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REPORT OF THE CHAIRMAN

REPORT OF THE CHAIRMAN

On 1st January 1967 the Coconut Research Board consisted of the following :—

EX-OFFICIO MEMBERS :

Director of Agriculture	Mr. M. S. PERERA
Treasury Representative	Mr. C. A. COOREY
Commissioner of Coconut Rehabilitation ...	Mr. C. CHANMUGAM
Chairman, Low Country Products Association ...	Mr. D. B. ELLEPOLA
Director, Coconut Research Institute	Dr. W. R. N. NATHANAEL

NOMINATED MEMBERS :

Nominated by the Honourable Minister from Senate and Members of Parliament	Mr. FESTUS PERERA, M.P. Mr. J. L. SIRISENA, M.P.
Nominated by the Planters' Association of Ceylon...	Mr. C. T. VAN GEYZEL, J.P. Mr. B. WARUSAWITHARNE.
Nominated by the Low Country Products Association	Mr. C. A. M. de SILVA (Chairman/C.R.B.) Mr. H. M. B. A. FERNANDO.
Nominated by the Honourable Minister to represent Small Holders	Mr. L. W. A. FERNANDO, Mr. M. M. KUMARAKULASINGHAM.

On 29th March 1967 Mr. T. C. A. de Soysa, Chairman of the Low Country Products Association replaced Mr. D. B. Ellepola on the Coconut Research Board.

On 29th January 1967 the Honourable Minister nominated Mr. W. Jayakody to represent the Small Holders in place of Mr. L. W. A. Fernando.

MEETINGS :

Five meetings of the Coconut Research Board the 214th, 215th, 216th, 217th and 218th were held on 24th January, 17th March, 6th June, 9th September and 15th December respectively. A special meeting of the Board was held on 26th August.

COMMITTEES :

Administrative Committee (Personnel as at 1st January 1967)—

1. Mr. C. A. M. de SILVA (Chairman, Coconut Research Board)
2. Mr. C. A. COOREY, CAS (Treasury Representative)
3. Mr. B. WARUSAVITHARNE
4. Mr. H. M. B. A. FERNANDO
5. Mr. C. CHANMUGAM, CAS (Commissioner, Coconut Rehabilitation)
6. Mr. M. S. PERERA, CAS (Director of Agriculture)
7. Mr. FESTUS PERERA, M.P.
8. Dr. W. R. N. NATHANAEL (Director, Coconut Research Institute).

The 56th, 57th and 58th meetings of the Administrative Committee were held on 8th February, 20th July and 10th October resepctively.

Estates and Experimental Committee (Personnel as at 1st January 1967)

1. Mr. M. M. KUMARAKULASINGHAM (Chairman)
2. Mr. D. B. ELLEPOLA
3. Mr. B. WARUSAVITHARNE
4. Mr. C. A. M. de SILVA
5. Mr. C. T. VAN GEYZEL
6. Mr. M. S. PERERA, CAS (Director of Agriculture)
7. Mr. L. W. A. FERNANDO
8. Mr. J. L. SIRISENA, M.P.
9. Dr. W. R. N. NATHANAEL (Director, Coconut Research Institute).

The 59th, 60th, 61st and 62nd meetings of the Estates and Experimental Committee were held on 23rd February, 22nd May, 12th August and 15th November respectively.

Extension Committee (Personnel as at 1st January 1967)—

1. Mr. C. T. VAN GEYZEL, J.P. (Chairman)
2. Mr. D. B. ELLEPOLA
3. Mr. C. A. M. de SILVA
4. Mr. C. CHANMUGAM, CAS (Commissioner of Coconut Rehabilitation)
5. Mr. M. M. KUMARAKULASINGHAM
6. Mr. L. W. A. FERNANDO
7. Dr. W. R. N. NATHANAEL (Director, Coconut Research Institute)

The 47th, 48th and 49th meetings of the Extension Committee were held on 14th May, 26th August and 8th November respectively.

Editorial Committee (Personnel as at 1st January 1967)—

1. Mr. M. M. KUMARAKULASINGHAM
2. Dr. W. R. N. NATHANAEL, Director/CRI.
3. Mr. L. W. A. FERNANDO
4. Director of Agriculture or his Representative.

The 16th and 17th meetings of the Editorial Committee were held on 16th June and 4th December respectively.

C. A. M. de SILVA,
Chairman,
Coconut Research Board.

14th May, 1968.

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REPORT OF THE DIRECTOR

1. STAFF

The Staff of the Coconut Research Institute as at 1st January 1967 was as follows :—

ADMINISTRATION DIVISION

Director ... ... Dr. W. R. N. NATHANAEL, M.Sc., Ph.D. (Lond.), F.R.I.C.

Chief Administrative Officer and Secretary to the Board ... ... Mr. S. C. KAHAWITA, B.Com. (Lond.), F.R.Econ.S.

Assistant Secretary ... ... Mr. T. T. A. J. C. SAMARASINGHE, LL.B. (Cey.)

CHEMISTRY DIVISION

Chemist ... ...Dr. W. R. N. NATHANAEL, M.Sc., Ph.D. (Lond.), F.R.I.C.

Research Assistant ... ... Vacant.

BOTANY DIVISION

Botanist ... ... Vacant.

Research Assistant ... ... Mr. M. A. P. MANTHRIRATNE, B.Sc. (Lond.), (On Overseas Study Leave from 4.10.66).

Officer-in-Charge ... ... Mr. R. B. RODRIGO.

SOIL CHEMISTRY DIVISION

Soil Chemist ... ... Dr. D. A. NETHSINGHE, B.Sc. (Ceylon), D.Phil. (Oxon.), A.R.I.C. (On Special Overseas Leave from 1.10.66).

Acting Soil Chemist ... ... Mr. T. S. BALAKRISHNAMURTI, M.Sc. (Aberdeen), B.Sc. (Cey.).

Research Assistant ... ... Mr. T. S. BALAKRISHNAMURTI, M.Sc. (Aberdeen), B.Sc. (Cey.).

AGROSTOLOGY DIVISION

Agrostologist ... ... Dr. K. SANTHIRASEGARAM, B.Sc. (Cey.), Ph.D. (Adelaide).

Research Assistant ... ... Mrs. N. RAJARATNAM, B.Sc. (Cey.), (On Overseas Study Leave from 27.9.66).

