂	1,927	119	+ 305***	3,383	124	+ 657	983	+ 42
P ₀	1,183	100	—	1,977	100	—	937	—
P ₁	2,167	183	+ 984***	3,667	185	+ 1,690	948	+ 11
P ₂	2,166	183	+ 983***	3,787	192	+ 1,810	979	+ 42
K ₀	1,663	100	—	2,978	100	—	1,003	—
K ₁	1,791	108	+ 128	3,057	103	+ 79	956	+ 47
K ₂	2,062	124	+ 399***	3,398	114	+ 420	923	+ 80

Significant difference P. 05 = 157 lbs. copra per acre.

***Significant at P. 001.

TABLE III (b)

lbs. Copra per acre

	N ₀	N ₁	N ₂	P—Total
P ₀	1,231	1,292	1,025	1,183
P ₁	1,834	2,368	2,297	2,167
P ₂	1,800	2,240	2,457	2,166
N—Total ..	1,622	1,967	1,927	1,839

	N ₀	N ₁	N ₂	K—Total
K ₀	1,533	1,811	1,643	1,663
K ₁	1,535	1,893	1,944	1,791
K ₂	1,797	2,196	2,193	2,062
N—Total ..	1,622	1,967	1,927	1,839

	P ₀	P ₁	P ₂	K—Total
K ₀	1,093	1,911	1,982	1,663
K ₁	1,088	2,072	2,212	1,791
K ₂	1,366	2,516	2,303	2,062
P—Total ..	1,183	2,167	2,166	1,839

TABLE III (c)
lbs. Copra per acre

	N_0K_0	N_0K_1	N_0K_2	<i>P—Total</i>
P_0	1,254	1,206	1,233	1,231
P_1	1,452	1,768	2,283	1,834
P_2	1,893	1,632	1,876	1,800
NK—Total ..	1,533	1,535	1,797	1,622

	N_1K_0	N_1K_1	N_1K_2	<i>P—Total</i>
P_0	1,079	1,167	1,629	1,292
P_1	2,263	2,133	2,708	2,368
P_2	2,092	2,379	2,251	2,240
NK—Total ..	1,811	1,893	2,196	1,967

	N_2K_0	N_2K_1	N_2K_2	<i>P—Total</i>
P_0	947	891	1,238	1,025
P_1	2,020	2,315	2,558	2,297
P_2	1,962	2,627	2,782	2,457
NK—Total ..	1,643	1,944	2,193	1,927

4. Manurial Experiment on Organics vs. Inorganics and frequency of manuring

(Co-operative experiment at Marandawila Group, Bingiriya).

(See C.R.I., Annual Report 1959 for details of treatment and design).

This experiment completed its 4th year in June 1962. The yield data for the 4th year (adjusted by co-variance analysis) is given in Table IV. All treatments have been found to be significantly better than the control (no manure). The following differences were also statistically significant at the 5% level:—

- Cattle manure with supplements — inorganic annually.
- Organics once in two years — inorganics once in two years.
- Cattle manure with supplements — inorganics once in two years.

TABLE IV

Yield data for 1962, Experiment on Organics vs. Inorganics Marandawila Estate

(Adjusted by co-variance analysis)

<i>Treatment</i>	<i>Lbs. Copra/acre</i>	<i>%</i>	<i>Difference in lbs. copra/acre</i>	<i>Out-turn nuts/candy</i>	<i>Difference</i>
Control	2,402	100	—	1,109	—
Inorganics annually	2,712	113	+ 310	1,074	-35
Inorganics in 2 years	2,680	112	+ 278	1,016	-93
Organics annually	2,800	117	+ 398	1,015	-94
Organics in 2 years	2,800	120	+ 478	1,056	-53
Cattle manure with supplements ..	2,980	124	+ 578	1,022	-87

5. 4 × 4 × 4 N.P.K. Experiment on adult palms (Bandirippuwa Estate)

(See C.R.I. Annual Report 1960 for details of treatment and design).

The 3rd annual manuring was done in October 1962. Records of nuts and weights of husked nuts from individual palms were maintained for each pick during the year. It is still premature to draw any conclusions.

6. Methods of placement and liming experiment on adult palms. (Co-operative experiment at Walahapitiya Estate, Nattandiya).

(See C.R.I. Annual Report 1961 for details of treatment and design).

The 2nd annual manuring was done in October 1962. The plots receiving lime were given two applications of 10 cwts. lime per acre each during the course of the year. These plots have now received a total of 30 cwts. lime per acre, and the pH raised from 4.2 to 5. The yields of nuts from individual plot palms and weights of husked nuts for plots were maintained for each pick during the year. It is yet premature to draw any conclusions on the effects of the different treatments.

7. 4 × 4 × 4 N.P.K. Experiment on Young Palms (Pothukulama Estate)

(See C.R.I. Annual Report for 1961 for details of treatment and design).

The 2nd annual manuring of this experiment was done in December 1962. Counts of total number of new leaves in palms were done at six monthly intervals. During the course of the year about 60 palms were found to be attacked by the fungus disease *Helminthosporium*. However, unlike in the case of the experiment on young palms at Ratmalagara, the fungal infestation was not observed to be associated with any particular manurial treatments.

8. Observation trials on yellowing palms, Walgama Estate, Rukmale, and Mattegoda Estate, Polgasowita
(See also C.R.I. Annual Reports for 1960 and 1961).

(1) *Walgama Estate*

The trials on this estate where yellow palms are being treated in groups of ten with N.P.K. fertilizers only and also N.P.K. with 1, 2 and 3 lbs. magnesium sulphate per palm annually showed the same pattern as in the previous year. Nearly all the palms treated with magnesium sulphate since 1957 are now green and they have given a distinctly higher yield of nuts than those treated with N.P.K. fertilizers only. Table VIII (a) gives the yield data per acre per annum for the two-year periods 1958-60, and 1960-62, adjusted by co-variance analysis for initial yield differences during the two-year period 1956-58. (The first differential manuring was done in 1957, so that yields in this period are assumed to represent pre-treatment data). The data in Table VIII (a) is based on the total yields of 5 palms under each treatment, these being so chosen that they fell within a total yield band of 25-40 nuts during the two-year pre-treatment period 1956-58. It is seen that the annual application of 3 lbs. magnesium sulphate per palm in addition to the N.P.K. mixture has given the best results.

TABLE VIII (a)

Yield data adjusted by co-variance analysis—Magnesium trials, Walgama Estate

Treatment	Nuts per acre per annum			
	1958-1960	%	1960-1961	%
Control	1,166	100	1,238	100
5 lbs. N.P.K. only	1,373	118	1,594	129
5 lbs. N.P.K. + 1 lb. Magnesium Sulphate	1,730	148	1,514	122
5 lbs. N.P.K. + 2 lbs. Magnesium Sulphate	1,625	139	1,996	161
5 lbs. N.P.K. + 3 lbs. Magnesium Sulphate	1,887	162	2,375	192

(2) Mattegoda Estate

On this estate adult yellow palms in groups of forty have been treated annually with N.P.K. mixture only and also N.P.K. with 1 lb. magnesium sulphate or an equivalent quantity (408 gms.) of dolomite per palm since 1957. The biennial application of cattle manure supplemented with muriate of potash and saphos phosphate is also being tested. A census of palms taken in December 1962 showed that about 60% of the palms receiving magnesium had been completely restored to a healthy green colour. The palms treated with dolomite are still a little behind. The census data given in Table VIII (b) also show an improvement in the colour of palms receiving no fertilizers at all, in comparison to those receiving N.P.K. only. A similar pattern was observed in the trials on young yellow palms on the same estate. This is in accordance with the established fact that magnesium deficiency is aggravated by the presence of ammonium and potassium salts.

Table VIII (b) also gives the annual yields per acre for the different treatments during the two-year periods 1958-60 and 1960-62, adjusted by co-variance analysis. Cattle manuring is seen to have as marked an effect as magnesium sulphate on the yield data. This confirms the observation of planters that yellowing palms have recovered after cattle manuring.

TABLE VIII (b)

Yield data adjusted by co-variance analysis and condition of adult yellow palms in magnesium trials, Mattegoda Estate

Treatment	No. of green palms	No. of moderate-ly yellow palms	No. of intense-ly yellow palms	Nuts per acre per annum (64 palms/acre)			
				1958-60	%	1960-62	%
Control	14	20	6	2,358	100	2,311	100
N.P.K. only	2	16	22	2,483	105	2,648	114
N.P.K. + 454 gms. Magnesium Sulphate	25	13	2	2,879	122	3,233	140
N.P.K. + 408 gms. dolomite	8	30	2	2,706	115	3,183	138
Cattle manure + supplements	16	22	2	2,645	112	3,408	147

9. Leaf Scorch problem, Gonapinuwala area. (See also C.R.I. Annual Report 1961).

The fortnightly foliar spraying of diseased palms in groups of ten with 0.3% solutions of each of the elements zinc (as zinc sulphate), boron (as boric acid) and molybdenum (as sodium molybdate) were commenced again in February 1962. The technique of foliar spraying was adopted in the hope that it would help in quick diagnosis of possible trace-element deficiency. But since no such quick response was apparent, the sprayings were abandoned in April, and some simple trials on soil applications of zinc, boron and molybdenum commenced.

At a census taken in August 1962, it was observed that the condition of palms receiving zinc and molybdenum had deteriorated considerably, while the group of palms treated with boron had shown slight improvement of foliar conditions. The zinc and molybdenum treatments were therefore stopped and further applications of boron were done. The results obtained so far are not conclusive and more trials on soil applications of trace elements are to be carried out.

During the course of the year, leaflet samples were taken from diseased and healthy palms for chemical analysis.

B. LABORATORY INVESTIGATIONS

1. Diagnosis of magnesium deficiency by leaf and soil analytical methods

Previously it was shown that magnesium deficiency in coconuts can be diagnosed by the chemical analysis of leaflets provided that a proper sampling technique is adopted (C.R.I. Annual Report 1961). The 6th fully opened frond proved to be a convenient leaf for sampling leaflets from palms in which deficiency symptoms had already set in.

During the course of the year under review, we received numerous reports of yellowing palms from various coconut growing areas in Ceylon—Southern and Western provinces, Kurunegala, Matale, and Chilaw/Negombo districts including some blocks in Bandirippuwa Estate as well. According to the usual symptoms, the yellowing was apparently due to magnesium deficiency. We considered it necessary to confirm this by the leaf analysis method already described. Leaflets (6th frond) were sampled from individual healthy and yellow palms in the different localities. The mean chemical composition for N, P, K, Ca and Mg are given in Table I B. It is seen that the samples from yellow palms have a distinctly lower content of magnesium.

Preliminary studies indicated that the exchangeable magnesium in soil was not a suitable criterion for assessing magnesium availability. The magnesium content of leaflets was independent of exchangeable soil magnesium. The magnesium concentration in 10^{-2} molar calcium chloride extracts of soil seemed to give a better indication of magnesium availability (10^{-2} molar CaCl_2 has been suggested for determining nutrient availability in soils by Schofield (1955) on the basis of his chemical potential concept—Soils and Ferts: 18 p. 373). Since the deficiency symptoms reported above occurred under diverse soil and climatic conditions we took the opportunity of making a more extensive study of this point. Simultaneously with the leaf sampling, soil samples (0-9") were also taken from the corresponding healthy and affected areas. The soils were analysed for exchangeable magnesium and concentrations of magnesium in 10^{-2} molar CaCl_2 extracts (10 gms. soil in 50 cc. solution shaken for $\frac{1}{2}$ hour). The results are given in Table I B. Leaf magnesium showed no correlation with exchangeable soil magnesium. This is clearly illustrated in the scatter diagram Fig. I. On the other hand, leaf magnesium was found to be positively correlated with concentrations of magnesium, (correlation coefficient 0.48) and better, with the molar ratio Mg/Ca in 10^{-2} molar calcium chloride extracts of the soils (correlation coefficient 0.56). Both correlations were significant at P. 05. The linear regression of leaf magnesium on molar Mg concentrations and molar Mg/Ca ratios in the soil extracts is seen in Figs. II and III.

It is apparent that exchangeable magnesium in soils is of no value in predicting magnesium availability. The calcium chloride method gives a more reliable estimate of soil magnesium availability. This method has also the advantage of being simple and quick, both calcium and magnesium being determined volumetrically by the E.D.T.A. method. The correlation between leaf magnesium and molar Mg concentrations and molar Mg/Ca ratios in the soil extracts though significant was not high. The predictive value of the calcium chloride method must presently be considered to be of a qualitative, rather than a quantitative nature.

A magnesium content of 0.25-0.30% in leaflets from the 6th frond would indicate sufficiency of magnesium, while if the Mg content fell below 0.2% deficiency symptoms can be expected. In 10^{-2} molar calcium chloride extracts of soil, magnesium deficiency is likely to occur if the molar M /Ca ratio is below 20×10^{-3} .

2. Radio Isotopes (P^{32}) project—Fertilizer placement trials

(See C.R.I. Annual Report for 1960, 1961).

Preliminary work on this project showed that when radioactive phosphorus is applied to the soil, leaflets sampled from moderately mature fronds are the most suitable plant organs for studying the uptake of radioactive phosphorus by the coconut palm. Within three days of the application of 5 millicuries P^{32} to the soil there was sufficient radioactivity in the leaflets for quantitative assay. The distribution

of radioactivity (as measured by the specific activity $\frac{\text{P}^{32}}{\text{P}^{31}}$) in leaflets taken from fronds between the 3rd and 9th fully opened leaves was comparatively uniform.

TABLE I B

Mean Leaf Analysis and Soil Magnesium for Different Localities

LOCALITY	% LEAF COMPOSITION (OVEN DRY BASIS)					SOIL ANALYSIS			
	N	P ₂ O ₅	K ₂ O	Ca	Mg	Molar Mg in 10 ⁻² M. CaCl ₂ ex- tracts of soil (X 10 ⁵)	Molar Mg/ Ca ratio in CaCl ₂ ex- tracts (X 10 ³)	Exchange- able % me Mg. in soils	
Lunuwila									
Bandirippuwa Botanist Block	GREEN	2.33	0.404	2.150	0.171	0.144	7.1	7.0	0.126
	YELLOW	2.38	0.413	2.300	0.201	0.065	4.3	3.5	0.183
Bandirippuwa Adult Palm Block	GREEN	2.35	0.381	1.217	0.231	0.271	17.9	24.5	0.321
Kahatawila									
Kahatawila Estate	GREEN	2.37	0.334	1.171	0.201	0.247	11.8	11.1	0.188
	YELLOW	2.46	0.339	0.958	0.306	0.147	13.2	12.6	0.258
Ja-ela									
Wisaka Estate	YELLOW	2.38	0.461	1.617	0.357	0.105	2.6	2.4	0.095
Dawatagahawatte Estate	GREEN	2.17	0.412	1.728	0.133	0.211	6.0	5.8	0.101
	YELLOW	2.33	0.393	1.812	0.114	0.112	4.8	4.6	0.131
Southern Province									
Kahatapitiya Estate	GREEN	2.19	0.375	2.085	0.152	0.137	17.6	16.8	0.568
	YELLOW	2.29	0.409	2.085	0.270	0.086	8.6	5.9	0.156
Fred's Ruhue Estate	GREEN	2.12	0.374	1.864	0.109	0.145	13.1	12.8	0.277
	YELLOW	2.27	0.359	1.899	0.190	0.102	9.7	9.4	0.211
Matale									
Warakanda Estate	YELLOW	—	0.393	1.506	0.433	0.139	5.4	5.7	0.118
Western Province									
Walgama Estate	GREEN	2.37	0.327	1.540	0.404	0.195	25.4	19.6	0.254
	YELLOW	2.41	0.358	1.740	0.409	0.062	6.0	5.1	0.227
Mattegoda Estate	GREEN	2.34	0.288	1.500	0.292	0.135	12.0	12.0	0.195
Kurunegala									
Handurukanda Estate	GREEN	—	—	1.546	0.134	0.293	64.7	77.0	1.380
	YELLOW	—	—	1.908	0.198	0.129	20.2	22.9	0.269

Experimental Procedure:

The first field trial on placement studies using P^{32} was carried out on twelve year old bearing palms grown on a sandy loam soil in the Botanist's underplantation block at Bandirippuwa Estate. The efficiency of different methods of placement was judged by placing an equal amount of radioactive phosphorus in the soil according to the various methods and estimating the amount of radioactivity taken up by the palm. The following methods of placement were compared:—(a) traditional 3 ft. wide circular trench, 3 ft. away from the base of the palm (b) 9.2 ft. square at centres of squares between rows of palms, and (c) basin round palm extending to a distance of 5.2 ft. from the bole. The areas (84.5 sq. ft.) and depths (4") of application of the radioactive phosphorus were similar for all three methods of placement. This ensured the elimination of any possible complications which may arise in the interpretation of results owing to isotopic exchange between the radioactive phosphorus and soil phosphorus. On account of the large amount of radioactive phosphorus required, (5 millicuries P^{32} per palm) it was decided that this first experiment should be a simple one, and that the experimental units be limited to single palms. Each placement was therefore tested on individual palms in three replicates. In order to minimise the errors due to individual palm variability and soil heterogeneity the following precautions were taken. Each replicate of the three different treatments were grouped together so as to form a block—palms receiving the different treatments being as close together as possible within each block. The experimental palms were separated from each other by guard palms. Palms of similar bearing capacity and vegetative growth were selected for treatment comparisons within each block.

Each experimental palm was treated with a solution of 66 grammes dibasic ammonium phosphate tagged with 5 millicuries P^{32} in 10 litres water. This solution was uniformly sprinkled in the entire areas of placement. In the case of placement (b) at centres of squares, the full phosphate dosage was given to each of the four squares surrounding the experimental palm since the fertilizer applied to each squares in equally accessible to four palms.