CROP PROTECTION DIVISION

Crop Protection Officer ... ... Mr. U. B. M. EKANAYAKE, B.Sc., Agric. (Cey.), (On Overseas Study Leave).

Officer-in-Charge ... ... Mr. J. K. F. KIRTHISINGHE

BIOMETRICS UNIT

Biometrician ... ... Mr. V. ABEYWARDENE

Research Assistant ... ... Mr. J. K. T. FERNANDO, B.Sc. (Cey.).

ADVISORY DIVISION

Chief Advisory Officer ... ... Mr. C. A. WICKRAMASURIYA, B.Sc. (Cey.).

PLANTING DIVISION

Planting Officer ... ... Mr. P. D. L. FERNANDO

Assistant Planting Officer ... ... Mr. C. W. S. de SILVA

2. GENERAL

Dr. W. R. N. Nathanael was confirmed in the post of Director during the year.

The Coconut Research Board granted study leave to Mr. V. Abeywardene, Biometrician, to follow a course of training (under the Colombo Plan) in Applied Statistics at the East Malling Research Station (U.K.), for a period of eight months from 28.3.67. After satisfactorily completing his course, he resumed duties on 24th November.

Dr. U. B. M. Ekanayake was appointed Head of the Crop Protection Division with effect from 18th November on his return from U.K., after successfully completing his Ph.D. degree course in entomology at the University of Oxford.

Mr. M. A. T. de Silva, Senior Technical Assistant, Soil Chemistry Division, left for U.K. on 18th November for a year's course of training (under the Colombo Plan) in the field of Soil Science at the Long Ashton Research Station, Bristol.

Applications were made through the usual channels to secure the services of Expert Consultants each in Plant Pathology and Physiology under the Aid Schemes to advise the Coconut Research Board on the future research plans in connection with the ' Leaf Scorch ' decline of coconut in the Southern Province.

Dr. Jurgen Kranz, Mycologist of the Tropeninstitut, Justus Liebig-Universitat, Giessen, was assigned by the Government of the Federal Republic of Germany from October 9th to December 21st to go into the " Leaf Scorch " problem from the mycological angle and to advise on future lines of research. At the close of his assignment Dr. Kranz submitted a report to the Coconut Research Board embodying his observations and recommendations.

Reports regarding the favourable progress of the Research Assistants in Botany and Agrostology who continued to be away on overseas training have been received during the period under review.

Coconut Crops

An all-time record in Coconut production estimated at 3,148 million nuts was recorded in 1964. The estimated production for 1967 however, is 2,577 million nuts, representing a decrease of 18.1% from 1964 and 9.9% from the average production (of 2,860 million nuts) for the past 5 years. The decrease from the preceding year's production (estimated at 2,621 million nuts) amounts to 1.7%.

The decrease in production during 1967 is also reflected in the steep decline in the volume of exports for the year. These represent decreases of 41.5% and 28.9% from 1964 and the average for the past 5 years, respectively. The drop in exports in comparison with the preceding year is 7.6%.

The value of exports during 1967 averaged Rs 178.88 per 1,000 nuts representing a decrease of 7.6% from 1966 and 30.7% from the previous record of Rs 258.29 reached in 1961. In terms of the average value of exports for the past five years (Rs 176.92), however, the figure for 1967 represents an increase of 1.1%.

3. VISITORS

The visitors during the year included the following :—

Dr. Dietrich Duvel, University of Hamburg, Germany,
Dr. K. Caesar, University of Gottingen, Germany,
Mr. R. A. Bull, Oil Palm Research Station, Malaysia,
Mr. T. H. Ghazali bin Jawi, Minister of Agriculture, Malaysia,
Mr. A. Kannegieter, F.A.O., Pasture Specialist,
Mr. H. Davelaar, UNICEF, New Delhi,
Mr. A. J. Vernon, Rothamsted, U.K.,
Mr. C. Parker, Agricultural Research Council, U.K.,
Dr. A. H. Al Abbas, Regional Adviser, IAEA, Austria,
Mr. W. P. Seton Peacey, London.

4. PUBLICATIONS

Articles entitled " Coconuts in 1967 " and " Activities of the Coconut Research Institute in 1967 " were contributed to the Annual Report of the Planters' Association of Ceylon.

Three issues of the Ceylon Coconut Quarterly (Vol. XVII No. 2, XVII Nos 3/4 and Vol. XVIII Nos. 1/2 were released during the year.

Two issues of the Ceylon Coconut Planters' Review (Vol. IV, No. 4 and Vol. V, No. 1) were released during the year. Vol. V, No. 1, was the last in the series that was issued free.

Vol. IV, No. 1 of the Sinhala Journal " Pol Pawath " was published. Vol. IV, No. 2 though sent to the press could not be released before the end of the year. There was increased demand for this publication during the year as evidenced by the rise in circulation from 5,000 to 6,000 copies.

5. STAFF RESEARCH CONFERENCES

Following the series of staff research conferences started in 1966, four Conferences were held during the year at quarterly intervals as follows :—

Quarter	*Date*	*Discussion led by*	*Subject*
First	30. 3. 67	Dr. K. Santhirasegaram (Agrostologist)	" Review of the work of the Division of Agrostology".
Second	30. 6. 67	Mr. C. A. Wickramasuriya (Chief Adv. Officer)	" Review of the Work of the Advisory Division".
Third	30. 9. 67	Mr. K. S. O. Perera (Tech. Asst. Soil Surveys)	" Soils of the South-West Coastal belt of Ceylon".
Fourth	17.12.67	Dr. J. Kranz (Expert under the German-Technical Aid Programme)	" Weak Fungal Parasites".

6. NOTES ON REPORTS OF DIVISIONS

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

CHEMISTRY DIVISION

(i) **Coir Technology.**—A series of quantitative trials was carried out at a fibre mill in the vicinity of the C.R.I. in order to test the efficiency of the traditional ' Fibre Drum '. This work was necessitated consequent on certain claims made for an imported machine of Austrian manufacture that has been installed in Ceylon for the processing of coir fibre.

(ii) **Studies on the Coconut Endosperm.**—Chemical studies on the coconut kernel were continued during the year. Oil gradients in the endosperm during its early developmental stages have been established on the basis of six separate experiments.

(iii) **Arrack.**—Twelve palms continued to be tapped for toddy during the year. The samples collected were used for laboratory studies on fermentation efficiencies and the preparation and examination of experimental samples of arrack.

(iv) **Pot Culture Experiment.**—The chemical examination of plant samples prepared from the previous pot culture experiments was continued.

Work on leaf-disc sampling as a prelude to foliar diagnosis of coconut seedlings grown in sand pot culture was continued during the year. Quantitative experiments were carried out to compare the chemical composition of leaves of different ranks from seedlings grown under the seven treatments (+ ALL, — ALL, — N, — P, — K, — Ca and — Mg) when sampling is done by the disc technique side by side with the gross method.

II. BOTANY DIVISION

(i) **Field Experiments.**—All the Field Experiments laid down by the former Botanist were maintained throughout the year.

(ii) **Hybridization Work.**—Controlled pollination work for the production of Tall × Tall and Tall × Dwarf seed-material was continued at the five stations—Bandirippuwa, Ratmalagara, Isolated Seed Garden, Marandawila and Achchithotam. Two new stations were opened at Kiniyama and Andigedera Estates for controlled pollination work on 250 palms each.

(iii) **Seed-nuts.**—15,882 Tall × Tall, 11,000 Dwarf × Tall and 409 open pollinated seednuts were harvested from the Isolated Seed Garden, Bandirippuwa, Ratmalagara, Marandawila and Achchithotam Estates.

(iv) **Seedlings.**—In all 18,634 Tall × Tall, Dwarf × Tall and open pollinated seedlings were issued to the industry. This is higher than the issues in 1966 by 6,781 seedlings.

(v) 17 private estates (as against 12 in 1966) were assisted in carrying out their own controlled pollination work. In all 506 tall and 359 dwarf pollen tubes (as against 269 and 328 tubes respectively in 1966) were supplied to these estates.

(vi) **Mother Palm and Seed supply.**—1,694,241 mother palm seed-nuts were supplied to the Planting Division during the year. This is higher than the issues in 1966 by 209,465 nuts.

III. SOIL CHEMISTRY DIVISION

(A) Field Experiments

1. The long term field experiments (seven) on the NPK requirements of young and adult palms, fertilizer placement, frequency of manuring, liming acid soils, ploughing, and the efficiency of different sources of nitrogen and phosphorus were continued in 1967. The observation trials on the problems of " Leaf Scorch ", immature nutfall and yellowing palms were maintained.

2. The first differential manuring of the 5^4 NPK Mg experiments at Naiwala and Marandawila Estates and the experiment on the quality of nitrogen and phosphorus and frequency of manuring at Pothukulama were carried out at the appropriate times. Just before manuring at Pothukulama a leaf count of the seedlings was taken.

3. Premanurial yield recording of the Boron/zinc/sulphur experiment at Monrovia Estate was continued.

4. A contract to carry out isotope studies on the efficiency of fertilizer utilization by coconut palms was signed with the International Atomic Energy Agency. A Preliminary trial was carried out using P^{32} and Rb^{86}. Preparations are under way to carry out an experiment with 48 palms.

5. Field Experimental results of interest are :

(i) The experiments at Bandirippuwa, Ratmalagara and Pothukulama continue to show significant responses to each of the nutrients N, P, and K.

(ii) At Pothukulama 89% of the young palms treated with complete NPK mixture were in flower at the end of the 7th year compared to 67% of the untreated palms.

(iii) At Nattandiya 3 applications of lime at the rate of 10 cwts per acre and 4 applications at the rate of 15 cwts per acre to an acid lateritic soil have raised the pH of the top soil from 4.2 to values between 7.16 and 11.32 and the subsoil between 6.05 and 8.08.

(iv) At Nattandiya the surface application of fertilizer round the palms continues to be as effective as trench manuring.

(v) On a light sandy soil at Bingiriya inorganic fertilizers continue to give yields comparable to those with organic fertilizers.

(vi) A plot of the Response Curve Experiment at Bandirippuwa has given a yield equivalent to 6,000 nuts per acre per annum.

(B) Laboratory Investigations

Laboratory investigations were mainly concerned with analyses of leaves, nut water and soil samples from field experiments.

(i) At Iranaville Estate the total carbon content of the soil has been found to be progressively increasing. The ammoniacal and nitrate nitrogen contents however continue to be low.

(ii) The nutrient composition of nut water (N, P, K) and leaflet samples (N, P, K, Ca, Mg) from the 4^3 NPK Experiment at B/E and the 3^3 NPK Experiment at Ratmalagara Estate has been determined. This has been done with the object of comparing the relative merits of nut water and leaf analyses as a guide to fertilizer response and also for developing a method for making quantitative manurial recommendations to individual lands.

(iii) Determination of radioactivity in leaf samples from palms treated with P^{32} showed that the activity in leaves 3 to 9 was fairly constant. For sampling purposes leaf 6 has been found a convenient one to select.

(iv) Leaf analysis has also been done for advisory purposes.

(C) Soil Surveys

(i) The main project for the year was the survey of the Eastern province covering Batticaloa, Kalkudah and Kuthiravelli.

(ii) At the request of Government Agents soil surveys were carried out in the Kalutara and Hambantota Districts.

(iii) At the request of planters, soil surveys were done in Kegalle, Denlyaya and Madampe.

(iv) Soil mapping of the Puttalam 1" sheet was commenced and a major portion of it has been completed. The hydrological survey of Vanatavillu was continued.

IV. AGROSTOLOGY DIVISION

1. **Soil Fertility Studies.**—No soil fertility studies as such were done during the year. The re-roofed glass house, however, was used to carry out physiological studies on paddy. These studies were centred on the determination of the effect of forms of nitrogen, light intensity and levels of water on some of the promising varieties of highland paddy.

2. **Pasture Studies.**—In the field of pasture under coconuts, the management studies of the two pasture grasses *Brachiaria miliiformis* and *Brachiaria brizantha* and the fodder grass *Panicum maximum* were continued. In addition to this a number of varieties of fodder and pasture grasses obtained from abroad were established in small plots to observe their performances under coconuts. Of these varieties *Brachiaria brizantha* (Tanganyika) appeared to be very promising. Detailed evaluation of this grass was undertaken during the latter part of the year.