Leaflets were sampled from the 6th frond of each experimental palm at intervals of one week, one month and three months after the P^{32} application. On account of the comparatively low amount of activity in the leaflets it was necessary to use a large quantity of leaf material for radioactive assay. 20 gms. of the oven dry samples were dry ashed and extracted with dilute hydrochloric acid. P^{32} was measured by the liquid counting technique and the P^{31} by the colorimetric vanado-molybdate method. The phosphate had to be precipitated and redissolved before estimating the radioactivity due to P^{32} in order to eliminate interference caused by the presence of significant amounts of natural radioactivity in coconut leaflet samples, and also an unknown source of radioactivity which was detected in leaflet samples only just before the placement experiment was commenced in June 1962. The natural radioactivity in leaflets was traced to radioactive potassium K^{40} . The ratio of active to non-active potassium present naturally in leaflets sampled from fronds of varying stages of maturity and different palms at Bandirippuwa estate was comparatively uniform, amounting to a mean of 97 counts per minute per gramme K_2O . The corresponding figure for analar KCl was 94. It is presumed that the unknown source of radioactivity which showed a half life period of about 69 days, and which was observed in all leaflets sampled during this period is due to radioactive fall out. The orders of magnitude of the interference due to radioactive potassium and the unknown source of activity is indicated in Table II B (a). The P^{32} count in equivalent quantities (8 gms.) of oven dry leaflet samples from the experimentally treated palms ranged from 150 to 1,500 counts per minute.

TABLE II B (a)

Blank radioactivity in coconut leaflets
(Sampled on 17.6.62 from 12 year old palms in Botanist's Block—Bandirippuwa Estate)
Counts per minute in 8 gms. oven dry samples

Date of Counting	Palm No.	Leaf No. 1 (1st fully opened)		Leaf No. 8	
		Radioactivity due to potash	Radioactivity from unknown source	Potash activity	Unknown activity
2nd August 1962	102	22	21	16	60
	106	20	11	18	60
	113	23	3	20	46
22nd August 1962	201	24	16	20	40
	218	20	11	16	40
	220	19	9	15	29
23rd August 1962	279	19	5	14	56
	289	20	15	18	43
	295	22	19	14	58

Specific activity of potassium in A.R. KCl = 93.6 cts./mt./gm. K₂O

Half-life period of unknown source of activity = 69 days.

RESULTS

The results of the placement studies are given in Table II B (b). It is seen that placement in a basin extending to 5.2 ft. from the bole of the palm has been about twice as efficient as either of the other two methods. The pattern of uptake has been similar at 7 day, 30 day and 120 day intervals after P³² application. The leaflet samples of replicates taken after 120 days were combined since owing to decay the activity was very low. The variability between replicates in placements (a) and (b) do not permit any definite conclusions to be drawn on the relative efficiency of uptake between these two methods

The results show that the density of absorbing roots is much higher close to the palm than further away in the case of these twelve year old palms on a sandy loam soil which had been regularly manured on the traditional circular trench system. Before drawing any conclusions on the general applicability of these results, it is necessary to carry out further trials on palms of different ages grown under the various soil conditions.

TABLE II B (b)

Placement Trial

Method of Placement	Repl-icate No.	Specific activity of (P ³² /P ³¹) of leaf phosphate in counts/minute/mg. P ₂ O ₅ at different time intervals after application					
		7 days	relative % efficiency of uptake	30 days	% Efficiency	120 days	% Efficiency
Basin extending to 5.2 ft. from bole of palm	1	52		173		—	
	2	58		159		—	
	3	54		133		—	
	Mean	55	100	155	100	224	100
Traditional manure circle 3 ft. wide and 3 ft. away from bole	1	39		77		—	
	2	40		31		—	
	3	24		74		—	
	Mean	34	62	61	39	120	53
Square of 9.2 ft. at centres of squares between rows of palms	1	12		59		—	
	2	7		12		—	
	3	22		31		—	
	Mean	14	25	34	22	107	48

3. Nut Water Analysis

Estimations of potash and inorganic phosphate concentrations were done for each of the six picks in 1962 on samples of nut water from each plot of the old 3³ N.P.K. and new 4³ N.P.K. experiments at Bandirippuwa, and the 3³ N.P.K. experiment on young palms at Ratmalagara. The results (mean values for the 6 picks) are given in Table III A along with the main effects for yield data for different treatments. It is interesting to note that although the nut-water potash concentrations in the Ratmalagara experiments is considerably higher than that of the Bandirippuwa experiment, yet the yield response to potash at Ratmalagara has been quite significant. The nut-water potash of K₀ plots at Ratmalagara is about 25% higher than that of the K₃ plots at Bandirippuwa. Phosphate was highly deficient at Ratmalagara, whereas at Bandirippuwa, the phosphate yield response has just begun to show significance in the 3³ N.P.K. experiment. The P₀ plots at Bandirippuwa however, still show a high nut-water phosphate in comparison to the P₁ or P₂ plots of Ratmalagara. If the nut water concentrations of potash and phosphate are to be considered a guide to fertilizer response, then it would be expected that at Ratmalagara still higher yield response could be obtained by raising the phosphate dosage, while at Bandirippuwa the K₃ level of potash would still be considered insufficient. This is a matter which remains to be further clarified.

TABLE III B
Nut-Water analysis—1962

	<i>K₂O gms./litre</i>			<i>P₂O₅ gms./litre</i>				
	<i>K₁</i>	<i>K₂</i>	<i>K₃</i>	<i>P₀</i>	<i>P₁</i>	<i>P₂</i>		
3 ³ N.P.K. Expt. B/E	1.16	1.70	2.01	0.24	0.26	0.26		
Yield lbs. copra per acre	1653	1692	2121	1808	1949	1980		
	<i>K₀</i>	<i>K₁</i>	<i>K₂</i>	<i>K₃</i>	<i>P₀</i>	<i>P₁</i>	<i>P₂</i>	<i>P₃</i>
4 ³ N.P.K. Expt. B/E	1.57	1.73	1.77	2.04	0.24	0.24	0.24	0.24
Yield lbs. copra per acre	1916	1912	1926	1962	1979	2008	1878	1851
	<i>K₀</i>	<i>K₁</i>	<i>K₂</i>		<i>P₀</i>	<i>P₁</i>	<i>P₂</i>	
3 ³ N.P.K. Expt. R/E	2.49	2.72	2.83		0.15	0.20	0.21	
Yield lbs. copra per acre	1663	1791	2062		1183	2167	2166	

4. Nitrogen losses from dolomite—sulphate of ammonia fertilizer mixtures

At present we recommend that the application of dolomite to coconut palms be done separately at a later date after the usual N.P.K. mixture containing sulphate of ammonia has been applied. This is to minimise nitrogen losses which result when dolomite reacts with sulphate of ammonia. As this practice involves extra expenditure on labour, we considered it necessary to get some quantitative estimate of nitrogen losses when dolomite is mixed with fertilizer mixtures containing sulphate of ammonia, both in the presence and absence of soil. Investigations on this subject are in progress.

C. MISCELLANEOUS

1. The following papers were presented at the Annual sessions of the Ceylon Association for the Advancement of Science by members of the division.

- (i) "Diagnosis and correction of magnesium deficiency in coconuts"—by D.A. Nethsinghe, M.A.T. de Silva and D.E.G. Nedimale.
- (ii) "The use of radioactive phosphorus in fertilizer placement studies on the coconut palms" by D.A. Nethsinghe and T.S. Balakrishnamurthi.

The Soil Chemist addressed the Southern Province Planters' Association on the problems of Leaf Scorch and Magnesium Deficiency.

2. The following articles were published in the Ceylon Coconut Planters' Review by members of the Division.

- (i) "Cover Crops under coconuts"—by M.A.T. de Silva.
- (ii) "Magnesium deficiency in Coconut palms"—by D.A. Nethsinghe.

D. PERSONNEL

Mr. D.E.G. Nedimala, Technical Assistant was successful in the B.Sc. Examination of the University of London.

Mr. P.M. Harischandra, was promoted from the grade of Field Attendant to Field Assistant.

Messrs. N.P. Ranaweera, A.M.P. Arthanayake and W.J.P. Fernando were appointed Lab/Field Attendants.

There were no other staff changes.

D.A. NETHSINGHE,
Soil Chemist,
Coconut Research Institute.

REPORT OF THE CHEMIST

1. Moisture studies on the Coconut Endosperm ('Typica' Palms)

(a) The results of various moisture studies that have been made with a view to understanding better the changes that take place in the ripening coconut, the appraisal of the quality of copra and the mechanisms involved in its manufacture, have been reported earlier.

In the manufacture of desiccated coconut, the kernel (after paring) is to all intents and purposes disintegrated with 'adventitious' moisture, picked up at the 'WASHING' stage of processing. The kernel of the freshly opened coconut too, may be reckoned to contain adventitious moisture, owing to the fact that it is in direct contact with the 'liquid endosperm' within the water cavity.

An experiment was carried out with a view to obtaining reliable estimates of the moisture contents of the absolutely fresh endosperm from the following classes of nuts *immediately on splitting*:—

1. Dead ripe nuts naturally falling from the palm ('Fallen Nuts').
2. Picked ripe green nuts.
 - (a) Immediately on harvesting.
 - (b) After 15 days' seasoning in the field.
 - (c) After 30 days' seasoning in the field.

The full results of this study are charted in Table I. On the basis of earlier results it has been inferred that 43.8% (ranging between 42.0% and 45.9% may for all practical purposes be reckoned as the true moisture content of the fresh mature kernel after it has been air dried for ten minutes from the time of opening.

The results of the present study show that the moisture content of the mature kernel when freshly opened is in the region of 46.9% (ranging between 46.0 and 47.8%). It may therefore be inferred that the 'adventitious' moisture associated with the wet kernel is of the order of 3 per cent.

(b) The study on the moisture content of the coconut endosperm was also extended to the kernel of the immature drupe.

Five lots of 25 nuts each from each of the four stages "Kalati", "Tender Kalati", "Kurumba" and "Tender Kurumba" (representing decreasing stages of maturity) were taken for the study. The full results are charted in Table II. The moisture estimations were carried out in each case, immediately on opening the nuts from the respective stages. In other words, the figures represent the moisture content of the endosperm (at the respective stages) when it is associated with "adventitious moisture". The results are self explanatory.

TABLE I

Moisture content of the Coconut Endosperm when it is associated with "Adventitious Moisture"

1	2	3		
Sample	FALLEN NUTS (Dead ripe nuts naturally falling from the palm)	PICKED RIPE GREEN NUTS		
		Immediately on harvesting)	After 15 days seasoning in the field	After 30 days seasoning in the field
1	46.67	47.14	44.91	44.36
2	46.59	46.41	44.53	44.26
3	46.92	46.83	43.81	42.99
4	46.31	46.37	45.18	43.44
5	46.48	47.73	43.95	43.58
6	46.02	46.96	44.04	43.16
7	47.83	46.94	43.93	44.22
8	47.29	47.81	44.53	43.23
9	47.30	47.96	43.98	43.09
10	47.31	48.07	44.93	43.37
Mean	46.87	47.22	44.38	43.57
Range	46.02 to 47.83	46.37 to 48.07	43.81 to 45.18	42.99 to 44.36
S.D.	0.5563	0.6291	0.5007	0.5196
C.V. (%)	1.19	1.33	1.13	1.19
S.E.	0.1759	0.1989	0.1583	0.1643

TABLE II

Moisture content of the Immature Coconut Endosperm when it is associated with 'Adventitious Moisture'

1	2	3	4	5
Sample	Kalati	Tender Kalati	Kurumba	Tender Kurumba
1	66.23	68.11	85.99	93.80
2	64.71	68.22	85.79	92.81
3	64.70	66.50	84.34	91.87
4	66.50	67.85	85.10	93.12
5	65.80	67.20	84.65	92.43
Mean	65.59	67.58	85.17	92.81
Range	64.70 to 66.50	66.50 to 66.22	84.34 to 85.99	91.87 to 93.80
S.D.	0.8439	0.7201	0.7108	0.7253
C.V. (%)	1.29	1.07	0.83	0.78
S.E.	0.3774	0.3220	0.3179	0.3244

S.D. = Standard Deviation.
 C.V. = Coefficient of Variation.
 S.E. = Standard Error.

2. Copra

(a) Work in connection with the Copra Conversion Factor for the FAO Survey, was completed during the early part of the year.

(b) Seven samples of copra sent by the Botanist (from his Experiment 54/61—Di-allel Crosses) were analysed for moistures and oil contents with the results shown in Table III.

TABLE III
Moisture and Oil Contents of copra from Botanist's Experiment 1954/1961

1 No.	2 Botanist's Reference	3 % Moisture	4 % OIL	
			% OIL	
			Wet bsais	Dry basis
1	54/61(2)	6.9	64.6	69.4
2	54/61(3)	12.1	56.3	64.1(?)
3	54/61(4)	11.1	61.4	69.1
4	54/61(5)	8.1	63.9	69.5
5	54/61(6)	10.9	60.7	68.2
6	54/61(7)	12.6	60.2	68.8
7	54/61(8)	5.8	65.3	69.3

(c) *Standard Ceylon Copra Kiln.*—In connection with the training course provided for a visitor from Pakistan, a study was made of the drying-time curve obtained with the Standard Ceylon Copra Kiln when following the operational schedule outlined in the Coconut Research Institute Leaflet No. 15.

The samples for moisture determinations were drawn from two levels (upper and lower) on the drying platform and the results obtained are summarised in Table IV below:

TABLE IV
Moisture Changes in Copra during Curing Procedure in the Standard Ceylon Copra Kiln

1 STAGE	2 No. of hours since split- ting	3 % MOISTURE			4 Total loss of MOIS- TURE (%) since splitting			5 Total Moisture loss as % of original		
		Lower Level	Upper Level	Mean	Lower Level	Upper Level	Mean	Lower Level	Upper Level	Mean
On Splitting	nil	43.30	43.30	43.30	nil	nil	nil	nil	nil	nil
After Sundrying	10	33.15	33.15	33.15	10.15	10.15	10.15	23.4	23.4	23.4
After 1st Fire	19	22.49	32.42	27.46	20.81	10.88	15.84	48.1	25.1	36.6
After 2nd Fire	34	20.24	28.06	24.15	23.06	15.24	19.15	53.3	35.2	44.2
After 3rd Fire	43	17.27	23.79	20.53	26.03	19.51	22.77	60.1	45.1	52.6
After 4th Fire	58	16.45	21.92	19.18	26.85	21.38	24.12	62.0	49.4	55.7
After 5th Fire	67	14.13	20.47	17.30	29.17	22.83	26.00	67.4	52.7	60.0
After 6th Fire	82	13.03	16.52	14.78	30.27	26.78	28.52	69.9	61.8	65.8
After 7th Fire	91	8.84	8.54	8.69	34.46	34.76	34.61	79.6	80.3	80.0
After 8th Fire	106	8.08	7.50	7.79	35.22	35.80	35.51	81.3	82.7	82.0

Regarding essential drying principles it is generally reckoned that the moisture content of the kernel should be progressively reduced to about 35% 20% and 6% during consecutive 24 hour drying periods. The earlier results have shown that these requirements are generally fulfilled during the first 48 hours which may be regarded as the critical period of dehydration. The present results (averages of Lower and Upper Levels) too confirm this. Regarding the 3rd period of 24 hours however, it will be seen that the rate of dryage is definitely slow in terms of the requirements. It is proposed to investigate this point further.

TABLE V

Chemical Examination of Samples of Desiccated Coconut collected at three Mills

<i>Sample</i>	<i>DESICCATED COCONUT</i>			<i>MILL I</i>
	<i>% Moisture</i>	<i>% OIL</i>		<i>Remarks</i>
		<i>Wet basis</i>	<i>Dry basis</i>	
Finished Product I	1.61	70.0	71.1	Composite sample before sifting into Grades
Finished Product II	1.79	70.1	71.3	
	1.70	70.1	71.2	<i>MEAN</i>
Lumps I	26.8	54.5	74.4	
Lumps II	14.7	62.0	72.7	
MEAN	20.8	58.2	73.6	
<i>DESICCATED COCONUT</i>				
				<i>MILL II</i>
Finished Product I	1.91	68.7	70.0	Composite samples before sifting
Finished Product II	1.94	69.3	70.7	
Finished Product III	1.88	69.6	71.0	
	1.91	69.2	70.6	<i>MEAN</i>
Lumps I	5.38	68.0	71.9	
Lumps II	5.49	67.9	71.8	
MEAN	5.44	68.0	71.8	
<i>DESICCATED COCONUT</i>				
				<i>MILL III</i>
Finished Product I	2.03	69.5	70.9	Composite samples before sifting
Finished Product II	2.28	69.2	70.8	
	2.16	69.4	70.8	<i>MEAN</i>
FORMATION OF LUMPS NOT EVIDENT				

3. Desiccated Coconut

(a) In connection with the work of the Technical Committee on Desiccated Coconut, three factories were visited and certain experimental samples were processed. The chemical analyses of the samples drawn for laboratory examination are given in Table V.

The Ceylon standard specification prescribes a moisture content under 3.0% and an oil content over 65.0% (wet basis) for granulated desiccated coconut. The analytical data show that the composite samples of the finished product drawn at the three factories are all satisfactory from the point of view of these characteristics. In spite of this fact, it is noteworthy that the samples from Mills I and II contained very moist lumps—the moisture contents ranging between 5.4% and 26.8%. There is no doubt that these moist lumps could very well constitute foci of bacterial invasion. The plausibility of this assumption was actually confirmed by bacteriological tests.