3. **Subsidiary Food Crops.**—Studies on Subsidiary food crops under coconuts were continued with the addition of several varieties of yams during the year. Of the yams tested sweet-potato appeared to be very promising and yields of approximately 80 cwt/acre have been recorded with moderate applications of fertilizers. The data so far recorded indicate that short term varieties of paddy can be successfully cultivated under coconuts during Yala only. The agronomic requirements for the successful cultivation of maize and groundnuts under coconut have been more or less established.

4. **Cattle.**—The cross-breeding of Sinhala cows to Jersey was continued during the year.

V. CROP PROTECTION DIVISION

1. Pests

(*a*) The Red Weevil (*Rhyncophorus ferrugineus*)

Surveys started during the previous year were continued to gather more information on the distribution, infestation potentiality and the economic aspects of the control of this pest.

Where there were pest outbreaks, the loss of palms was found to vary from locality to locality. In general the average mortality rate was of the order of 2 per cent. of the affected palms.

(*b*) The Coconut Caterpillar (*Nephantis serinopa*)

The biological control project was continued during the year.

Parasites of the coconut caterpillar were bred in the insectaries at Lunuwila and Batticaloa and they were despatched on request, to the plantations where the pest occurred.

On a few selected estates, where parasites were liberated, population records of the pest and parasites have been kept.

(c) The Coconut Scale (*Aspidiotus destructor*)

There were 15 reported infestations of the coconut scale pest. Of these 7 were found to be declining at the time of inspection and they were left for natural control, whilst 8 were brought under control with kerosene oil emulsion.

(*d*) Other Pests

Nettle grub (*Parasa lepida*).—A mild incidence was observed in the Isolated Seed Garden, Rajakadaluwa.

Locust (*Aularchis Miliaris*).—Four infestations were reported, but only two needed insecticidal treatment. Endrex and Bidrin were sprayed with satisfactory results.

Bag Worm (*Psyche albipes*).—On one estate an outbreak which occurred on adult palms was controlled effectively with D.D.T.

Reports were received of damage to seedlings from termites, wild boar and porcupine.

2. Diseases

(*a*) **Bud Rot.**—The trial in which packetted fungicides are placed in the axils of leaves was continued during the year and the incidence of the disease has been found to be low in the experimental area.

(*b*) **Leaf Scorch Decline.**—In collaboration with Dr. O. S. Perles, Plant Pathologist, the microbiological studies initiated in 1966 were continued during the year.

A technical conference attended by research officers from the R.R.I., T.R.I. and the Department of Agriculture was held during the year, in order to consider the future lines of research on the Leaf Scorch problem.

An indication has been given in the report by Dr. Kranz, that Fusaria fungi probably cause root decay of the diseased palms and accelerate their decline, once they have been affected by a primary unknown cause.

VI. BIOMETRY

In the absence of the Biometrician on overseas training, the work of the division was restricted mostly to routine work.

1. Statistical Service

(I) The routine analysis of the experiments of the research divisions of the Institute were carried out.

(II) Statistical summaries of production and exports of coconut products and also charts and diagrams pertaining to same were prepared for the Director.

2. Biometrical Studies

(i) Growth and yield measurements of the Marandawila progeny trial and the Ratmalagara calibration trial were taken to serve as raw material for the Biometrician's proposed studies at East Malling Research Station.

(ii) The routine recordings of the Calibration trial at Ratmalagara were carried out as per schedule.

(iii) The analysis of the Botanist's 300 palm block data with a view to determining the efficiency of pre-experimental yield as a calibrating variate for experiments with adult coconut was completed before the Biometrician left for overseas studies.

3. Agri-Meteorology

The meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily.

VII. ADVISORY DIVISION

1. Advisory Visits

(*a*) During the year 6,661 visits have been made by the field staff to coconut lands for advice and demonstrations on planting, soil conservation, draining, manuring, cultivation, pests and diseases control and for inspections under the Fertilizer Subsidy Scheme.

(*b*) 14,544 holdings in all were visited in connection with general advisory work. 2,470 holdings were visited for advice and demonstrations in connection with pests and diseases.

(*c*) The field staff attended 147 meetings and delivered 137 talks. The Division participated in two exhibitions.

2. Demonstration Centres

(*a*) Routine items of work were carried out at the Demonstration Centres at Pallai, Alampil, Mundel and Mylambavelly.

3. Citronella Subsidy Scheme

The main items of work for the year under this Scheme comprised inspection of lands for the payment of cash subsidy and the issue of free fertilizer. The actual fertilizer distribution was as follows :—

(*a*) 2,197 applicants who had obtained seedlings during May/June 1962, were issued 380 tons 6 cwts 14 lbs of fertilizer in May 1967.

(*b*) 4,147 applicants who had obtained seedlings during May/June 1960 and October/November 1962 were issued 1,102 tons 14 cwts 84 lbs of fertilizer in October 1967.

VIII. PLANTING DIVISION

1. Seed-nuts

The Planting Division maintained 12 nurseries during the year. A total of 2,066,354 seednuts were planted for issue of seedlings in May/June and October/November seasons. 455,370 seednuts were planted for issue of seedlings in May/June and 1,610,984 seednuts for October/November.

2. Seedlings

A total of 1,415,327 seedlings were booked for the two planting seasons as follows :—

	Number
May/June 1967	352,592
October/November 1967	1,062,735
Total ...	1,415,327

W. R. N. NATHANAEL,
Director.

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REPORT OF THE CHEMIST

I. COIR TECHNOLOGY

A series of quantitative trials were carried out at a fibre mill in the vicinity of the CRI in order to test the efficiency of the traditional ' Fibre Drum '. This work was necessitated consequent on certain claims made for an imported machine of Austrian manufacture that has been installed in Ceylon for the processing of coir fibre.

(*a*) **Manual Processing** :—Before commencing the quantitative factory trials on " Drum Processing " a preliminary study was made on seven lots of five retted husks each, to get an estimate of the possible quantitative recovery of the various fibrous components of the coconut husk by manual separation. The components examined were (i) Bristle fibre, (ii) Mattress fibre and (iii) Coir fibre dust. The fibre dust was further separated into (*a*) epicarp, (*b*) fibrous dust and (c) corky dust. Accurate moisture determinations were made at each stage of the processing on the wet and air dry samples of the different components in order to calculate back the data obtained on the moisture free basis and compare them with corresponding data for ' drum processing '. The full results obtained in the preliminary and six quantitative experiments are summarised in Tables I to IV.