(b) *Losses of Dietary Factors during Desiccated Coconut Manufacture.*—A simple *Ad hoc* laboratory experiment was carried out in order to obtain an assessment of the combined losses in the major dietary factors to Wash and Sterilization waters during desiccated coconut manufacture. The results (that have been embodied in a mimeographed brochure) show that the sterilization of the pared coconut kernel in boiling water involves losses affecting its constitutive food factors (fat, protein, carbohydrates and minerals) with consequent detraction from quality. From the quantitative angle the experiment has revealed that in terms of average exports—the economic losses to Ceylon's desiccated coconut industry every year would be of the order of 6.9 lakhs of rupees if fresh coconuts were processed, and 4.9 lakhs if seasoned nuts are used in desiccated coconut manufacture. Since these are dead losses to the industry, the subject certainly warrants attention.

4. Pot Culture Experiment

(a) A Fourth sand Pot Culture Experiment on 288 amputated coconut seedlings was laid down in April. The experiment has been designed to evaluate the concentrations of the macronutrients—N, P, K, Ca and Mg in the laminae and rachids of leaves of different ranks, and their gross concentrations in the composite shoots and roots.

(b) The work of the Division was focussed principally on analytical work on plant samples from the previous Pot Culture Experiments.

5. Vinegar

(a) A new Vinegar Factory at Nainamadama employing the "Generator" process went into production in June.

After the generator had been seeded it was found possible to completely acetify toddy within six days. The acetification efficiency was over 85% and the quality of vinegar produced has been uniformly good.

(b) A satisfactory method was evolved during the year for the preparation of caramel (of high tinctorial efficiency) for colouring vinegar. A bottle of this caramel has been found adequate to colour 20 gallons of vinegar to dark wine-tint.

(c) A simple *Ad hoc* experiment was carried out during the year to test the efficacy of common salt in retarding the growth of mycodermal film in bottled vinegar. It was found that a minimum concentration of 2 per cent salt dissolved in the vinegar would completely arrest the formation of any mycodermal suspensions.

As an effective substitute for sterilisation, common salt at a concentration of 2% is now being used at the Nainamadama factory.

6. Miscellaneous Work

1. Analyses and reports have been made on a few samples of copra, desiccated coconut, coconut oil, coconut poonac and farmyard manure.

2. Apart from help and advice, regular samples of acetifying toddy were analysed for the vinegar-maker at Nainamadama.

3. The Chemist served on the technical Committee on Desiccated Coconut during the year.

4. The Chemist served on the Standards Sub-Committee on Coconut Oil during the year.

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Chemist, Coconut Research Institute.

REPORT OF THE BOTANIST

HYBRIDISATION BETWEEN VARIETIES AND FORMS

The programme of work on breeding and selection of coconut palms was continued during the year. Crossing work on three experiments initiated in 1961, viz. (a) diallel crosses, (b) testing male transmitters from selected palms of the Isolated Seed Garden, and (c) study of the influence of the male parent on endosperm characters of the nut, was completed during the year and harvesting of nuts is in progress.

New experiments initiated during the year are: (a) a further diallel cross between 10 selected palms, (b) study of segregation of characters in the F₂ of *typica* × *pumila*, (c) study of F₁ progenies of *gonthembili* × *regia* forms, and (d) a field experiment to study the relative performances of F₁ palms of *typica* × *typica*, *typica* × *pumila* and *typica* open-pollinated.

Data collected from the progenies of various crosses under investigation are given below.

Typica × *pumila*

The experimental material consisting of 22F₁ palms of *typica* × *pumila* (tall × dwarf) planted in 1950 has given a mean yield of 146 nuts and a husked-nut weight of 284 lb. per palm in 1962, i.e. the 12th year after planting. The yield of the 10 *typica* × *typica* F₁ palms planted in the same field during the same year has been equally high: 161 nuts with a husked-nut weight of 287 lb. per palm in 1962. The yearly mean yields of the palms of these two types of crosses are listed in Table I.

TABLE I
Mean yield per progeny of F₁ palms of experimental material

Year after planting	<i>typica</i> × <i>pumila</i>		<i>typica</i> × <i>typica</i>	
	Nuts	Weight of husked-nuts (lb.)	Nuts	Weight of husked-nuts (lb.)
5th	23	36.0	—	—
6th	68	106.1	22	35.8
7th	86	122.9	52	70.0
8th	65	110.5	65	102.2
9th	103	147.0	84	126.7
10th	108	187.8	88	—
11th	129	225.6	121	212.3
12th	146	284.1	161	286.9

Out of palms planted in May 1958, in order to study their performance on a larger scale, there are 193 of *typica* × *pumila* and 72 of *typica*, excluding casualties. Their progress in flowering has been as follows:—

	Palms in flower
Age of palms—3½ years	
<i>typica</i> × <i>pumila</i>	87 per cent
<i>typica</i> × <i>typica</i>	19 per cent
Age of palms—4½ years	
<i>typica</i> × <i>pumila</i>	95 per cent
<i>typica</i> × <i>typica</i>	50 per cent

The above data clearly indicate that the F_1 palms of *typica* \times *pumila* are early bearing. These palms have been planted in a block at Ratmalagara Estate where the soil is of a heavy clay type and consequently not very suitable for coconuts. Yet it is interesting to record that the early flowering character is maintained. Because of adverse soil conditions, the palms have suffered, particularly in periods of drought, but so far there are no indications that *typica* \times *pumila* palms are affected more than the *typica* palms.

Now that there is sufficient data available on an experimental basis to indicate that the hybrid palms are early bearing and high-yielding, it is necessary to test them in relation to normal plantation type of palms on a statistical lay out. With that end in view, a field trial was laid down at Pothukulama in November 1962. Three treatments are being tried out: (i) *typica* \times *pumila*, (ii) *typica* \times *typica*, and (iii) *typica* open-pollinated. The design of the experiment is randomised blocks, with 12 replications and 12 palms per plot.

Typica \times typica

The programme of production of seedlings of *typica* \times *typica*, where the male parent is a prepotent palm was continued during the year. Pollinations were carried out at 6 stations and nearly 57,500 female flowers have been pollinated. 13,679 nuts resulting from pollinations done in the previous year were harvested.

Isolated Seed Garden

In field No. 1 ($4\frac{1}{2}$ acres) planted in December 1955, 49.3 per cent of the palms were in full bearing giving a mean yield of 84 nuts per palm, and most of the other palms were in partial bearing. Yield per acre during the year was 4,174 nuts on an area basis. Nearly 16 acres were planted with hand pollinated seedlings, bringing the total area planted to 110 acres (approx).

A programme to test male transmitters from palms within the Seed Garden was initiated. Six selected palms were used as the male parents in a crossing programme.

REPLANTATION EXPERIMENT

A field trial was laid down in 1950 to study the relative merits of three systems of underplanting senile coconut plantations: viz. (a) *new clearing*—planting after removing completely the old stand of palms, (b) *gradual thinning*—underplanting and removing the old stand gradually, and (c) *no thinning*—underplanting and removing the old stand in the 8th year. The design of the trial is randomised block layout with 7 replications and 25 palms per plot.

It has been shown that the young palms in the no thinning system of underplanting have been at a disadvantage relative to the palms in the other two systems during the first few years of growth particularly with respect to yearly leaf production and early flowering (vide Annual Reports for 1957 and 1959).

The bearing status of palms has varied relative to the treatments as shown in Table II, where a full bearing palm is taken as one that has given a crop in the first harvest gathered at the beginning of the year.

TABLE II
Bearing status of palms in the Replantation Experiment

<i>Treatment</i>	<i>Full bearing</i>	<i>Percentage of palms Partial bearing</i>	<i>Non bearing</i>
8th year after planting			
No thinning	8.0	8.6	83.3
Gradual thinning	13.8	17.8	68.4
New clearing	32.4	17.3	50.3
9th year after planting			
No thinning	18.4	14.9	66.7
Gradual thinning	38.5	16.1	45.4
New clearing	54.3	17.9	27.7
10th year after planting			
No thinning	35.6	6.9	57.5
Gradual thinning	56.3	12.1	31.6
New clearing	75.1	9.8	15.0

The analysis of transformed data of the number of palms in full—and partial—bearing indicates that the differences between the three treatments, with respect to full-bearing palms are statistically significant. As shown in the above table a significantly larger number of palms in the new clearing treatment were in full bearing during the 8th to 10th years relative to the other treatments. Differences in the number of partial bearing palms between treatments were not significant.

The yield of copra per palm in full bearing palms was analysed after correcting for the number of bearing palms by the covariance technique. The differences between treatments with respect to yield of copra per bearing palm during the 8th, 9th, 10th and 11th years (Table III) were not statistically significant, *i.e.* the type of treatment had no effect on the yielding capacity of bearing palms during these years.

TABLE III
Yield per palm in full-bearing and yield per acre

	<i>Yield of copra per palm in full-bearing (lb.)</i>	<i>Nuts</i>	<i>Yield per acre Copra (cwt.)</i>
	8th year after planting		
No thinning	19.2	225	1.21
Gradual thinning	27.6	537	2.71
New clearing	26.2	1,064	5.69
9th year after planting			
No thinning	23.9	594	2.96
Gradual thinning	24.3	1,244	5.76
New clearing	25.6	1,720	8.42
10th year after planting			
No thinning	16.4	790	4.04
Gradual thinning	18.2	1,263	6.03
New clearing	20.0	1,766	8.71
11th year after planting			
No thinning	30.3	1,584	8.65
Gradual thinning	26.9	2,014	10.57
New clearing	27.3	2,389	12.94
12th year after planting			
No thinning	—	2,097	11.21
Gradual thinning	—	2,715	13.75
New clearing	—	2,906	15.31

In the above Table, yield per acre is on a basis of area of land irrespective of bearing status of palms.

The analysis of variance of yield per acre data after appropriate transformations, show that the differences between treatments are significant ($P = 0.05$) as follows: 8th year—yield of nuts only, 9th and 10th years—both yield of nuts and copra, 11th and 12th years—not significant. When the critical differences are evaluated the only significant factor is that palms in the new clearing treatment have given significantly higher yield of nuts and copra than those in the no thinning treatment during the 8th, 9th and 10th years, except yield of copra in the 8th year. The differences in yield of nuts and copra between the new clearing and gradual thinning treatments, and the latter and no thinning treatment are not significant.

The old palms in the no thinning treatment were removed early in the 9th year, and it is interesting to note that the yield of young palms in this treatment has increased considerably two years later (Table III).

Thus, although the palms in the new clearing treatment were distinctly at an advantage over the other two treatments, the yield of copra per acre during the first 5 years of bearing has not been sufficiently high to offset the loss in crop due to the removal of the old stand of palms completely. A system of gradual thinning of the old stand of palms seems to be a feasible method of underplanting senile plantations.

Correlations

The number of new leaves produced in each young palm during the 2nd to 6th years after planting and the total number of green leaves borne on each palm at the end of the 5th year in 122 palms of the new clearing treatment are available. These data have been used in phenotypic correlation studies with the flowering period, yield of nuts and weight of copra gathered during the 4 years, 9th to 12th after planting.

TABLE IV
Phenotypic correlation coefficients between leaf production, flowering-period and yield of young palms

	<i>X</i> flowering period	Correlation coefficient, <i>r</i> <i>X</i> yield of nuts	<i>X</i> yield of copra
No. of leaves produced in the 2nd year	-0.5076*	0.1269*	0.1809*
No. of leaves produced in the 3rd year	-0.6836*	0.3956*	0.3912*
No. of leaves produced in the 4th year	-0.8046*	0.4903*	0.5001*
No. of leaves produced in the 5th year	-0.7556*	0.5618*	0.5982*
No. of leaves produced in the 6th year	-0.7698*	0.6277*	0.6443*
Total No. of leaves produced from 2nd to 6th year	-0.8560*	0.5773*	0.6029*
Total No. of green leaves borne on palm at the end of the 5th year	-0.8092*	0.5438*	0.5894*
Flowering period		-0.5442*	-0.5521*

*Significant Value of $r = 0.1684$ ($P = 0.05$)

Yearly leaf production from the 2nd to the 6th year is negatively correlated with the flowering-period. Thus, in a programme of selective thinning of transplanted material, it is possible to use an index of leaf production for rogueing purposes, with a view to promote early flowering of palms in the population. Leaf production and initial yield of palms, both nuts and copra, are positively and significantly correlated, but the magnitude of the correlation coefficient is not so high as in the previous case.

PLANTING TECHNIQUES

Hedge Planting

The observation plots of a new system of close planting for selective thinning, planted at Ratmalagara Estate in 1956 and the Isolated Coconut Seed Garden, in 1957, show satisfactory growth although the palms are spaced in rows 24 feet apart and 18 feet within each row. Close planting as in this trial apparently has no adverse effects on early flowering: 91.5 per cent of the palms in the Hedge Planting Plots and 75.6 per cent in the rectangular planting plots at Ratmalagara have flowered by the end of the 6th year after planting. It is necessary to ascertain the yield of copra per unit acre under the two systems of planting.

Depth of Planting

Four depths of planting, 6, 12, 18 and 24 inches are being tried out in this trial planted in November 1956. It has been shown that there were no significant differences between treatments with respect to yearly leaf production during the first five years. At the end of the 6th year, 39 per cent of the palms in the entire trial were in flower and the differences between treatments with respect to number of palms in flower were not significant.

PROGENY TRIALS

The three progeny trials at Marandawila, Walpita and Bandirippuwa were maintained during the year. A number of selected palms from the Marandawila plantation were used for pollination work.

MISCELLANEOUS

Seed Supply Scheme

Seven estates were visited for selection of palms and 3,643 palms were selected from two estates. A total of 44,467 palms have been selected from 16 estates by the end of the year. 1,606,261 selected seednuts were supplied to the Planting Division.

Nursery

5,899 hand pollinated seedlings were issued.

Pollen Bank

Storage of pollen collected from prepotent *typica* palms and selected *pumila* palms was maintained. 1964 pollen samples have been issued to private estates to carry out their own pollination programme.

Other Field Trials

Routine observations, yield recording, etc., of Latin Square experiment, Dwarf Palm Block, and Inbred Progenies were continued.

Publications

The following papers were published.

1. Dr. D.V. Liyanage. "The use of isolated seed gardens for coconut seed production". The Ceylon Coconut Quarterly, Vol. 12, Nos. 3/4.
2. Dr. D.V. Liyanage. "Genetic improvement of the coconut palm". Proceedings of the Symposium on Tropical Crops Improvements:—Tenth Pacific Science Congress, South Pacific Commission, Noumea.
3. Dr. D.V. Liyanage. "The isolated seed garden". The Ceylon Coconut Planters Review, Vol. 2, No. 4.

D.V. LIYANAGE

10th April, 1963

Botanist, Coconut Research Institute.

REPORT OF THE ACTING AGROSTOLOGIST

I. Soil Fertility Studies

1. Soils from Bandirippuwa Estate

The experiment set up last year with soil from the experimental area of P₇ and planted to *Brachiaria brizantha* was completed this year, with the eighth harvest.

The trend of responses is similar to that obtained in the case of *Brachiaria milliformis*—N, P, and K being deficient—the deficiency due to N being acute. Mean increments of yields recorded for the eight harvests, for N, P and K were 151.78%, 35.31% and 14.03% respectively.

This experiment was then repeated late this year as follows:—

Pots were filled with fresh soil from the P₇ experimental area (Replicate two, Estate Control Plots) and a 3 × 2 × 2 experiment with N, P and K planted to *Brachiaria brizantha* and *Brachiaria milliformis* was set up.

Commercial fertilizers were used. The pots were kept outside and watered with rain water, as done previously.

2. Cinnamon Sand from Horekelle Estate

(a) Soils 3½ years after manuring

The two experiments set up with this soil late last year have been completed.

Experiment I

This was a 2⁵ factorial pot experiment of N, P, K, Ca and Mg with two replicates of all treatments planted to *Paspalum commersonii*.

The experiment was harvested twice. The results indicate very acute deficiencies of N and K. The same was true of soils sampled in this plot earlier.

Experiment II

This was a 4² factorial pot experiment of N and K, with two replicates of all treatments, planted to *Paspalum commersonii*. A basal application of 5 cwts./acre CaCO₃ was made at the time of planting.

The experiment was harvested thrice.

The data indicate an acute deficiency of N and to a lesser extent, of K.

(b) Soils 4 years after manuring

Soils were sampled, of the follow-up plot 4 years after manuring in April, this year, and the following experiments set up:—

Experiment I

This was a 2⁵ factorial pot experiment of N, P, K, Ca and Mg, set up as for experiment 2 (a) I.

The experiment was carried through two harvests each for the first and second plantings.

The data indicate acute deficiencies of N and K. This was the same as obtained for soils of this plot sampled earlier.

Ca was found to depress yields during the early stages—but increased yields later.

Experiment II

This was a 4² factorial pot experiment of N and K, set up as for Experiment 2 (a) II. However, the basal treatment was omitted.

The experiment was harvested four times. Acute deficiencies of N and K were noted.

(c) *Soils 4½ years after manuring*

Soils were sampled of the follow-up plot 4½ years after manuring in October this year, and the following experiment set up:—

Experiment I

This was a 4² factorial pot experiment of N and K, set up as for Experiment 2 (b) II.

3. Soils from Ratmalagara Estate

A. Soils were sampled of Block A follow-up, 2½ 3 and 3½ years after manuring.

(a) *Soils 2½ years after manuring*

Experiment I

This was a 3 × 2 × 2 factorial pot experiment of N, P and K, with three replicates of all treatments, planted to *Paspalum commersonii*.

The experiment was harvested thrice.

The data indicate that all tested nutrients (N, P and K) increased yields significantly, P increasing yields especially in the early stages of growth, while K increased yields at the later stages.

Experiment II

This was a 4² factorial pot experiment of P and K, with two replicates of all treatments, planted to *Paspalum commersonii*.

The experiment was harvested four times. The data indicate an early deficiency of P and a later deficiency of K.

(b) *Soils 3 years after manuring*

Experiment I

This was a 3 × 2 × 2 factorial pot experiment of N, P and K, set up as for experiment 3 (a) I.

The experiment was harvested thrice. A similar trend of responses as in Experiment I was noted here too.

Experiment II

This was a 4² factorial pot experiment of P and K set up as for Experiment 3 (a) II.

The experiment was harvested thrice. The data indicate a similar trend of responses as noted in that experiment.

(c) *Soils 3½ years after manuring*

Experiment I

This was a 3 × 2 × 2 factorial pot experiment of N, P and K set up as for Experiment 3 (a) I.

Experiment II

This was a 4^2 factorial pot experiment of P and K set up as for Experiment 3 (a) II. Both experiments were set up late this year and are in progress.

B. Block B—Soils were sampled of Block B (follow-up), $1\frac{1}{2}$, 2, $2\frac{1}{2}$ years after manuring.

(a) *Soils $1\frac{1}{2}$ years after manuring*

Experiment I

This was a $3 \times 2 \times 2$ factorial pot experiment of N, P and K set up as for Experiment 3 (a) I.

The experiment was harvested thrice. A similar trend of responses as observed for Experiment 3. A. (a) I was noted here too—all tested nutrients N, P and K increasing yields—P increasing yields during the early stages of growth, while K increased yields at the later stages.

Experiment II

This was a 4^2 factorial pot experiment of P and K, set up as for Experiment 3. A. (a) II.

The experiment was harvested thrice. Here too, a similar trend of responses was noted—P increasing yields at the early stages of growth while K increased yields at the later stages of growth.

(b) *Soils 2 years after manuring*

Experiment I

This was a $3 \times 2 \times 2$ factorial pot experiment of N, P and K set up as for Experiment 3. A. (a) I. The experiment was harvested twice for the first planting and once for the second.

The data indicate deficiencies of all tested nutrients —N, P and K—the same trend of responses. was observed here too.

Experiment II

This was a 4^2 factorial pot experiment of P and K set up as for Experiment 3. A. (a) II.

The experiment was harvested twice for the first planting and once for the second planting. The responses were also similar.

(c) *Soils $2\frac{1}{2}$ years after manuring*

Experiment I

This was a $3 \times 2 \times 2$ factorial pot experiment of N, P and K set up as for Experiment 3. A. (a) I.

Experiment II

This was a 4^2 factorial pot experiment of P and K, set up as for Experiment 3. A. (a) II.

Both experiments were set up late this year and are in progress.

4. Keenekelle Soils

Experiment I

This was a 2^5 factorial pot experiment, to test the effect of the minor nutrients, Fe, Cu, Zn and Mo on the growth of:—

- | | |
|-----------------------------------|----------------|
| (i) <i>Paspalum commersonii</i> | — 2 replicates |
| (ii) <i>Phaseolus lathyroides</i> | — 1 replicate |
| (iii) <i>Sesamum indicum</i> | — 1 replicate |

The experiment was harvested four times for *Paspalum commersonii*; thrice for the first planting and once for the second planting for *Phaseolus lathyroides*, and once for *Sesamum indicum*. Thinnings were included for *Phaseolus lathyroides* and *Sesamum indicum* for additional data.

The data indicate no response to any of the tested nutrients.

Experiment II

This was a simple experiment to study the effect of Sulphur on the growth of *Paspalum commersonii*. The experiment was harvested once and two sets of 'thinnings' taken for additional data.

The data indicate no significant response to added sulphur.

Experiment III

This was a 4³ factorial pot experiment of N, P and K with two replicates of all treatments planted to *Paspalum commersonii*.

The experiment was harvested thrice and two sets of 'thinnings' included for additional data. All tested nutrients—N, P and K increased yields—the response to added P being more evident at the early stages of growth while the response of added K was more at the later stages.

5. Pothukulama Soils

(a) Soils under old plantations

The experiment set up late last year with this soil has been completed.

Experiment I

This was a 4² factorial pot experiment, with two replicates of all treatments, to measure the effect of increasing doses of N and K on the growth of *Paspalum commersonii*.

The forms and levels of nutrients applied were:—

N. as NH_4NO_3 — Nil, 1½, 3 and 4½ cwts./acre.
P. as NaH_2PO_4 — Nil, 1½, 3 and 4½ cwts./acre.

The experiment was harvested twice. Both tested nutrients increased yields.

(b) Sub-Soil

The sub-soil was sampled this year and the following experiments set up:—

Experiment I

This was a 2⁵ factorial pot experiment of N, P, K, Ca and Mg on the growth of:—

- (i) *Paspalum commersonii* — 2 replicates
- (ii) *Phaseolus lathyroides* — 1 replicate
- (iii) *Sesamum indicum* — 1 replicate

The experiment has been harvested twice for *Paspalum commersonii*, once each for *Phaseolus lathyroides* and *Sesamum indicum*, and is in progress.

The results obtained so far, indicate acute deficiencies of N, P and K. There was no response to added N in the case of *Phaseolus lathyroides*, showing that effective nodulation had taken place. A depression of yields due to added Ca and Mg have been noted in the early stages.

This is the same trend of responses as obtained for the top-soil but the deficiencies in the top soil were of a lower magnitude than that obtained for the sub-soil.

Experiment II

This was a 2⁵ factorial pot experiment of Fe, Cu, Zn, Mn and Mo on the growth of:—

- (i) *Paspalum commersonii*, and
- (ii) *Phaseolus lathyroides*

The experiment has been harvested once each for the two species tested and is in progress.

Experiment II

This was a 2⁵ factorial pot experiment of Fe, Cu, Zn, Mo and B on the growth of *Medicago sativa*. The experiment was set up late this year and has proceeded through the 'thinnings' stage only.

6. Ambakelle Soils

Soils were sampled from an area cleared and planted to coconuts in 1958, and the following experiment set up:—

Experiment I.

This was a 2⁵ factorial pot experiment of N, P, K, Ca and Mg on the growth of:—

- | | |
|-----------------------------------|----------------|
| (i) <i>Paspalum commersonii</i> | — 2 replicates |
| (ii) <i>Phaseolus lathyroides</i> | — 1 replicate |
| (iii) <i>Medicago sativa</i> | — 1 replicate |

The experiment was harvested thrice for *Paspalum commersonii*, once for the first planting and twice for the second planting of *Phaseolus lathyroides*, and twice for *Medicago sativa*.

High increments of yields were noted for N, P and K for *Paspalum commersonii* and with P and K for *Phaseolus lathyroides*. There was hardly any response to added N from *Phaseolus lathyroides* and *Medicago sativa*. This indicated, effective nodulation.

In the case of *Medicago sativa* the response to P and K were not marked.

II. Pasture Trials

1. Comparison of grasses (P₁)—Bandirippuwa Estate.

Objective:—To ascertain the performance of *Brachiaria milliformis* *B. brizantha* and *Panicum maximum* (Ginea Grass) under coconuts, and the effect of the pasture on the yield of coconut palms, as compared with estate (control).

Manuring:—The pastures were manured with 1 cwt./acre of Sulphate of Ammonia in July and 1 cwt./acre each of Sulphate of Ammonia and Muriate of Potash in December—manure being applied broadcast.

Palm manuring was done in May-June with the normal estate manure mixture of 10 lbs./palm forked round the base.

Cultivation:—Disc harrowing was done prior to manuring.

Sampling and Grazing of pastures were done to schedule—2 adult cows grazing each of the *Brachiaria* plots while 9 adult cows grazed the *Panicum* plot.

Pick:—The six picks for the year were recorded.

Results:—The data were analysed by the Biometrician and a summary of the conclusions is given below:—

1. Effect on nut yields

(a) **Nut yields:**—The data show that in comparison to the control (weed) plot the *Panicum* pasture reduced the yield of the palms considerably (by 200 nuts/acre/year). The spp. of *Brachiaria* however increased nut yields—*B. milliformis* by 218 and *B. brizantha* by 95 nuts/acre/year. The trends in nut yields in the four plots over the period 1956-1962 are shown graphically in Figure I, where two year moving averages were converted to percentages with the first averaged values (that for 1956-57) taken as 100. The two year moving averages were taken to eliminate fluctuation in yields due to bienniality in coconuts (Abeywardena 1963).

(b) **Herbage yields:**—The total yield of two cuts each year taken after the May-June and Oct.-Nov. manuring and prior to the introduction of cattle are given in Table I.

TABLE I

Dry matter yield (lbs./acre) based on two cuts./year

Pastures	1958	1959	1960	1961	1962	Mean
<i>Panicum maximum</i> ..	14,762	16,934	16,397	12,298	13,037	14,672
<i>Brachiaria brizantha</i> ..	6,586	6,608	7,616	10,864	7,168	7,773
<i>Brachiaria milliformis</i> ..	9,117	8,243	7,616	8,064	6,720	7,952

It may be noted that *P. maximum* produced almost twice the dry matter compared to the other two between which there is no worthwhile difference.

Carrying capacity:—It is found that an adult Sinhala cow could be maintained on 0.34 acres of *P. maximum* pasture while 1.10 and 1.20 acres are necessary in the case of *B. milliformis* and *B. brizantha* respectively.

Conclusion:—At the level of manuring (5.6 lbs. Sulphate of ammonia, 1.6 lbs. Saphos phosphate and 3.6 lbs. Muriate of Potash/palm/year) and type of managing, *B. milliformis* is the most suitable grass among those tested for this area. This grass has an additional advantage in its ease of establishment.

2. Experiment (P₂) Bandirippuwa Estate

Objective:—(1) To ascertain the performance of *Brachiaria milliformis* and *Paspalum commersonii* under cultivated and uncultivated conditions; and the effect of the two pastures on coconut palms.

(the *P. commersonii* was replaced with *B. milliformis* in 1959).

(2) To test the efficiency of four fertilizer placement methods on the yield of coconuts:—(a) Buried in strips; (b) Buried in circles; (c) Open in circles and (d) Open in strips.

Half of each plot is sub-soiled and each plot has four replicates of the fertilizer placements.

Manuring:—The pastures were manured with 1 cwt./acre of Sulphate of Ammonia in July and 1 cwt./acre each of Sulphate of Ammonia and Muriate of Potash in December each year—manure being applied broadcast.

Palm manuring was done in December this year, fertilizer placement being as per the treatments.

Cultivation:—Disc-harrowing was done prior to manuring. Due to delay in the advent of the monsoon sub-soiling was done in early 1963.

Sampling and grazing of pastures were done to schedule with 2 and 4 cows/plot in the 'New' *B. milliformis* (formerly *Paspalum commersonii*) and 'Old' *B. milliformis* plots respectively.

Pick:—The six picks for the year were recorded.

General:—One of the experimental cows died during the fourth quarter, due to toxemia during pregnancy.

Results:—1. Effect on nut yields

(a) *The two pastures*:—Nut yields in the *Paspalum commersonii* plots were significantly higher than in the *Brachiaria milliformis* plots.

(b) *Cultivation*:—Sub-soiling has a tendency to improve nut yields. But the benefit is felt only on the trees in the *Paspalum commersonii* plot and not in the *B. milliformis* plot.

The yield of palms is given in Table II.

TABLE II

Palm yields (mean nuts/acre) for the two pastures and the two types of cultivation

	Nuts/acre			
			<i>P. commersonii</i> <i>B. milliformis</i>	
No sub-soiling	3,275	2,594
Sub-soiling	3,633	2,582

(c) *The types of manuring*.—There has been no evidence of any response to the methods of fertilizer placement. It is submitted that the overall broadcast manuring applied to the pasture masked any effects.

2. Herbage yields

(a) *The two pastures*.—The herbage yields in *Brachiaria milliformis* were nearly 3 times that of *Paspalum commersonii*.

(b) *Cultivation*.—The effect of sub-soiling on herbage yields follows almost the same trend as on nut yields. This is shown in Table III.

TABLE III

Mean herbage yields (dry matter lbs./acre) for the two grasses and the two cultivations

	Dry matter—lbs./acre			
			<i>P. commersonii</i> <i>B. milliformis</i>	
Not sub-soiled	1,671	4,696
Sub-soiled	1,926	4,751

The beneficial effect of sub-soiling is shown more in the *Paspalum commersonii* plots.

3. Experiment (P₄) Ratmalagara Estate

Objective.—To ascertain the performance of *Brachiaria brizantha* in cultivated and uncultivated conditions; and the effect of the pasture on the yields of palms.

Experiment.—The experiment consists of two one acre plots—one half of each plot is sub-soiled. In 1959—the *Paspalum commersonii* plot was planted to *B. brizantha*—the experiment consisting of 2 replicates under *B. brizantha* since 1960.

Manuring.—Fertilizer was applied broadcast twice for the year—1 cwt./acre Sulphate of Ammonia in May/June, and 1 cwt./acre each of Sulphate of Ammonia, Saphos phosphate and Muriate of potash in Oct./Nov.

Cultivation.—The plots were disc-harrowed both ways after manure application.

Sampling and grazing of pastures have been done to schedule. Two adult cows grazed each of the plots alternatively every 28 days.

Pick.—The 6 picks for the year were recorded.

General.—The palms in both plots are showing signs of yellowing.

The pastures have been unevenly grazed—grazing being confined to certain patches, which due to repeated over-grazing have been infested with weeds.

Results.—The data were analysed by the Biometrician and a summary of the conclusions is given below:—

Effect on nut yields

- (a) *The two pastures*:—The pastures have highly depressed nut yields. The depressing effect was less so in the case of *Paspalum commersonii*.

This depressing effect of pastures on the yields of coconuts may be due to competition between the palms and the pastures—to the detriment of the former.

- (b) *Cultivations*:—Sub-soiling has a beneficial effect on nut yields.

- (c) *Interaction of (a) and (b)*:—The beneficial effect due to sub-soiling is stronger in the case of the plots which were under *Paspalum commersonii* earlier.

This same trend of the beneficial effect of sub-soiling being more pronounced in the case of *Paspalum commersonii* was observed in the experiment at Bandirippuwa Estate of (P₂). This was due to the fact that most of the *Paspalum commersonii* plants died.

2. Herbage yields (*Brachiaria brizantha*)

Sub-soiling improves herbage production as shown in Table V.

Mean herbage production (dry matter lbs./acre/year) and stocking capacity for the two types of cultivations

				Production lbs. dry matter/acre year	Stocking capacity Acreage/Animals
No sub-soiling	..	..	..	740	0.615
Sub-soiling	..	..	..	879	0.700

4. Intensity of Grazing Trial (P₆) Ratmalagara Estate

Objective:—To ascertain the intensities of grazing (i.e. the carrying capacities) of *Brachiaria brizantha* and *Paspalum commersonii*. In 1959, all *Paspalum commersonii* plots were planted to *Brachiaria brizantha*. Thus from 1960, the experiment has been continued under a stand of *Brachiaria brizantha* only (2 replicates).

Experiment:—The experiment consists of:—

Two, $\frac{1}{2}$ acre plots with weeds (Estate control).

Two, $\frac{1}{2}$ acre plots with grass (ungrazed).

Two, 1 acre plots with grass (grazed).

Two, $1\frac{1}{2}$ acre plots with grass (ungrazed).

Two, 2 acre plots with grass (grazed).

Manuring:—All plots were manured with 1 cwt./acre Sulphate of Ammonia in May/June and 1 cwt./acre each of Sulphate of Ammonia, Saphos phosphate and Muriate of potash in Oct/Nov. this year. The manure was applied broadcast.

Cultivation:—All plots were disc-harrowed both ways after manure application.

Sampling and grazing of pastures were done to schedule—two adult cows grazing each of the plots grazed, for a period of 3 months with three months of rest following—

- | | | |
|-----------------------|---|----------------|
| i.e. January to March | — | Grazing period |
| April to June | — | Resting period |
| July to September | — | Grazing period |
| October to December | — | Resting period |

Pick:—The 6 picks for the year were recorded.

General:—In this experiment too, the palms are yellowing. This has been diagnosed by the Soil Chemist as due to mal-nutrition.

Results:—The data available on effect of pasture on nut yield were analysed by the Biometrician and may be summarised as follows:—

1. Effect on nut yields

(i) All pastures depressed nut yields.

(ii) Ungrazed pastures depressed more than grazed pastures.

This is shown in Table VI.

TABLE VI

Giving average nuts/acre/year for the different treatments

	Average nuts/acre/year
Estate Control ($\frac{1}{2}$ acre)	5,541
2 acres (grazed) grass	4,619
1 $\frac{1}{2}$ acres (grazed) grass	4,496
1 acre (grazed) grass	4,547
1 $\frac{1}{2}$ acre (ungrazed) grass	4,064

The depressing effect of pastures on the nut yields of coconuts, could be attributed to competition between palms and pastures for moisture, and or soil nutrients, to the detriment of the palms. This competition is less marked in the case of the grazed pastures.

5. Rotational vs. Continuous grazing Experiment (P₀) Ratmalagara Estate

Objective:—To compare two methods of grazing (i.e. rotational and continuous) and study its effects on the yields of pastures and coconuts.

This experiment was commenced in 1960 and consists of 2 replicates—each replicate having one acre *Brachiaria brizantha* being grazed continuously while another acre of *Brachiaria brizantha* is divided into 4 $\frac{1}{2}$ acre sub-plots and grazed rotationally.

Manuring:—The experiment was manured with 1 cwt./acre Sulphate of Ammonia in May/June. and 1 cwt./acre each of Sulphate of Ammonia, Saphos phosphate and Muriate of potash in Oct./Nov., this year. Manure was applied broadcast.