In a nut-shell the overall findings indicate that the dry matter in the coconut husk would be distributed as follows :—

	Per cent	
Bristle Fibre	27.5	
Mattress Fibre	16.8	
Coir Fibre Dust—		
(*a*) Epicarp	18.7	55.7%
(*b*) Fibrous dust	2.7	
(*c*) Corky dust	34.3	
Total ...	100.0	

The results on " Drum Processing " reported further on show that the dry matter in 1,000 husks weigh 502 pounds. On this basis, the above findings for " Manual Processing " could be expressed (in terms of weights) as follows :—

TABLE I

Moisture Contents of the Components of Retted Coconut Husk (Manual Processing)
(Per cent)

BATCH	ORIGINAL RETTED HUSK (Calculated)			BRISTLE FIBRE		MATTRESS FIBRE		COIR FIBRE DUST							
								EPICARP		FIBROUS DUST		CORKY DUST		COMPOSITE DUST	
	Wet	Wet (Corrected for dry-age)	Air Dry	Wet	Air Dry	Wet	Air Dry	Wet	Air Dry	Wet	Air Dry	Wet	Air Dry	Wet	Air Dry
PRELIMINARY	83.8	79.9	12.2	62.6	9.9	62.5	11.5	—	—	—	—	—	—	87.5	13.8
I	85.3	81.6	7.5	51.8	9.3	49.5	9.3	—	5.2	—	5.8	—	6.7	85.8	9.9
II	84.8	81.3	9.3	58.4	6.2	61.4	8.6	—	8.4	—	10.9	—	12.1	89.7	10.4
III	84.2	82.3	10.2	57.3	8.6	59.7	8.9	—	8.6	—	11.2	—	12.4	86.4	14.7
IV	85.0	83.1	10.7	63.1	8.6	58.4	9.2	—	9.2	—	12.0	—	13.3	85.8	13.6
V	86.3	83.8	10.2	61.2	9.7	66.3	9.4	—	8.8	—	11.0	—	11.9	88.1	11.9
VI	88.0	86.6	10.0	66.4	9.1	71.3	9.3	—	8.7	—	11.0	—	12.5	90.3	9.6
Mean (6)	85.6	83.1	9.6	59.7	8.6	61.1	9.1	—	8.2	—	10.3	—	11.5	87.7	11.7
C.V. (%)	1.5	2.1	10.9	7.8	13.2	11.1	3.1	—	16.4	—	19.9	—	19.0	2.1	16.4

TABLE II

Data obtained on the Components of the Retted Coconut Husk (Manual Processing) Wet-Weight Relationships (5 Husks per Batch) (In Grammes)

BATCH	Original Wet Weight of Husks	Dryage during Processing		Original Wet Wt. of Husks (Corrected for Dryage)	BRISTLE FIBRE		MATTRESS FIBRE		COIR FIBRE DUST						
									EPICARP		FIBROUS DUST PLUS CORKY DUST		TOTAL COMPOSITE DUST		
		Weight lost	As % of original		Wet Wt.	As % of original corrected	Wet Wt.	As % of original corrected	Wet Wt.	As % of original corrected	Wet Wt.	As % of original corrected	Wet Wt.	As % of original	As % of original (corrected)
PRELIMINARY	8,845	1,701	19.2	7,144	794	11.1	1374	19.2	—	—	—	—	4976	56.3	69.7
I	11,350	2,255	19.9	9,095	1047	11.5	570	6.3	441	4.8	7037	77.4	7478	65.9	82.2
II	9,988	1,864	18.7	8,124	1075	13.2	637	7.8	510	6.3	5902	72.6	6412	64.2	78.9
III	9,988	1,057	10.6	8,931	1190	13.3	625	7.0	533	6.0	6583	73.7	7116	71.2	79.7
IV	10,215	1,145	11.2	9,070	1336	14.7	574	6.3	577	6.4	6583	72.6	7160	70.0	79.0
V	10,896	1,668	15.3	9,228	1304	14.1	941	10.2	627	6.8	6356	68.9	6983	64.1	75.7
VI	11,350	1,209	10.7	10,141	1166	11.3	906	8.8	805	7.9	7264	71.6	8069	71.1	79.5
Mean (6)	10,631	1,533	14.4	9,098	1186	13.0	709	7.7	582	6.4	6621	72.9	7203	67.8	79.3
C.V. (%)	5.6	28.3	26.6	6.5	9.0	9.6	21.7	18.3	19.7	14.5	6.7	3.5	7.0	4.6	2.4

TABLE III

Dry Weight Relationships (5 Husks per Batch) (Air Dry Basis)—Manual Processing
(In grammes)

BATCH	Original Dry Weight of Husks (Calculated)	BRISTLE FIBRE		MATTRESS FIBRE		EPICARP		COIR FIBRE DUST				TOTAL COMPOSITE DUST	
								FIBROUS DUST		CORKY DUST			
		Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original
PRELIMINARY	1,634	330	20.2	582	35.6	—	—	—	—	—	—	722	44.2
I	1,806	485	26.9	291	16.1	290	16.1	50	2.8	690	38.2	1,030	57.1
II	1,673	429	25.6	264	15.8	313	18.7	57	3.4	610	36.5	980	58.6
III	1,760	480	27.3	273	15.5	288	16.4	50	2.8	669	38.0	1,007	57.2
IV	1,713	510	29.8	213	12.4	299	17.5	99	5.8	592	34.6	990	57.9
V	1,661	460	27.7	329	19.8	309	18.6	11	0.7	552	33.2	872	52.5
VI	1,515	390	25.7	314	20.7	356	23.5	10	0.7	445	29.4	811	53.6
Mean (6)	1,688	459	27.2	281	16.7	309	18.4	46	2.7	593	35.0	948	56.1
C.V. (%)	5.4	8.6	5.2	13.4	16.7	7.4	13.4	65.7	64.4	13.6	8.8	8.3	4.0

TABLE IV

Dry-Weight Relationships (5 Husks)—(Oven-dry Basis)—Manual Processing.
(In Grammes)

BATCH	Original Dry Wt. of Husks (Calculated)	BRISTLE FIBRE		MATTRESS FIBRE		COIR FIBRE DUST							
						EPICARP		FIBROUS DUST		CORKY DUST		TOTAL COMPOSITE DUST	
		Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original	Dry Weight	As % of original
PRELIMINARY	1,434	297	20.7	515	35.9	—	—	—	—	—	—	622	43.4
I	1,670	440	26.3	264	15.8	275	16.5	47	2.8	644	38.6	966	57.9
II	1,517	402	26.5	241	15.9	287	18.9	51	3.4	536	35.3	874	57.6
III	1,581	439	27.8	249	15.7	263	16.6	44	2.8	586	37.1	893	56.5
IV	1,530	466	30.5	193	12.6	271	17.7	87	5.7	513	33.5	871	56.9
V	1,491	415	27.8	298	20.0	282	18.9	10	0.7	486	32.6	778	52.2
VI	1,363	355	26.1	285	20.9	325	23.8	9	0.7	389	28.5	723	53.0
Mean (6)	1,526	420	27.5	255	16.8	284	18.7	41	2.7	526	34.3	851	55.7
C.V. (%)	6.1	8.0	5.5	13.3	16.8	7.0	13.2	64.9	63.3	15.2	9.6	9.3	4.0

Recoveries of Components (in lbs.)—Moisture free basis

	Pounds	
Bristle Fibre	138.0	
Mattress Fibre	84.3	
Coir Fibre Dust—		
(*a*) Epicarp	93.9)	
(*b*) Fibrous dust	13.6)	279.7
(*c*) Corky dust	172.2)	
	502.0	

To obtain wet weight relationships the above data could of course be re-calculated for any required moisture content of the components involved.

(*b*) "**Drum Processing**".—In this process, the separation of the fibre from the inter-connective tissues of the retted husk is accomplished by special machines called " Fibre drums ". They are arranged in pairs, the first one of which is called the ' breaker ' and the other the ' cleaner '. They are both power driven wooden wheels fitted with iron spikes. In the 'cleaner' the teeth are closer spaced, sharper and finer.

The operator in charge of the ' breaker ' drum holds one end of a husk segment and forces the other end against the teeth of the revolving wheel through two iron bars. The nails tear away the epicarp, pith and much of the short fibres which fall to the ground. When he has similarly repeated this operation with the other end of the husk, only the long stapled ' bristle fibre ' is left in his hands. Next, the fellow operator on the ' cleaner ' drum takes three or four lots of this fibre all together and subjects them to precisely the same treatment. This cleans up the fibre further and removes any short staples not removed by the breaker.

The mattress fibre is recovered from the crude mixture of wet fibrous material, pith and epicarp that have been collected from the ground by passing through a sifter.

For the purpose of the present experiment six batches of 1,000 retted husks each were processed quantitatively in a pair of fibre drums and the weight characteristics of the three main components (i) Bristle fibre, (ii) Mattress fibre and (iii) composite Fibre Dust were recorded. The full results, giving details of recoveries of the different components from the ' breaker ' and ' cleaner ' machines are charted in Tables V to VII.

The overall findings indicate that the dry matter in the husk gets distributed as follows during " Drum Processing " :—

TABLE V (a)

Data obtained on the Components of the Retted Coconut Husk ("Drum" Processing)
Wet-weight Relationships (1000 husks per Batch) (In Pounds)

1	2		3	4					5	6	7					
BATCH	Wet Weight of 1000 husks		% Adventitious moisture	Dryage during Processing					Wet Wt. of 1000 husks (corrected for Drainage and Dryage)	No. of Segments	OVERALL RECOVERY OF COMPONENTS					
				Breaker processing	Cleaner processing	TOTAL					BRISTLE FIBRE		MATTRESS FIBRE		COIR FIBRE DUST Composite	
	(a) Dripping wet	(b) After draining				Lbs.	As % of 2(a)	As % of 2(b)			Wet Wt. (lbs)	As % of original (corrected)	Wet Wt. (lbs)	As % of original (corrected)	Wet Wt. (lbs)	As % of original (corrected)
I	3520	3307	6.1	70	60	130	3.7	3.9	3177	3404	265	8.3	529	16.7	2383	75.0
II	3379	3341	1.1	83	36	119	3.5	3.6	3222	3656	290	9.0	547	17.0	2385	74.0
III	3565	3435	3.6	108	79	187	5.2	5.4	3248	3326	255	7.9	492	15.1	2501	77.0
IV	3465	3440	0.7	54	61	115	3.3	3.4	3325	3298	257	7.7	559	16.8	2509	75.5
V	3589	3570	0.5	47	58	105	2.9	3.0	3465	3390	264	7.6	601	17.3	2600	75.1
VI	3689	3547	3.8	61	63	124	3.4	3.5	3423	3328	265	7.7	550	16.1	2608	76.2
Mean (6)	3534	3440	2.6	70	60	130	3.7	3.8	3310	3400	266	8.0	546	16.5	2498	75.5
C.V. (%)	2.8	2.8	95.5	29.0	21.0	20.5	19.7	20.0	3.2	3.5	4.3	6.1	6.0	4.4	3.6	1.3

TABLE V (b)

Details pertaining to Recovery of the Components from the Breaker and Cleaner Machines.
Wet Weight Relationships (1000 husks per Batch) (In pounds)

1	2	3						4						5		
BATCH	Wet Weight of 1000 husks (corrected for dryage etc.)	BREAKER MACHINE						CLEANER MACHINE						TOTAL RECOVERIES		
		Crude Bristle Fibre		Mattress Fibre (1)		Fibre Dust (1)		Cleaned Bristle Fibre		Mattress Fibre (2)		Fibre Dust (2) by Difference		BRISTLE FIBRE	MATTRESS FIBRE	FIBRE DUST (Composite)
		Lbs.	As % of original (Corrected)	Lbs.	As % of original (Corrected)	Lbs.	As % of original (Corrected)	Lbs.	As % of original (Corrected)	Lbs.	As % of original (Corrected)	Lbs.	As % of original (Corrected)	Lbs.	Lbs.	Lbs.
I	3177	905	28.5	276	8.7	1996	62.8	265	8.3	253	8.0	387	12.2	265	529	2383
II	3222	897	27.8	303	9.4	2022	62.8	290	9.0	244	7.6	363	11.2	290	547	2385
III	3248	933	28.7	267	8.2	2048	63.1	255	7.9	225	6.9	453	13.9	255	492	2501
IV	3325	932	28.0	293	8.8	2100	63.2	257	7.7	266	8.0	409	12.3	257	559	2509
V	3465	955	27.6	309	8.9	2201	63.5	264	7.6	292	8.4	399	11.6	264	601	2600
VI	3423	969	28.3	268	7.8	2186	63.9	265	7.7	282	8.3	422	12.3	265	550	2608
Mean (6)	3310	932	28.2	286	8.6	2092	63.2	266	8.0	260	8.0	406	12.2	266	546	2498
C.V. (%)	3.2	2.7	1.4	5.8	5.9	3.7	0.62	4.3	6.1	8.7	6.3	6.9	6.9	4.3	6.0	3.6