Cultivation:—All plots were disc-harrowed both ways after manure application.

Grazing and sampling of pastures were done to schedule. One adult cow rotating every 2 weeks from sub-plot to sub-plot in the rotationally grazed plots, while one adult cow grazed throughout in the continuously grazed plots. All rotationally grazed sub-plots were sampled every two weeks before and after grazing while continuously grazed plots were sampled every two weeks.

Pick:—The six picks for the year were recorded.

General:—Grazing especially in the continuously grazed plots was very uneven. There was also a tendency for the animals in adjoining plots to graze the areas abutting the fence separating these plots (herd instinct). As a result, these areas were overgrazed while there was considerable feed left in the other areas.

The palms of these plots too are showing signs of yellowing.

Results:—The data available so far were analysed by the Biometrician. A summary of the conclusions is given below:—

1. Effect on nut yields

It is premature to comment on the effect on rotational and continuous systems of grazing on coconut yields. The indications are that nut yields are better in the continuously grazed plots.

2. Herbage yields

(i) Rotational grazing gives more herbage yields than continuous grazing. This is shown in Table VII.

TABLE VII

Giving mean dry weights (lbs./acre) of pasture

				Dry matter (lbs./acre)
Rotational	..	..	..	950
Continuous	..	..	..	825

(ii) The percentage of weeds seems to be higher in the rotationally grazed than the continuously grazed plots.

This is shown in Table VIII.

TABLE VIII

Giving percentage of weeds/acre

				% weeds/acre
Rotational	..	..	..	1.07
Continuous	..	..	..	0.85

6. Pasture cum manurial trial (P₇) Bandirippuwa Estate

Objective:—(1) To study the effect of two pastures on coconuts.

(2) To study the competition between coconuts and pasture for the major nutrients, N, P and K.

Experiment:—This was a 3 × 2 × 2 N.P.K. factorial experiment planted to *Brachiaria brizantha* and *Brachiaria milliformis* with Estate management as control in split plots. Each plot was approximately ½ acre in extent. A pair of calves—one male and one female grazed each of the pasture plots. They rotated from one replicated to the other, after 28 days of grazing in each,—the pair of calves from one treatment moving to the same treatment in the next replicate.

Manuring:—All plots were manured with split dosage (half total dosage) of Sulphate of Ammonia, full dosage of Muriate of potash and Saphos phosphate with the South-West monsoons in May; and the remaining split dosage (half total dosage) of Sulphate of Ammonia along with the North-East monsoons in November this year.

Kieserite manuring of palms was done in November, as a result of the palms yellowing due to Magnesium deficiency.

Cultivation:—All plots were lightly harrowed prior to manuring.

Grazing and sampling of pastures and Estate (control) plots have been done to schedule—the pastures being sampled before and after each grazing, while the Estate (control) plots were sampled one month prior to and after each manuring.

Cattle:—Due to outbreak of hoof and mouth disease among the cattle, there was temporary abatement of cattle weighing—the animals being isolated in the plots itself.

Towards the middle of the year, there was a certain amount of deterioration in the health of the herd maintained on this experiment resulting in the death of a calf due to general debility. Considerable improvement was shown towards the end of the year. Minerals have been given to these animals since the beginning of this year.

Moisture readings have been temporarily stopped due to the moisture meters being out of order.

Pick:—The six picks for the year were recorded.

Results:—(1) Nut yields

The results at this stage are very tentative and shown as % of the 1959 yields for the main treatments in Table IX.

TABLE IX

Number of nuts/plot/year as % of 1959 yields

	1959	1960	1961	1962
N ₁	100	102.5	156.3	122.9
N ₂	100	100.1	162.1	124.2
N ₄	100	85.5	181.8	145.3
P ₁	100	100.0	161.0	125.8
P ₂	100	97.4	172.2	135.5
K ₁	100	95.8	158.2	123.4
K ₂	100	101.7	174.5	137.5
E.C.	100	97.8	168.6	144.3
B.m.	100	100.9	170.7	130.4
B.b.	100	97.6	160.0	117.1

It may be noted that there is some improvement in the yields to the addition of fertilizers at all levels. The pastures, particularly *B. brizantha*, seem to have a considerable depressive effect on the yields of nuts. The main purpose of this experiment is to study the effect of the pasture at the various levels of manuring and it is hoped that within the next few years this information will emerge.

2. Yield of pastures

Considerable response to N was observed in both pastures. There was hardly any response to P and K. It is of interest to note that the yields during the May/June season were always higher than that during the Oct./Nov. season. The dry matter yields of samples taken following each manuring and prior to introduction of cattle for the years 1960 and 1962, of the main treatments are shown in Table X.

TABLE X

Dry matter yield (lbs./acre) of pastures following each manuring

Pastures	Treatments	1960		1961		1962	
		May/June	Oct./Nov.	May/June	Oct./Nov.	May/June	Oct./Nov.
<i>Brachiaria</i>	N ₁	3881	2459	3416	2139	4609	2285
	N ₂	5466	2851	4122	2475	5079	3601
	N ₄	5231	3478	4508	2879	6356	3730
<i>brizantha</i>	P ₁	4962	2979	3993	2459	5718	3489
	P ₂	4760	2879	4038	2548	4979	2918
	K ₁	4844	2929	4251	2526	5651	3187
	K ₂	4878	2929	3786	2487	5046	3220
		N ₁	4290	2386	2985	1731	4357	1350
<i>Brachiaria milliformis</i>	N ₂	5180	3136	3959	2257	6222	1893
	N ₄	5427	3786	5550	2470	7392	2744
	P ₁	5051	3007	4178	2313	5947	1854
	P ₂	4878	3187	4155	2005	6026	2145
	K ₁	4503	3091	4189	2100	6160	1787
	K ₂	5421	3097	4139	2207	5813	2201

It may also be noted that there was very little difference in the yield and response of the two pastures.

3. Carrying capacity of pastures

Only the levels of Nitrogen have any appreciable difference among the manurial treatments on the number of days the two animals could graze the pastures. These are summarised in Table XI.

TABLE XI

Mean number of days grazed in the 3 levels

	<i>B. brizantha</i>	<i>B. milliformis</i>
N ₁	24.0	22.4
N ₂	27.5	26.3
N ₄	27.8	27.4
Possible days	28.0	28.0

The possible days (28) is based on the system of grazing where the animals rotate from replicate to replicate after 28 days grazing.

7. Frequency of cutting trial (P₃) Ratmalagara Estate

Objective:—To determine the optimum time between successive cuttings from the point of view of herbage quantity and quality.

Experiment:—Consist of 5 frequencies of cutting with 2 levels of Nitrogen.

Manuring:—Was done along with the monsoon rains—the two levels of Nitrogen (1 and 2 cwt./acre Sulphate of Ammonia), being applied in two split doses in May/June and Oct./Nov. All plots were mown to a height of approximately 3 inches, before each manure application. Sampling was done as per the treatments. Namely:—

- A — no cutting
- B — cutting every 2 weeks.
- C — cutting every 4 weeks.
- D — cutting every 6 weeks.
- E — cutting every 8 weeks.

All dried samples of pastures are being preserved for chemical analysis.

Results:—The data gathered so far was analysed by the Biometrician. A summary of the conclusions is given below:—

1. Effect of higher dosage of Nitrogen

There is better production of pastures with higher dosage of nitrogen as shown in Table XII.

TABLE XII

	Pasture production (dry weight lbs./acre/year)		
	N ₁ (1 cwt./acre)	N ₂ (2 cwt./acre)	% increase
<i>Paspalum commersonii</i>	1,823	2,423	32.9
<i>Brachiaria milliformis</i>	5,601	6,686	19.4

Mean pasture production (lbs. dry matter/acre/year) with dosage of N

2. Effect of frequency of cutting

More frequent cutting gives a higher total yield as shown in Table XIII.

TABLE XIII

Dry matter (lbs./acre/year) for the different frequencies

		Pasture production (dry weight lbs./acre/year)			
		Cut once in 8 weeks	Cut once in 6 weeks	Cut once in 4 weeks	Cut once in 2 weeks
Paspalum commersonii	.. .	1,980	2,157	1,813	2,543
		100%	109%	92%	128%
Brachiaria milliformis	..	5,206	5,529	6,110	7,326
		100%	106%	117%	141%

3. Interaction of nitrogen and frequency of cutting

TABLE XIV

Dry matter (lbs./acre/year) for dosages of N and frequencies of cuttings

Nitrogen			Cut once in 8 weeks	Cut once in 6 weeks	Cut once in 4 weeks	Cut once in 2 weeks
1 cwt./acre	..	..	5,101	5,120	6,175	6,009
			100%	100%	121%	117.8%
2 cwts./acre	..	..	5,206	5,529	6,110	7,326
			102.1%	108.4%	119.8%	143.6%

At higher dosages of Nitrogen more frequent cutting gives a higher yield per acre.

At 1 cwt./acre of Nitrogen, the maximum yields are given by 4 weekly cuttings. At 2 cwts./acre of Nitrogen, 2 weekly cutting is better. In fact, at less frequent cuttings such as 8 weekly, there is not much to be gained by the extra addition of Nitrogen.

Nitrogen increases the rate of growth of pasture, thus allowing for near maximum growth within shorter periods. Thus, if sufficient time is given for maximum growth there will be hardly any difference between yields from the two pastures manured with 1 cwt./acre and 2 cwts./acre of Nitrogen.

Therefore, if any benefit is to be expected from liberal application of Nitrogen more frequent cuttings should be resorted to.

TABLE XV

B. milliformis (dry weight) lbs./acre (Smoothed value)

	Frequencies of cutting (in weeks)			
	8	6	4	2
N ₁	5,707	5,443	5,958	5,958
N ₂	5,600	5,600	6,272	7,100

8. Nitrogen vs. Type of planting trial (P₁₁) Ratmalagara Estate

Objective:—To study the effect of nitrogen manuring and type of planting on the growth, and chemical composition of *Brachiaria brizantha*.

Experiment:—Consists of:—

- (a) Types of planting—
 (i) land harrowed and hand planting.
 (ii) unharrowed and mammoty planting.
- (b) Levels of Nitrogen—
 (i) N₀ — No Nitrogen.
 (ii) N₁ — (1 cwt./acre/year).
 (iii) N₂ — (2 cwts./acre/year).

Manuring was done with the monsoon rains—the three levels of Nitrogen (Nil, 1 and 2 cwts./acre Sulphate of Ammonia) being applied in two split doses in May/June and Oct./Nov. The pastures in all plots were moved to an approximate height of 3 inches prior to manure application.

Sampling of pastures was done at fortnightly intervals as per schedule. All dried samples have been preserved for chemical analysis.

III. Cattle population and milk yield

Herd Strength

TABLE XVI

Herd strength at the beginning and end of the year

	Bulls		Cows		Heifers		Bull calves		Total	
	B/E	R/E	B/E	R/E	B/E	R/E	B/E	R/E	B/E	R/E
January	3	1	28	30	51	23	47	17	129	71
December	3	1	36	26	53	29	56	27	148	83

Herd particulars

TABLE XVII

Herd particulars for the full year

	Births		Deaths		Sales	
	B/E	R/E	B/E	R/E	B/E	R/E
Total for the year ..	35	18	5	1	15	—

Yield particulars

TABLE XVIII

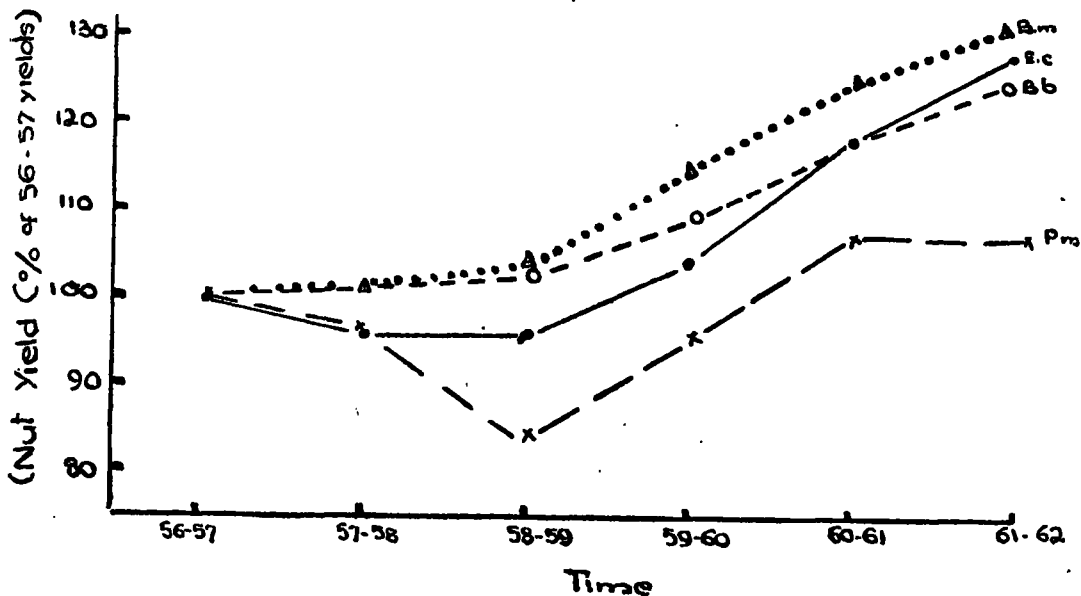
Average yield particulars for the year

Av. No. of cows in milk		Av. Yield/Cow/Month (in pints)		Av. yield/Cow/Day (in pints)	
B/E	R/E	B/E	R/E	B/E	R/E
21.36	15.34	158.0	152.80	5.19	5.00

The total milk production at Bandirippuwa Estate was 39,743 pints and at Ratmalagara Estate was 27,743 pints.

Milk Distribution

The milk at both stations was supplied to the staff. The surplus milk at Bandirippuwa Estate was sold to the National Milk Board—while at Ratmalagara Estate it was turned into Ghee. The price of Ghee was increased from Rs. 4/- to Rs. 6/- per bottle from the middle of September this year,



Animal Health

Animal health has been fairly satisfactory. Common ailments like rumen impaction, tympanitis, mastitis and lameness were prevalent.

At Bandirippuwa Estate there was an outbreak of Foot and Mouth disease. This is believed to have been brought into the Estate by stray cattle. Stray cattle continue to be a problem at Bandirippuwa Estate, inspite of the cattle grid installed at the gate.

There were 6 deaths in the herd of which only one was at Ratmalagara Estate. Of these six, only one was a cow which died of toxemia due to the death of an 8 week old foetus in the womb. The other five were calves, which died of acute scours; tympanitis, general debility; or of having been born deformed.

The herd was inoculated against H.S. They were wormed regularly.

Scindhi Cross Breeding Programme

This programme has been carried out at Ratmalagara Estate and on a smaller scale at Bandirippuwa Estate—where the heifers, of the Pasture cum Manurial trial, reaching maturity have been crossed to Scindhi.

General

The water supplies to the cattle at Ratmalagara Estate, both at the dairy and in the field, in experimental plots, continue to be inadequate and of very low quality.

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Edited and re-submitted by
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REPORT OF THE OFFICER - IN - CHARGE, CROP PROTECTION.

INTRODUCTION

There were two notable pest problems that demanded special attention during the year under review. One was the Coconut Scale pest out-breaks and the other, the premature decline of palms following a leaf scorch. Though less attention was drawn by the Red Weevil pest, there is enough evidence on record, to consider this pest a major menace, having caused much damage to young plantations.

Several trials that were initiated to gather fundamental information on important pests and diseases had to be abandoned for want of personnel in the staff.

By way of crop protection service, much time was spent on the control of the Coconut Scale pest whose infestations increased over the previous year. A control programme was worked out and simultaneously observations were taken on the bionomics of the pest with a view to introduce an exotic predator.

(1) The bionomics and control of the Red Weevil pest

From field data collected, it was observed that the Red Weevil pest, which is the most destructive of all the pests of coconut in this country, has continued to increase for three main factors, viz. (i) the increase in the number of young plantations (ii) neglect in the practice of phytosanitation (iii) ineffective preventive treatment.

The practice of phytosanitation was recommended as the most effective method of keeping the pest under control. Where there is negligence, it appears that the effective enforcement of the Pest Control Ordinance, whereby offenders are prosecuted, should now prove to be beneficial.

In the course of carrying out control programmes, it has been felt that a study of the ecology and bionomics of this pest, in as much detail as possible, should yield valuable data that could help in working out practical control methods. The pest populations are tending to increase, but its limited potentialities and the ecological conditions now prevailing permit a chequered spread whilst on the increase. However, there should be no surprise, with the lack of attention as stated above, if this pest becomes a greater menace in the future.

In spite of the warnings and advice for the exercise of adequate attention, there appears to be insufficient co-operation forthcoming, specially from the owners and caretakers of small plantations.

(2) The Coconut Caterpillar and its control

The biological control project was in progress under the directions of the Colombo Plan Entomologist.

The Colombo Plan Entomologist has made a separate report on this work.

(3) The Coconut Scale pest and its control

The Coconut Scale pest out-breaks that began to rise since 1960, continued to increase during the year under review. The insecticide, Kerosene oil emulsion was successfully used in its control. A spraying campaign was put into operation. The off-season rains interrupted the spraying work.

(4) Bud Rot and its control

The problem of Bud Rot control remains unsolved for two formidable obstacles. One is the difficulty of detection before fatality and the other is the prohibitive costs in applying preventive treatments now known.

It has been observed that the disease could develop within the plant to a fatal extent without showing out readily noticeable external symptoms. In such a case, a curative treatment is obviously not possible after detection is done. Since the disease appears sporadically, all palms in the plantation has to be protected. Hence a preventive treatment, in such a coverage, should necessarily cost much and invariably, under present conditions, could be more than the actual loss from the disease.

At present, under general estate management, the only means of control remains to be the burning of every affected palm no sooner than the detection is made, thus eliminating a possible source of infection.

(5) The "Leaf Scorch Decline" of palms in the Galle District

The Plant Pathologist of the Department of Agriculture, Peradeniya, visited the affected area for an inspection and took samples for laboratory examination. A report was received later, out-lining a programme for an investigation.

Arrangements were made to construct an insect proof cage, for the purpose of conducting transmission trials.

(6) Other pests, diseases and weeds

Leaf blight	— was controlled by fertilizer application.
Locusts	— recommended spraying, Aldrin.
Stem bleeding	— recommended removal of dead tissues and application Bordeaux paste.
Black beetle	— recommended Estate Sanitation.
Rats	— recommended tree banding with a metal sheet and rat poisons.
<i>Eupatorium odoratum</i> (Weed)	— suggested spraying of an ester formulation of 2, 4, 5T. (weedicide).

(7) Staff

Mr. W.L.B. Silva was recruited as an Attendant. Mr. D.J. Senarath resigned from the post of Lab/Field Attendant.

A review of the position of all important pests and diseases and their control was made at the end of the year.

J.K.F. KIRTHISINGHE,
Officer-in-Charge, Crop Protection Division.

REPORT OF THE BIOMETRICIAN

During the year, apart from the usual routine statistical work for the Research Divisions, the designing of experiments and offering advice to Research Officers in the statistical interpretation of experimental data, this division initiated a series of biometrical studies pertinent to coconut research. This is a field which has not received much serious attention in most Crop Research Institutes, in this part of the world.

Problems such as the best quantitative expression of certain characters used in the analysis of research problems; or the statistical distribution of such characters i.e. whether they are or are not distributed 'normally' and how they are to be transformed; or problems such as measures of pest situation in a plantation; or certain special features such as bienniality which make interpretation of data difficult and how best to circumvent such difficulties; or the efficiency of alternative calibrating variates etc. In fact there are a host of such problems that have to be clarified in an objective manner if the best is to be derived from statistical methods which most of us now use in a purely matter of fact way, sometimes conscious and sometimes unconscious of certain assumptions implied in these methods. It is the intention of this division to tackle some of these problems and pass on such information to Research Officers, who have to analyse some of their data by themselves. This we feel, is a vital function of a division of Biometrics devoted to any Crop Research Institute, because each plant species has its own biometrical problems.

The following is a summary of the work done during the year.

1. Statistical Work

The more important investigations carried out for the Research Officers are as follows:—

(a) *Director*:—On a directive from the Director, a complete analysis was carried out of all the pasture experiments conducted by the division of Agrostology from its inception in 1956. The report was submitted in two parts viz. (i) a report on the findings of "Pasture under coconut" experiments, (ii) a report (under confidential cover) incorporating certain recommendations maintenance of records and also the conduct of the experiments etc.

(b) *Botanist*:—Work on selection indices for coconut, genetic variability and percentage outcrossing were carried out. The formulae used for the estimation of genetic variability and percentage outcrossing (same as used in Paddy at the National Institute of Genetics Japan) were critically examined by us from the point of view of their applicability on coconut and our comments thereon were conveyed to the Botanist.

(c) *Soil Chemist*:—A complete analysis was carried out of the ten years' data of the fertilizer cum cover crop experiment at Letchemy Estate.

2. Biometrical Studies

(1) An investigation into the universal applicability of four mathematical models used in fitting curves to univariate fertilizer responses.

The models compared were:—

(a) Mitscherlich's Model

$$y = A - be^{-ax}$$

(b) Cobb-Douglas' model

$$y = a + \beta x^\alpha$$

(c) Quadratic Model

$$y = a + bx - cx^2$$

(d) Square root model

$$y = a - bx + \frac{c}{\sqrt{x}}$$

y is the expected yield; A is the maximum yield under ideal fertilizer conditions to be estimated from the data; a , b , c in the quadratic and square root models, b , r , a of the Mitscherlich's model and α and β of the Cobb-Douglas' model are parameters to be estimated by the method of least squares; a in the Cobb-Douglas' model is the average yield at zero level of fertilizer; e stands for epsilon = 2.71828.

These models were compared on the basis of Mathematical considerations through three accepted econometric criteria applicable to production functions viz. (a) the total product (b) the marginal product and (c) the rate of the marginal product. These were also compared on the basis of results of application on data of 19 nutrient response experiments conducted in a phytosolarium by the Division of Agrostology—the index of the goodness of fit being the coefficient of determination.

From the point of view of the best fit, the following table gives the number of experiments in which each of the four models occupied the first and second places.

Order of best fit	No. of experiments in which the first and second places were taken by			
	Mitscherlich's	Cobb-Douglas'	Quadratic	Sq. Root
First	1	1	4	13
Second	3	4	8	4

Both on the basis of mathematical considerations and on the basis of results of application on experimental data, it is noted that (a) the polynomial models (i.e. quadratic and square root) are more generally applicable (b) among the polynomial models, the square root model is the more adaptable and (c) there are situations in which any one of the four models may be better.

Taking these facts into consideration, if one is confronted with the question of deciding on a universally applicable or a standard model for fitting curves to fertilizer responses showing diminishing returns, it would be reasonable to suggest that the square root model is the most acceptable.

(2) Genetic and environmental components of the between palm variation in coconut yields.

The analysis of the 300—palm block yield data to determine the genetic and environmental components based on Fairfield Smith's Law is being continued.

(3) Studies on Biennial Bearing Tendency in Coconut.

A quantitative assessment of bienniality in coconut yields was made using the method adopted for horticultural crops at East Malling Research Station (Hoblyn et al 1936). However, due to the fact that coconut is a perennial bearer, with its crops fluctuations controlled to an appreciable extent by the weather, we felt that the detection of bienniality in coconut yields, calls for some modified methods. Accordingly we devised two alternative methods and these and the results of their applications are embodied in a paper now with the Editor, Ceylon Coconut Quarterly to be published shortly.

All the three methods employed indicate that the biennial rhythm is a significant feature in coconut. But the intensity of biennial fluctuations is pretty low and therefore should cause the least concern in commercial circles.

However its importance to Research workers from the biometrical angle has to be examined. A further study was therefore commenced with the view to determine the minimum plot size which will ensure the near elimination of problems of interpretations arising as a result of bienniality.

This work is now proceeding.

3. Agri Meteorology

(a) Meteorological Stations

The meteorological station at Bandirippuwa Estate, Ratmalagara Estate and the Isolated Seed Garden were maintained satisfactorially.

(b) Due to pressure of work in our substantive field of activity namely Biometrics—hardly any time could be devoted to Agri-Meteorological studies. With the present staff available, we have no alternative but to adopt a step-motherly attitude on this field.

Rainfall 1962 and Crop Prospects 1963

Rainfall

The rainfall in five stations representative of the important coconut growing areas is given below:—

STATION	TOTAL RAINFALL			EFFECTIVE RAINFALL			DISTRIBUTION INDICES		
	1962	1961	Av. 53-61	1962	1961	Av. 53-61	1962	1961	Av. 53-61
Lunuwila (B/E) ..	78.4	84.0	79.5	67.9	83.9	75.5	1.84	2.32	1.82
Madampe (R/E) ..	53.3	64.2	65.8	51.4	64.2	63.9	2.70	2.90	2.82
Chilaw ..	55.0	58.8	62.8	49.6	58.8	59.6	1.30	2.64	1.75
Puttalam ..	56.7	46.3	46.8	56.7	46.3	44.4	1.96	3.48	2.48
Kurunegala ..	82.0	84.2	86.2	71.9	84.2	79.8	1.47	1.96	1.50
							1.98	3.08	2.16
							1.48	1.85	1.23
							1.74	2.47	1.56
							1.99	2.74	1.92
							3.09	3.74	2.80

Crop Prospects

In most coconut growing areas except Puttalam, the total rainfall during 1962 was lower than in 1961, as well as the average from 1953-1961. A drop of over ten inches was recorded in the Madampe (R/E) Station.

The effective rainfall too followed more or less the same pattern.

The distribution of rainfall in all these areas had been rather poor and not so favourable as in 1961. In Lunuwila and Kurunegala areas it had been somewhat similar to the average for the last 9 years. In Puttalam area the distribution had been better than the average, although it is not so good as in 1961.

Therefore in all these areas, coconut crops are likely to decline—Chilaw and Madampe areas being affected most. The crops in the Puttalam area might be just average, although it may not be better than last year.

4. Production and Exports

(a) Production

The estimated production of coconut in Ceylon for the year 1962 is 2,993 million nuts—the highest ever recorded. This production is 7.0% higher than in 1961, 23.9% higher than last 5 years' average and 7.0% higher than the earlier peak production recorded in 1961.

(b) Exports

(i) Quantity:—Total Quantity of major coconut products exported (in nut equivalent) in 1962 is 1,537 million nuts—this being 11.9% higher than 1961, 43.9% higher than the last 5 years' average and 0.3% lower than the previous record exports registered in 1955.

(ii) Value:—The average value of exports in 1962 is Rs. 148.69 per 1,000 nuts—this being 0.2% higher than in 1961, 16.8% lower than the last 5 years' average and 42.4% lower than the previous record in 1951.

5. Publications

Published during 1962

- (1) "The raingauge and estate management" by V. Abeywardena (Ceylon Coconut Planters' Review).
- (2) "Some noteworthy features of the 'Initial Flowering Pattern' in a Coconut Plantation" by V. Abeywardena (Ceylon Coconut Quarterly).

In Press

- (1) "A Comparison of some popular mathematical models used for the determination of the physical production function in respect of univariate fertilizer responses" By V. Abeywardena (Tropical Agriculturist).
- (2) "Production and Exports of Coconuts in Ceylon" By J.K.T. Fernando (Ceylon Coconut Planters' Review).

Submitted for Publication

- (1) "Statistical Control of Variability in Coconut Experiments" By V. Abeywardena (With Editor Emp. J. of Expt. Agric.).
- (2) "Some suggestions for minimizing errors for mishaps in field experiments with perennials" By V. Abeywardena (With Editor, Ceylon Coconut Quarterly).
- (3) "Studies on Biennial Bearing Tendency in Coconut".
 1. "The measurement of bienniality in coconut" By V. Abeywardena (With Editor, Ceylon Coconut Quarterly).

6. Research Conferences

The Biometrician led a discussion on "Some problems in the interpretation of experimental data in respect of young coconut palms", at the Research Conference held on 19th February, at the Coconut Research Institute.

7. Honorary Work

The Soil Chemist and the newly recruited Statistician of the Rubber Research Institute of Ceylon, continued to consult the Biometrician in their biometrical problems.

8. Personnel

The Research Assistant (Statistics) who was directly responsible to the Director since his appointment (1959), was transferred to this Division as from March 1962.

Mr. P.G.F. Fernando, Field Attendant, left this Division on his appointment as Clerk/Typist in the Administration. His vacancy was filled by Mr. A.M. Chandrasena.

The cadre now stands as follows:—

Biometrician	— 1
Research Asst. (Statistics)	— 1
Field Asst.	— 1
Field Attendants	— 3

V. ABEYWARDENA,
Biometrician, Coconut Research Institute.

REPORT OF THE SOIL SURVEY UNIT

This year, in addition to greater emphasis on aerial survey, the approach was decidedly mineralogical, with a bias towards field geology.

A. Melsirippura-Beligama Soil Survey

This area was in the Nalanda one inch sheet on flight lines A 30/A 31, and photonumbers 91, 92, 25, 26.

Climate and Vegetation

Average annual precipitation was 3 inches. The forest vegetation was represented by tall trees such as Weera, Mara and Pallu.

Geomorphology

The landform was that of a ridge-valley pattern, the drainage of the Kimbulwana-Oya and its tributaries being incised through the valleys.

In addition to the quartzite ridges having a North-South parallel strike, there were hills of higher elevation with outcrops of rounded boulders.

Geology

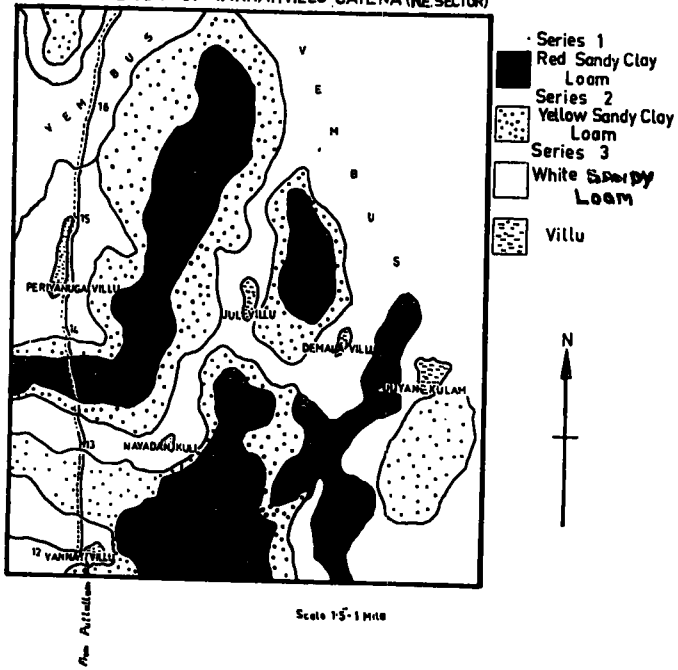
The rocks in the area belonged to the Khondalite Series, which are metamorphosed metasediments of Archaean Age.

- (a) Quartzite on the quartzite ridges.
- (b) Ultra-basic charnokites in deep wells and boulder outcrops on higher elevations.
- (c) Biotite charnokite gneissies in the plains, as at Lenawa.
- (d) Garnet granulites on the high hills round Beligama.

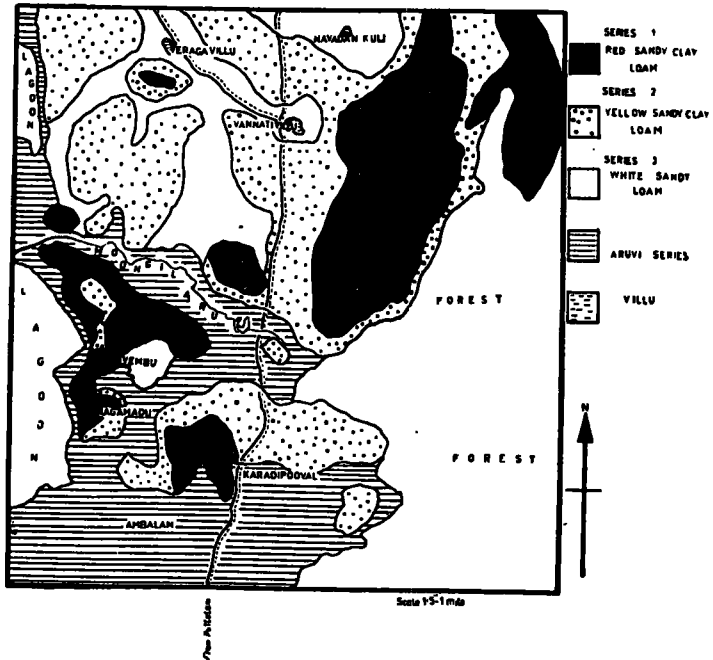
Mineralogy and Pedology

- (a) It was demonstrated by comparing the heavy mineral suite in the rocks, decomposing rock and mature solum that the latter was derived from basic charnokites. The abundance of ferromagnesium minerals in the solum like hypsthene and hornblende support this view. Therefore soils in the hill top are residual.
- (b) The red colour of the soils of the ridges and hill top is due to the presence of hematite, and the yellow colour of the soils of the pediment and alluvial plain is due to the hydration of iron compounds, forming goethite and hydrogoethite.
- (c) There was an abundance of epidote in the soils of the pediment and alluvial association, and an advanced degree of weathering in all the ferromagnesium minerals. It could be deduced that these soils are sedimentary and transported from the hill top.

SOIL MAP OF VANNATIVILLU CATENA (NE SECTOR)



SOIL MAP OF VANNATIVILLU CATENA (SW Sector)



Fertility Assessment

There was a great abundance of biotite mica in the decomposing rock, and also as sub-soil deposits. It is noteworthy that none of the palms in this area demonstrated magnesium deficiency.

Abundance of feldspars, especially of the orthoclase variety may have contributed to the fertility by increase of potash content.

Soil Classification

Three soil series were developed on a catenary sequence on the hill front, pediment, and alluvial plain.

Series I (Hill Front):—Soil here is dry, shallow and gravelly, the stoneline being struck at 1-3½ ft. The intensely leached soil has a low pH below 6, while correspondingly the T.E.B. was low 2.3 m.e. % C.E.C. 5-10% of B horizon. Base saturation 40% organic matter 3.2% of A horizon.

Following is the profile description.

0-8" 2.5 YR 4/6, coarse sandy clay loam sticky, plastic, roots fair, horizon change diffuse to

8"-35" 5 YR 4/8, coarse sandy loam, slightly sticky and plastic, passing into laterite, impregnated with quartz.

Land Use

The extent of this area was limited c.f. soil map. Palms were fairly stunted, and nuts small.

Series II (Pediment):—This series was on the pediment of the catena, a reddish brown, deep sandy clay loam mean water table 18 ft. pH 6-7, exchangeable base status. 4.3 m.e. % cation exchange capacity 10-12% of B horizon, percentage of organic matter 6-7% of A horizon. Base saturation 36%.