TABLE VI

Dry-Weight Relationships (1000 Husks per Batch) (Air-Dry Basis)—"DRUM" Processing (In pounds)

1	2	3		4						5	
BATCH	Original Dry Weight of Husks (calculated)	BRISTLE FIBRE (Sun-dried) Mean Dryage from wet weight—60.7%		MATTRESS FIBRE (Sun dried) Mean Dryage from Wet Wt.—57.4%						TOTAL COMPOSITE FIBRE DUST (Calculated to 11.7% Air-dry moisture basis).	
				BREAKER		CLEANER		TOTAL			
		Dry Weight (lbs)	As % of Original	Lbs	As % of Total	Lbs	As % of Total	Lbs	As % of Total	Dry Weight (lbs)	As % of Original
I	664	104	15.7	137	20.6	91	13.7	228	34.3	332	50.0
II	669	113	16.9	134	20.0	90	13.5	224	33.5	332	49.6
III	692	113	16.3	130	18.8	100	14.5	230	33.3	349	50.4
IV	685	95	13.9	148	21.6	92	13.4	240	35.0	350	51.1
V	686	99	14.4	131	19.1	94	13.7	225	32.8	362	52.8
VI	712	103	14.5	151	21.2	94	13.2	245	34.4	364	51.1
Mean (6)	685	104	15.3	138	20.2	94	13.7	233	33.9	348	50.8
C.V. (%)	2.3	6.4	7.1	5.9	5.1	3.5	3.0	3.4	2.2	3.7	2.0

TABLE VII

Dry-Weight Relationships (1000 husks per batch) (Oven-dry Basis)—" DRUM " Processing.
(In Pounds)

1	2	3		4						5	
BATCH	Original Dry Weight of Husks (Calculated)	BRISTLE FIBRE (Calculated on a Moisture basis of 73.6%)		MATTRESS FIBRE (Calculated on a Moisture basis of 76.1%)						COMPOSITE FIBRE DUST (Calculated on a Moisture basis of 87.9%)	
				BREAKER		CLEANER		TOTAL			
		Dry Weight (lbs)	As % of Original	Lbs.	As % of Total	Lbs.	As % of Total	Lbs.	As % of Total	Dry Weight Lbs.	As % of Original
I	484	70	14.5	66	13.6	60	12.4	126	26.0	288	59.5
II	496	77	15.5	72	14.5	58	11.7	130	26.2	289	58.3
III	488	67	13.7	64	13.1	54	11.1	118	24.2	303	62.1
IV	506	68	13.4	70	13.8	64	12.6	134	26.4	304	60.1
V	529	70	13.2	74	14.0	70	13.2	144	27.2	315	59.5
VI	517	70	13.5	64	12.4	67	13.0	131	25.3	316	61.1
Mean (6)	502	70	13.9	68	13.5	62	12.4	130	25.9	302	60.2
C.V. (%)	3.2	4.6	5.8	5.7	5.0	8.8	5.9	6.0	3.6	3.7	2.0

Basis for the Moisture Contents used in Computations

BRISTLE FIBRE	% Moisture (Mean of six each)	MATTRESS FIBRE	% Moisture (Mean of six each)	COMPOSITE FIBRE DUST	% Moisture (Mean of six each)
From Breaker	... 75.5	From Breaker	... 76.5	From Breaker	... 87.6
From Cleaner	... 67.1	From Cleaner	... 75.7	From Cleaner	... 89.3
Weighted Mean	... 73.6	Weighted Mean	... 76.1	Weighted Mean	... 87.9

	Per cent
Bristle Fibre	13.9
Mattress Fibre	25.9
Composite Fibre Dust	60.2
	100.0

In terms of weights the above findings could be expressed as follows :—

Recoveries of Components (in lbs.)—Moisture free basis

	Pounds
Bristle Fibre	70.0
Mattress Fibre	130.0
Composite Fibre Dust	302.0
Total ...	502.0

If we assume that recoveries by manual separation approximate the theoretical yields, then in general, the conclusion can be drawn that in " Drum Processing " about 49.5 per cent of the " bristle fibre " in the husk gets broken down into mattress fibre (33.1%) and dust (16.4%).

It is proposed to repeat the trials in a " Dry Decorticator " using unretted husks.

2. COIR DUST

In connection with the investigations on the technology of coir fibre, there was occasion to examine samples of coir waste for their mineral nutrient composition. (i) Four composite samples of dry milled coir fibre dust from unretted husks, processed in a " Dry Decorticator " were analysed with the results shown in Table VIII.

(ii) Twelve composite samples of coir fibre dust from retted husks, processed in " Fibre Drums " at twelve different factories in the Chilaw district were analysed with the results shown in Table IX. Sifting trials on these 12 samples were made to get an estimate of the percentage composition of the constituent grades. The results are summarised in Table X.