Profile description—

8"-24" 5 YR 5/4, sandy clay loam, moist, fine crumb structure, very sticky and plastic, horizon change gradually to

24"-60" 2.5 YR 4/6, coarse sandy clay loam moist, very sticky and plastic, coarse due to abundance of quartz.

The best coconut estates such as Melgreen, Walpolayaya, Ragedera and Beligama were on this series. There were also thriving forest plantations of Mahogany, Jak and Milla at Diyatura and Omoragolla.

Series III A and III B:—These are soils of an alluvial association as was demonstrated by mineralogical studies of the sediments Series III A consist of yellowish brown soils of coarse texture, pH 6.8-7, C.E.C. 12-20 of B horizon, organic matter 2.3% of A horizon.

Profile description

0-17" 10 YR 4/2, sandy loam, slightly sticky and plastic, roots goods, moist, horizon change distinct to

17"-28" 10 YR 6/3, sandy clay loam, very sticky and plastic roots good, kaolin present Manganese concretions.

Soil Survey of Vanativillu

This area is in the Kalpitiya one inch about 14 miles north of Puttalam.

The project was commenced with a survey of 9 square miles of jungle, as standard of comparison for soils in the cleared areas, the survey of which is proceeding.

Geomorphology

The land form was a rolling mantle plain, the highest elevation being about 170 ft. above sea level. On the lowest points of the plain were the villus (about 120 ft. above sea level). To the north and east of the area surveyed were the vembus, which contained highly eroded gullies draining into the basin of the Kalaoya.

Geology

The beds of Miocene limestone were overlaid by Pleistocene sediments of ferruginous gravels and red earth from which the present solum has developed. The mineralogical and hydrological studies of this area is being continued.

Vegetation

Three patterns of vegetation emerged in a study of the jungle area, as revealed by photo-interpretation and checked by ground observations.

- (a) Tall trees dominant.
- (b) Tall trees scattered amidst scrub.
- (c) Scrub, and a few scattered trees.

The tall trees were mainly Ebony, Tammana, Palu and Weera.

Soil Classification

The soil series were in a catenary sequence, the deep (I) red sandy clay loam being formed on elevation of 132' upwards while on the intermediate levels were the (II) yellowish red sandy clay loam, while on the levels of the villus were the (III) white sandy loams.

That the three series differed in fertility was demonstrated by the following correlation of soil types to vegetation in the jungle area.

Series I:—Red sandy clay loam gave rise to type (a) tall trees dominant.

Series II:—Yellowish red sandy clay loam gave rise to (b) mixed tall trees and scrub, while

Series III:—gave rise to pattern (c) few scattered trees amidst scrub.

The following are the profile descriptions. Series I (Red Loams) land gently sloping about 2%.
Root distribution—good (surface and sub-soil) Run off—medium. Internal drainage—good.

0-20 ft. Sandy clay loam. 75 YR 7/4 plastic, sticky, friable moist.

20-42 ft. Clayey gravel, gravel yellowish red, in matrix of kaolin.

Below 42 ft. Kaolin increases, white quartzitic gravel, water at 36 ft.

Series II:—Yellowish red sandy clay loam.

Details same as for Series I, except for the following:— 0-9 ft. 10 YR 6/3.

9-27 ft. Clayey gravel and kaolin—water at 27 ft.

Below 27 ft. quartzitic gravel.

Series III:—Internal drainage rapid; permeability—moderate.

0-60 inches Sandy loam, sand increases with depth. Slightly sticky and plastic. 10 YR 6/3; water at 25'-27'.

K.S.O. PERERA,
Officer-in-Charge, Soil Survey Unit.

REPORT OF THE PLANTING OFFICER

Nurseries

Seednuts:—2,257,866 seednuts were planted in the nurseries during the year.

The distribution of seednuts in nurseries is as follows:

SEEDNUTS PLANTED IN 1962 FOR ISSUE OF SEEDLINGS IN

	<i>May/June '62</i>	<i>Oct./Nov. '62</i>	<i>Total</i>
1. Ratmalagara Nursery	140,928	175,972	316,900
2. Eraminigolla Nursery	35,000	—	35,000
3. Karawaddana Nursery	103,450	208,034	311,484
4. Walpita Nursery	95,817	78,055	173,872
5. Hettipola Nursery	25,000	35,000	60,000
6. Handapangala Nursery	—	103,425	103,425
7. Mylambavelly Nursery	—	75,975	75,975
8. Kalawewa Nursery	—	75,165	75,165
9. Wilpotha Nursery	96,939	175,000	271,939
10. Kilinochchi Nursery	—	93,651	93,651
11. Alampil Nursery	—	100,005	100,005
12. Koggala Nursery	55,000	32,000	87,000
	<u>552,134</u>	<u>1,152,282</u>	<u>1,704,416</u>
13. Medamulana Nursery (Citronella Subsidy Scheme)	125,000	305,500	430,500
14. Mapalana Nursery (Citronella Subsidy Scheme)	122,950	—	122,950
	<u>800,084</u>	<u>1,457,782</u>	<u>2,257,866</u>

Seedlings

Orders for 1,020,900 seedlings were booked for both planting seasons, i.e. May/June and Oct./Nov. 1962. Distribution of seedlings from the nurseries is as follows:—

<i>Name of Nursery</i>	<i>Total No. of seedlings booked for May/June</i>	<i>Total No. of seedlings booked for Oct./Nov.</i>	<i>Total No. of seedlings booked for both seasons</i>
1. Ratmalagara Nursery	38,822	114,440	153,262
2. Hettipola Nursery	16,440	15,555	31,995
3. Wilpotha Nursery	44,290	137,242	181,532
4. Carmel Nursery	28,881	140,000	168,881
5. Walpita Nursery	42,940	68,603	111,543
6. Eraminigolla Nursery	10,125	22,080	32,205
7. Koggala Nursery	15,791	19,633	35,424
8. Medamulana Nursery	1,700	8,125	9,825
9. Kilinochchi Nursery	—	57,105	57,105
10. Alampil Nursery	—	70,780	70,780
11. Kalawewa nursery	—	49,605	49,605
12. Mylambavelly Nursery	—	46,574	46,574
13. Handapangala Nursery	—	72,169	72,169
	<u>198,989</u>	<u>821,911</u>	<u>1,020,900</u>

2. Inspections

The nurseries were inspected by Planting Officer, Assistant Planting Officer and Senior Field Assistant as follows:—

<i>Nurseries</i>	<i>No. of visits for the year</i>		
	<i>P.O.</i>	<i>A.P.O.</i>	<i>S.F.A.</i>
Ratmalagara—Hettipola and Wilpotha ..	5	2	7
Carmel—Kalawewa and Batticaloa ..	4	4	4
Kilinochchi and Alampil	5	4	3
Southern Province	3	3	5
Walpita and Eraminigolla	5	1	10

P.D.L. FERNANDO,
Planting Officer.

REPORT OF THE CHIEF ADVISORY OFFICER

Coconut growers, who sought or needed guidance on improved methods of coconut cultivation, control of pests and diseases and other related problems have been given advice, and where necessary, demonstrations free of cost. Those persons who applied to purchase seedlings, and who needed demonstrations have been shown how lining and planting of coconuts should be done. Newly planted lands have also been visited by the field staff for advice on after-care of seedlings. This assistance has been made available through the Advisory Field Officers stationed in various parts of the coconut growing districts. In carrying out this work, the field staff have visited a number of coconut lands, particularly small-holdings.

Besides the above work, the field staff have carried out inspections of lands for which fertilizer had been purchased, through Co-operative Societies, under the Fertilizer Subsidy Scheme. The field staff have also carried out inspection of lands for payment of annual cash subsidy to applicants under the subsidy scheme for planting coconut in Citronella lands, in the Southern Province. As a result of such additional work, the field staff have not been able to devote their full time attention to advisory work in their ranges.

Replanting of Pallai, Mundel and Koggala Demonstration Centres has been completed this year. At Alampil, a new plantation of $4\frac{1}{2}$ acres was established. The others at Hettipola and Ratmalagara continued to be maintained.

The work done during this year included the following:

1. GENERAL ADVISORY VISITS TO SMALL HOLDINGS AND ESTATES

A. Small Holdings

1. No. of holdings visited for general advisory work	4429
2. No. of holdings visited for soil conservation work	191
3. Extent of drains traced	3225 chains
4. No. of holdings visited to advice on draining low lying lands	50
5. Extent of drains pegged	402 chains

B. Large Holdings

1. No. of holdings visited for general advisory work	927
2. No. of holdings visited for soil conservation work	64
3. Extent of drains traced	1868 chains
4. No. of holdings visited to advice on draining low lying lands	15
5. Extent of drains pegged in these lands	337 chains

2. INSPECTIONS UNDER THE FERTILIZER SUBSIDY SCHEME

a. No. of small holdings visited	652
b. No. of manure application forms distributed to small holders	699
c. No. of manure application forms distributed to large holders	112

3. PESTS AND DISEASES

Unlike in previous years, increasing outbreaks of Red Weevil infestations have been reported on new and underplanted areas and more commonly in Highland Colonization Schemes. The field staff have visited 1,118 holdings, on receipt of complaints, to advise on Red Weevil control.

A preliminary survey of Red Weevil infestation in a majority of the land schemes in the Kurunegala District has been carried out by the field officers of the area. Following an outbreak of Red Weevil in Katupotha Colony, in Chilaw District, an intensive campaign on estate sanitation and palm injection for prevention and control of this pest has been carried out by the field officers at Mundel and Madampe. This work has been done with the assistance and material provided by the Land Commissioner's Department. The work has been subsequently handed over to the Colonization Officer and his staff in charge of the Scheme, after they had been trained by our field officers on the technique of Red Weevil control.

The field staff have also visited more lands than in the previous year to advise on the control of coconut caterpillar and coconut scale. In the case of the latter, the field officers have carried out spraying of palms with power sprayers handed to them by the Crop Protection Division.

Number of holdings visited for advice on the following pests and diseases.

	<i>Small Holdings</i>	<i>Large Holdings</i>
a. Termites	592	178
b. Black Beetle	702	339
c. Red Weevil	855	263
d. Caterpillar	110	138
e. Grey Blight	94	34
f. Scale insect	102	40
g. Other pests and diseases	111	35

4. PRE-PLANTING AND FOLLOW-UP SERVICE

The following is a summary of work done under the above.

A. Pre-Planting

1. *Small Holdings*

a. No. of holdings lined for planting	305
b. Extent lined for planting	405 acres
c. No. of holdings visited for soil conservation work	18
d. Extent of drains traced for soil conservation work	367 chains
e. No. of holdings visited to advice on draining low lying lands	11
f. Extent of drains pegged in these lands	76 chains

2. *Large Holdings*

a. No. of holdings lined for planting	118
b. Extent lined for planting	167 acres
c. No. of holdings visited for soil conservation work	3
d. Extent of drains traced for soil conservation work	150 chains

B. Follow-Up

1. *Small Holdings*

a. No. of visits for follow-up work	1173
b. No. of holdings visited for soil conservation work	11
c. Extent of soil conservation drains traced	59 chains
d. No. of holdings visited for advice on draining low lying lands	4
e. Extent of drains pegged in these lands	12 chains

2. Large Holdings

a. No. of visits for follow-up work	585
b. No. of holdings visited for soil conservation work	5
c. Extent of soil conservation drains traced	32 chains
d. No. of holdings visited for advice on draining low lying lands	2
e. Extent of drains pegged in these lands	7 chains

5. MEETINGS AND TALKS

a. No. of meetings attended by the field staff	99
b. No. of talks delivered by the field staff	70

6. DEMONSTRATION CENTRES

Pallai

Sixteen acres of land have been replanted. Of this extent 10 acres have been planted on the square system and 6 acres on the triangular system. The adult palms and seedlings have been manured with C.R.I. mixture C. The manuring of Block A which had hitherto been done by tethering cattle had to be stopped owing to the difficulty of obtaining cattle for the purpose. Manuring of this block has subsequently been done with C.R.I. "C" fertilizer mixture. The thick weed growth in the block has been ploughed and incorporated into the soil. "Atlas Tree Killer" has been continued to be used, as a trial, on palms that have been marked for removal. So far 31 such palms have died as a result.

Mundel

One and a quarter acres of land have been replanted on the triangular system with artificially pollinated Tall × Tall seedlings. The adult palms and seedlings have been manured with C.R.I. mixture C. Illuk has been uprooted and the block sown with seeds of *Centrosema pubescens* and *Calapogonium muconoides*.

Alampil

Four and a half acres of jungle land have been opened out and planted on the triangular system, besides the already planted area. The coconut seedlings that had previously been planted have been manured with C.R.I. mixture A.

Ash pumpkins and Red Pumpkins have been harvested from seed that had been sown the previous year. The crop would have been better if not for the damage caused to the fruits by monkeys.

Koggala

Replanting of blocks A, B, D, E, F and G had been completed. Two major problems on the land are water logging and heavy weed growth. Owing to the situation of the land, draining is difficult. Yet every effort had been made to drain out the excess water on the land in the best possible manner. *Centrosema pubescens* and *Calapogonium muconoides* have been planted with a view to controlling weed growth. Unfortunately, owing to serious infestation of *Kalutera* snails, which eat up the shoots, it had not been possible to establish the cover satisfactorily. Chemical baits are now being used against the pest. Manuring of adult palms and seedlings have been done with C.R.I. mixture C.

Hettipola and Ratmalagara

Manuring of palms has been done with C.R.I. mixtures in both demonstration blocks. At Ratmalagara cutting of contour drains and burying of coconut husks in pits have been done.

STAFF

Appointments and Resignations

Mr. T. Ganarajah who was Advisory Field Officer was appointed District Coconut Instructor in June.

Mr. J.B. Galagedera who was Advisory Field Officer temporary was appointed to the permanent cadre in January.

Mr. J. Weragama who took up duties as Advisory Field Officer in January, resigned his post in May.

Transfers of Advisory Field Officers

Mr. E.N. Ratnam was transferred to Mullativu in April.
Mr. S.B. Karunaratne was transferred to Hettipola in August.
Mr. J.G. de Silva was transferred to Ibbagamuwa in August.

Messrs. R.W. Senaratne, District Coconut Instructor and H.H. Samarakoon, Advisory Field Officer continued to work in the F.A.O. Pilot Coconut Survey under the Department of Census and Statistics.

Ten Advisory Field Officers were sent to the Southern Province for periods ranging from 2-4 months, for work in connection with the Citronella Subsidy Scheme.

SECTION II SUBSIDY SCHEME FOR PLANTING COCONUT IN CITRONELLA LANDS IN THE SOUTHERN PROVINCE

Work in regard to the above continued to be carried out during the year.
A summary of the work done is given below:

1. *May/June, 1962 Planting Season*

(a) No. of applicants to whom seedlings, fertilizer and "Aldrex 2" were issued	2208
(b) No. of seedlings issued	156596
(c) Acreage covered	2090 Acres 1 Rood 01½ Perches
(d) Quantity of fertilizer issued	52 Tons 4 Cwts. 70 lbs.
(e) Quantity of "Aldrex 2" issued	12535½ ozs.

2. *October/November, 1962 Planting Season*

(a) No. of applicants to whom seedlings, fertilizer, and "Aldrex 2" were issued	2500
(b) No. of seedlings issued	280832
(c) Acreage covered	3761 Acres 3 Roods 28 Perches
(d) Quantity of fertilizer issued	93 Tons 14 Cwts. 10 lbs.
(e) Quantity of "Aldrex 2" issued	22488 ozs.

Cash Subsidy

Lands for which seedlings and fertilizer have already been issued have been inspected by the field staff in order to determine the number of seedlings that have been planted for the purpose of paying the cash subsidy. In doing so, a first inspection is done for the payment of the first subsidy. Thereafter, the applicants are called upon to declare annually correct number of seedlings maintained by them on the land. Such declarations are test checked by the field staff before payments of the annual cash subsidy due to land owners are recommended; the payment being made by the Commissioner of Coconut Rehabilitation.

STAFF

Appointments and Resignations

Messrs. E.N. Ratnam and S. Jayanetti were appointed Advisory Field Officers in January and April respectively.

Messrs. G.D. Abeywardena, K.A. Ariyadasa and Miss P.C.S. de Silva were appointed Clerk/Typists in February.

Mr. H.B. Senarath who was appointed Advisory Field Officer resigned his post in March.

Transfers of Field Attendants

Mr. M.M.A. Abeyratne was transferred to Head Office in February.

Messrs. A. Randeniya, P.A. Hemapala, W.W.R. Fernando and C. Gunasekera were transferred to Head Office in July.

Messrs. K.B. Samarakkody, R.M. Peiris Singho, M.A.S. Perera and K.N.L.P. Seneviratne continued to work in the F.A.O. Pilot Coconut Survey under the Department of Census and Statistics.

C.A. WICKRAMASURIYA,
Chief Advisory Officer.

REPORT OF THE WELFARE OFFICER

	<i>Senior</i>	<i>Intermediate</i>	<i>Assistant</i>	<i>Minor</i>
The Staff position is as follows:—				
At the end of 1961	8	6	114	108
New appointments in 1962	—	—	17	7
	8	6	131	115
Resignations and Terminations	—	—	7	4
Position as at 31.12.1962	8	6	124	111

The cadre of the Staff at the end of 1962 was 249 as compared with 237 last year. This included the Colombo Plan Entomologist—whose term of service was extended for another one year during this period. 7 employees of the labour force were appointed to the Minor Staff Grade including a watcher who has completed 15 years of service in the Institute. 5 employees of the Minor Staff Grade were appointed to the Assistant Staff Grade II as Clerk/Typists and Field Assistants respectively and 3 other Minor Staff employees were promoted to the Selection Grade. 1 Advisory Field Officer and 2 Technical Assistants were promoted to the Assistant Staff Grade I during this period. Thus 15 out of the 24 new appointments made in 1962 have been selected from internal applicants and this should make the staff more persevering and enthusiastic in their work and nevertheless increase from strength to strength the loyalty to the Board. Study leave facilities with full pay and a Scheme of promotion to the Technical Assistants on completion of their final degree examinations have increased the cadre of Assistant Staff Grade I. Two Officers who were successful in the finals were promoted to this Grade during the year.

Labour Force—The strength of the labour force as at 31.12.1962 was 458 distributed as follows:—

On monthly pay — 30
On daily pay — 428

The monthly paid workers continued to remain as non-staff employees of the Institute. There is only one employee of this category who was promoted to the Minor Staff during this year. There is provision for one class of workers only viz. the watchers to be promoted to the Minor Staff Grade on completion of 15 years service and apparently the case of Drivers who draw higher salaries than the watchers have been overlooked for such concessions. In fairness to this class of monthly paid workers it is felt that there should be some form of uniformity of privileges allowed to one and the same class of workers and the privilege of recruiting this category of workers to the Minor Staff on completion of 15 years service should be extended to all monthly paid workers of this class, such as Drivers, Cleaners, Office labourers etc. The percentage of workers qualifying for the service allowances on completion of 5 years and 10 years respectively have continued to increase as the older hands, perhaps with a view to qualify for these allowances, remained in employment without either ceasing to work or leaving the services of the Institute. 13 accidents including a death case have been reported during the year as against 22 cases last year. A sum of Rs. 85/74 has been paid on 8 temporary disablement cases and a sum of Rs. 3,500/- has been deposited by the Insurance Co. with the Commissioner of the Workmans Com-

compensation for disposal to the legal heirs of the deceased Driver who died while on duty. A further sum of Rs. 2,000/- is payable to him under the Personal Accident Policy which has been extended to Drivers, Cleaners and passengers as a welfare measure. Another sum of Rs. 2,400/- has now been deposited with the Commissioner of Workmans Compensation by the Insurance Company for payment to the legal heirs in respect of an accident occurred while on duty in 1961. In the case of accidents resulting in temporary disablements wages for the first seven days, for which there is no legal liability, the Institute has obtained special cover for this period to relieve workers from any financial embarrassments as due consideration has been given to the fact that they have to undergo medical treatment at their expense besides their non entitlement for wages during the first seven days of an accident. This is a special privilege given to them and may not be in force in several other establishments. The Board recognised the payment of bills from snakebite specialists not registered as Ayurvedic Physicians and this has given a big relief to the workers who frequently take treatment from local specialists.

Housing:—The construction of a Circuit Bungalow at a cost of Rs. 11,000/- and a Labour Rest Room at an estimated cost of Rs. 5,000/- at the Pothukulama Research Station have been in progress during this year. A twin watch hut and an extension to the Stores at R/E have been completed at a cost of Rs. 6,000/-. An Office and a Watch hut is under construction at Mulativu at an estimated cost of Rs. 6,000/-. An Assistant Staff Grade bungalow is being constructed at the Pallai Demonstration Centre at an estimated cost of Rs. 18,000/-. Two wells and a kitchen to a Minor Staff bungalow at Bandirippuwa Estate have been completed at a cost of Rs. 1,169/- and another well at the Alampil Nursery at a cost of Rs. 2,495/-. Construction of roads at Pothukulama Research Station has cost a sum of Rs. 9,073/- while the Insectory in progress at the Parasite Breeding Station, Batticaloa is estimated to cost Rs. 12,000/-. It may be interesting to note that these have been constructed departmentally under the supervision of the Institutes Clerk of Works and it has been observed that the total cost of all these buildings etc., and compared with buildings given to outside Contractors, has been comparatively very low, thus saving the Institute's funds to an appreciable extent. One set of Minor Staff furniture and a few items of office furniture has been provided during this year. Two meetings of the Housing Committee have been held during the year with Chief Administrative Officer (Chairman), a representative each from the Research and Extension Staff Officers Association and Coconut Research Institute Employees' Union with Welfare Officer as Secretary. 3 recommendations for the allocation of 3 AS G. II bungalows, 3 for labour cottages and a few recommendations for Hostel accommodation and occupation of Labour cottages were made at these two meetings and subsequently by circulation to Committee Members. The Canteen, bathroom and few other facilities common to all employees were freely made available to the employees of the Institute without any discrimination on the class or category of work and their status.

Financial Aid:—All applications from employees for Provident Fund, Gratuity, Loans, allocation of quarters, transport, accommodation, furnishing, employment, training and generally the establishment work of the Institute referred for my attention have been dealt with during the year. A sum of Rs. 116,572.78 have been granted to officers as loans for purchase of building sites and/or construction of houses. A sum of Rs. 36,844.10 have been paid as Insurance Premia to 112 officers from the amount lying to the credit of the members. A sum of Rs. 19,700/- to the Staff and a sum of Rs. 21,790/- to the labour force have been granted during the year as festival advances. A sum of Rs. 80,290.48 was contributed to the Staff Provident Fund by the officers to which the Board contributed an equal amount during the year. Interest derived was Rs. 23,392.83 during the year. The Employees Provident Fund membership as at 31.12.62 was 458, consisting labourers and monthly paid non-staff workers. The Board's contribution for the year was Rs. 12,227.96.

Medical Aid:—The payment to members in the Medical Aid Fund was Rs. 26,696.77 at 10 meetings held during this year. The members contributed at the rate of Rs. 10/- per month in the case of Senior and Intermediate Staff and Rs. 6/- per month in the case of Assistant and Minor Staff. The Board contributed an equal amount at the end of each month. The total contributions by the officers and the Board as at 31.12.62 were Rs. 13,562.19 and Rs. 13,561.99 respectively. The Committee of Management reconsidered the position with regard to the payment of bills issued by registered Ayurvedic Physicians and it was decided to consider payments without any restrictions on bills reserving the committee's right to refer any bills for the scrutiny of the Registrar of the College of Indigenous medicine on payment of Rs. 17/- per case. Normally bills up to Rs. 32/- were paid without any such reference. The decision to restrict payment up to Rs. 15/- only was therefore revoked. It was also decided to consider the payment of bills for spectacle frames up to a limit of Rs. 15/-. No restriction was made on the lenses. The Committee also considered the payment on bills issued for Homeopathy treatment and whenever necessary such bills were referred to the President of Homeopathy Association for scrutiny. A loan of Rs. 300/- was granted under rule 15 of the Fund to a member to meet a hospital bill during this year. Special concession to members have been obtained from doctors in the panel whenever possible.

Thrift, Savings and Supply of Goods:—The Coconut Research Institute Co-operative Welfare Society Ltd. continued to make satisfactory progress during this year and has made a *divisible* profit of Rs. 2,843.78 during this period. The high profits were derived from the increased turnover in the sales and selling prices remained at very reasonable rates. The stores and canteen functioned very satisfactorily and thrift and savings were also part of the Society's business. The Board's Annual Grant is Rs. 1,500/-.

A fully furnished rest room with canteen facilities and radio music have been maintained at the Institute's expenses.

Recreation and Cultural Activities:—The "D" Division cricket team of the Coconut Research Institute Recreation Club participated in the Government Service Cricket Tournament and came up to Semi-finals by defeating the Emigration and Immigration Department, Bank of Ceylon, Ministry of Defence, External & Internal Affairs and was eliminated by the Department of Agriculture. Out of the four friendly cricket matches played during the year, two matches were won by the Coconut Research Institute team. The Club also participated in the Government Service Indoor Games tournament. The Club held its Club days and Christmas party during the year. The party was mainly organised for the benefit of the officers children and prizes and gifts were distributed among them followed by a sports meet. The Boards Annual Grant to the Club is Rs. 500/- and a sum of Rs. 65/- per match was met from the Institute's funds for the Government Service Cricket tournament.

The Coconut Research Institute Art Circle made good progress during the year. The Library continued to be very useful to the members. The members participated in a two days excursion to Pollonnaruwa and Medirigiriya. The Sinhalese New Year celebrations was also well organised in an oriental fashion.

Industrial Relations:—In the field of industrial relationship the Institute still remains free from the level of trade disputes but nevertheless it will arise without tactical aids to settlement at employer-employee level. There are 5 Unions covering about 75% of the employees of the Institute and are registered under the Trade Union Act. The Coconut Research Institute Employees Union remained defunct for a short period during the course of the year due to the Union's failure to elect an Executive Committee. However, the Executive Committee was elected at the latter stage of the year and the Unions activities were revived. The Institute continued to allow labour Conferences with representatives of the respective Unions to avoid trade disputes as far as possible and a number of problems relating to alleged victimisation and terms and conditions of services have been amicably settled during the year.

F.H.B. FELIX SILVA,
Welfare Officer, Coconut Research Institute, Lunuwila.

REPORT ON THE ESTATES

I BANDIRIPPUWA ESTATE

Acreage

	A.	R.	P.
B/E. (1)	153	0	00
(2) A	118	0	38
B	59	3	26
C	34	3	07
	<u>365</u>	<u>3</u>	<u>31</u>

The above acreage comprises as follows:—

Research Section (working a/c)	175	0	04
Estate Section (working a/c)	168	0	13
Buildings, streams and roads	17	0	00
Waste land and Paddy	0	3	14
Playing Field	5	0	00
	<u>635</u>	<u>3</u>	<u>31</u>

Census

Census of Palms as at February 1962 is as follows:—

<i>Fields</i>	1	2	3	4	5	6	BB	GA	CB	A	B	C	Total
Full Bearing	1546	845	1370	2143	880	248	75	109	286	5640	2904	1560	17606
Partial Bearing	53	21	22	182	104	7	8	—	9	593	753	432	2184
Duds	41	11	37	50	5	8	5	—	—	286	88	130	661
In Flower	6	1	4	114	—	—	—	9	—	46	—	3	183
With Stem	7	42	8	162	4	4	—	270	—	43	—	2	542
Established Palms	5	103	3	104	103	—	—	120	—	1461	—	6	1905
Supplies	—	9	—	13	23	—	—	12	—	406	3	—	466
Vacancies	30	8	28	104	77	4	—	4	5	563	178	216	1217
Total	1688	1040	1472	2872	1196	271	88	524	300	9038	3926	2349	24764
Left out for Playing Field													462
Unplantable vacancies													1388
Grand Total													<u><u>26614</u></u>

Field Notes

Weeding:—The whole estate was controlled of its heavy growth of weeds.

Drains:—Altogether 834 fathoms of new drains in the contour have been cut in B/E (2) A. 1232 fathoms drains were cleaned and 1562 fathoms old drains were closed.

Roads and Bridges:—All estate roads have been maintained in good order.

Streams 2563 fathoms stream in B/E (1) and B/E (2) A and B have been cleaned once for the year.

Husk Pits:—833 husk pits ($9^1 \times 6^1 \times 1^1$) have been cut in the alternate rows in B/E (2) and No. 1 field and they were closed with an application of husks.

Pests and Disease:—Frequent examination for beetle on palms have been undertaken.

Cultivation:—The whole estate has been disc-harrowed twice by Tractor.

Rainfall

This compares with the previous year as follows:—

Average 1934/50	Months	1961 inches	Wet days	1962 inches	Wet days
2.20	January	2.24	4	3.27	4
2.17	February	4.30	6	4.57	1
5.38	March	7.06	10	3.94	8
8.40	April	9.92	12	8.22	11
10.31	May	14.03	15	17.96	11
7.42	June	14.13	19	8.68	14
2.82	July	5.22	11	3.34	8
3.45	August	5.43	14	3.78	12
4.28	September	10.66	17	4.06	16
12.56	October	5.47	17	20.46	26
12.92	November	10.60	12	4.46	9
4.91	December	2.20	8	0.87	5
76.72	Total	91.26	145	83.61	125

Crops

This compares as follows:—

Picks	1958	1959	1960	1961	1962	5 year average
1	43996	152823	72224	132987	177091	130126
2	65862	216861	165615	234073	208157	198548
3	107669	195786	202811	338525	290938	253808
4	166302	178196	206694	288305	247566	231026
5	117312	130296	137012	185311	144433	149773
6	97366	76358	119750	120618	111280	106628
	598507	950320	904106	1299819	1179465	1069907

The total crop realised for 1962 was 1779465 nuts from 19790 palms equivalent to 314 acres. Thus nuts per palms were 59.6 nuts and 3756.3 nuts per acre.

The disposal of crops as follows:—

	<i>Nuts</i>
Sold on contract	494095
Sold to Planting Division	21350
Sold to Research	624
Sold to Staff	992
Nursery	1475
Cured	653307
Allowances to Staff	27136
Empties	10486 0.9%
	<hr/> <hr/> 1179465 <hr/> <hr/>

The 653307 nuts cured into copra obtained 513 candies. 558 lbs. on an out-turn of 1213 nuts to a candy. The percentage of No. 1 copra was 94.1%.

Manuring

The following palms have been manured for 1962:—

Estate	No. 1 field	1678	} 3 lbs. Sulphate of Ammonia 3 lbs. Saphos phosphate 3 lbs. Muriate of potash - 9 lbs. @ 7 lbs. per palm half circles. -
	2 field	559	
	4 field	147	
	5 field	439	
	6 field	195	
	A field	2112	
Research	N.P.K. Guard Rows	707	} As per experimental requirements.
	Botanist	300	
	Pasture Plots	2449	
	Response Curve	1353	
		<hr/> 9939 <hr/> <hr/>	

Manure was applied on half circles of palms and forked in.

Expenditure

The estate expenditure for the year as follows:—

General Charges	Rs. 36122.62	@	33.68	Estimated	Rs. 37827.00	@	34.39
Upkeep	20010.84	@	18.66	„	18680.00	@	16.98
Cultivation	10640.72	@	9.92	„	11290.00	@	10.26
Collection	16963.62	@	15.82	„	17198.00	@	15.64
	<hr/> 83737.80 <hr/> <hr/>		<hr/> 78.08 <hr/> <hr/>		<hr/> 84995.00 <hr/> <hr/>		<hr/> 77.27 <hr/> <hr/>

D.F. WITHANA,
Superintendent, Bandirippuwa Estate.

II. RATMALAGARA ESTATE

Superintendent:—Mr. S.T. Braine.

Estate Staff:—Mr. W.H.R.A. Fernando, Field Attendant (Estate) Tractor Driver and Four Watchers.

Acreege Statement:—Ratmalagara Estate which is also called Ratmalagara Research Station, is approximately 272 acres in extent and comprise of the Botanist Division; Soil Chemist Division; Agrostologist Division; Advisory Division; Planting Division and Estate Division. There is also a three (3) acre block of clonal rubber originally planted by the Rubber Research Institute, which is now under estate management.

<i>Census of Palms</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>	<i>VI</i>	<i>VII</i>	<i>VII B/B</i>	<i>Total</i>	
Full bearing	1521	389	608	1459	1110	1701	2471	206	2379	11844
In flower	9	1	2	3	16	27	32	63	—	153
In Stem	4	1	3	17	23	16	54	29	559	706
Duds	14	4	18	37	23	18	20	—	18	152
Established Palms	45	4	7	84	4	1	65	172	42	424
Vacancies	50	18	35	180	29	110	6	14	80	522
	1643	417	673	1780	1205	1873	2648	484	3078	13801

Rainfall for 5 Preceeding Years

	1958	1959	1960	1961	1962
January	1.25	1.86	.29	3.12	.94
February	.95	1.11	4.13	4.78	1.20
March	6.61	2.47	1.65	2.48	1.85
April	10.78	8.86	10.60	3.09	1.52
May	12.86	12.09	14.68	10.81	15.91
June	5.34	4.39	2.37	9.09	4.26
July	1.13	4.39	13.91	5.68	.79
August	1.36	2.74	.50	2.20	1.69
September	.78	4.31	.25	8.20	2.95
October	6.00	10.53	9.81	5.59	14.30
November	8.38	9.74	14.21	5.98	3.64
December	3.17	1.92	.72	3.13	1.18

58.61	60.06	73.12	64.15	50.23
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Crop Statistics

Disposal of Crops Estate Section 1962

<i>Pick</i>	<i>Crop</i>	<i>Cured</i>	<i>Sold on contract</i>	<i>Allowance</i>	<i>Sundry Sales</i>	<i>Sold to P. Div.</i>	<i>Rejections</i>
1	74515	3245	70140	602	—	—	528
2	119875	115387	—	2358	—	—	2130
3	116417	15023	95080	3387	—	—	2927
4	117747	61188	51931	1749	—	—	2879
5	70622	6515	31919	758	—	30000	1430
6	56680	2268	15980	2154	28	35100	1150
Total	555856	203626	265050	11008	28	65100	11044

The 203626 nuts turned into copra during 1962 produced 178 candies 1 cwt. 2 qurs. 03 lbs. giving an average of 1143 nuts per candy.

Field Works carried out during the year

<i>Item</i>	<i>Quantity</i>	<i>Fields</i>
Weeding	4848 sqrs.	1, 2, 3, 4, 7, 8 and RSG
Cutting new drains	1293 faths.	3, 6, 8
Clearing and deepening drains	1714 faths.	1, 7, 8
Road repairs	260 faths.	All roads
Levelling ant hills	24	1 to 8
Boundary Fences	1920 faths.	All round
Manuring young palms	184	4, 7
Manuring adult palms	2815	1 to 8
Disc-harrowing	935 sqrs.	3 to 7
Mulching	2553 sqrs.	1 to 8
Weeding round palms	261	4 to 7

Buildings:—The Circuit Bungalow and IAS Nos. 5 and 6 were colour washed during the year.

Fences:—The boundary fence was repaired all round with new posts and wire wherever necessary.

S.T. BRAINE,
Superintendent, Raṭmalagara Estate.