TABLE VIII

Analytical Data on Four Composite Samples of Coir Fibre Dust produced from Unretted Coconut Husks processed in a " Dry Decorticator "

Mineral Constituents (Calculated on Dry Weight and on Mean Moisture Values) (Per Cent)

1	2					3					4				
CONSTITUENT	POWDERED SAMPLES (As Analysed)					ORIGINAL (Air-dry Basis)					ORIGINAL (Wet Basis)				
	Oven-Dry Basis					(Calculated on 11.7% Moisture)					(Calculated on 87.9% Moisture)				
	I	II	III	IV	Mean	I	II	III	IV	Mean	I	II	III	IV	Mean
Nitrogen (as N) ...	0.18	0.18	0.18	0.16	0.18	0.16	0.16	0.14	0.16	0.02	0.02	0.02	0.02	0.02	0.02
Phosphorus (as P_2O_5)	0.09	0.10	0.07	0.09	0.09	0.08	0.09	0.06	0.08	0.08	0.01	0.01	0.01	0.01	0.01
Potassium (as K_2O)	2.05	1.87	1.05	1.33	1.58	1.81	1.65	0.93	1.17	1.40	0.25	0.23	0.13	0.16	0.19
Calcium (as CaO) ...	0.25	0.30	0.19	0.22	0.24	0.22	0.26	0.17	0.19	0.21	0.03	0.04	0.02	0.03	0.03
Magnesium (as MgO)	0.25	0.25	0.35	0.42	0.32	0.22	0.22	0.31	0.37	0.28	0.03	0.03	0.04	0.05	0.04
Total Mineral Matter (ASH)	7.14	7.38	3.84	4.28	5.66	6.30	6.52	3.39	3.78	5.00	0.86	0.89	0.46	0.52	0.68

TABLE IX

Analytical Data on Twelve Composite Samples of Coir Fibre Dust produced from Retted Coconut Husks—"DRUM PROCESSING"

Mineral Constituent (PER CENT)

CONSTITUENT	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	MEAN
(a) POWDERED SAMPLES AS ANALYSED (Oven-dry Basis)													
Nitrogen (as N)	0.44	0.51	0.50	0.46	0.43	0.47	0.49	0.43	0.41	0.55	0.42	0.47	0.46
Phosphorus (as P_2O_5)	0.18	0.12	0.10	0.12	0.07	0.10	0.11	0.08	0.10	0.06	0.15	0.11	0.11
Potassium (as K_2O)	0.50	0.47	0.63	0.76	0.54	0.98	1.52	0.89	1.35	1.43	2.12	0.92	1.01
Calcium (as CaO)	0.46	0.50	0.41	0.38	0.37	0.28	0.29	0.30	0.28	0.27	0.29	0.40	0.35
Magnesium (as MgO)	0.66	0.50	0.66	0.84	0.30	0.25	0.39	0.48	0.37	0.51	0.48	0.66	0.51
Total Mineral Matter (ASH) ...	7.9	5.2	5.4	9.3	6.5	8.2	7.5	7.5	8.5	8.6	9.4	6.5	7.5
(b) ORIGINAL (Air-Dry Basis)—Calculated on 11.7% Moisture.													
Nitrogen (as N)	0.39	0.45	0.44	0.41	0.38	0.42	0.43	0.38	0.36	0.49	0.37	0.42	0.41
Phosphorus (as P_2O_5)	0.16	0.11	0.09	0.11	0.06	0.09	0.10	0.07	0.09	0.05	0.13	0.10	0.10
Potassium (as K_2O)	0.44	0.42	0.56	0.67	0.48	0.87	1.34	0.79	1.19	1.26	1.87	0.81	0.89
Calcium (as CaO)	0.41	0.44	0.36	0.34	0.33	0.25	0.26	0.26	0.25	0.24	0.26	0.35	0.31
Magnesium (as MgO)	0.58	0.44	0.58	0.74	0.26	0.22	0.34	0.42	0.33	0.45	0.42	0.58	0.45
Total Mineral Matter (ASH) ...	7.0	4.6	4.8	8.2	5.7	7.2	6.6	6.6	7.5	7.6	8.3	5.7	6.6
(c) ORIGINAL (Wet Basis)—Calculated on 87.9% Moisture													
Nitrogen (as N)	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.05	0.05	0.07	0.05	0.06	0.06
Phosphorus (as P_2O_5)	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Potassium (as K_2O)	0.06	0.06	0.08	0.09	0.07	0.12	0.18	0.11	0.16	0.17	0.26	0.11	0.12
Calcium (as CaO)	0.06	0.06	0.05	0.05	0.04	0.03	0.04	0.04	0.03	0.03	0.04	0.05	0.04
Magnesium (as MgO)	0.08	0.06	0.08	0.10	0.04	0.03	0.05	0.06	0.04	0.06	0.06	0.08	0.06
Total Mineral Matter (ASH) ...	0.96	0.63	0.65	1.13	0.79	0.99	0.91	0.91	1.03	1.04	1.14	0.79	0 91

TABLE X

Percentage composition of the Constituent Grades of Coir Dust from retted husks processed in " Fibre Drums "

(Sieve Used—5—mesh per linear inch)

1	2	3	4	5
SAMPLE	*Epicarp and Broken Fibre (%)*	*Coarse Fibrous Dust (%)*	*Fine Corky Dust (%)*	*Total composite Dust (%)*
I	6.5	19.5	74.0	100.0
II	14.5	11.4	74.1	100 0
III	10.6	15.9	73.5	100.0
IV	11.1	14.3	74.6	100.0
V	5.1	15.2	79.7	100.0
VI	21.3	11.1	67.6	100.0
VII	8.0	12 0	80 0	100.0
VIII	10.1	9.6	80.3	100.0
IX	10.8	16.1	73.1	100.0
X	10.6	9.3	80.1	100.0
XI	14.8	12.5	72.7	100.0
XII	14.7	7.9	77.4	100.0
MEAN	11.5	12.9	75.6	100.0

III. STUDIES ON THE COCONUT ENDOSPERM

(*a*) Moisture and oil gradients in the coconut kernel during the development of the drupe.

This work is in continuation of what has been reported earlier on dead ripe fallen nuts where interesting observations have been made on moisture, oil, sugar and mineral gradients in the kernel on segments drawn from the equatorial region of the endosperm.

As before, samples of the segments for examination were drawn by slicing the following regions of the kernel parallel to the testa :—

T ... Testa
RT ... Region near testa
IR ... Intermediate region
RW ... Region near water cavity.

The drupes from six palms were sampled and the following developmental stages were studied :—

Developmental Stage of Floral Branch	*No. of months since opening of spathe*	*Description*	*Regions sampled*
40	8	" Tender Kalati "	RT and RW
41	9	" Kalati "	T, IR & RW
42	10	" Mature Kalati "	T, RT, IR & RW
44	12	" Ripe Green "	T, RT, IR & RW

The full results obtained in the study, which are self explanatory are presented in Tables XI to XIV.

TABLE XI

Oil and Moisture Gradients in the " Ripe Green Nuts "

SAMPLE	I			II			III			IV			V			VI			Mean %	Mean % Oil (Six Samples)	
REGION	% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		Moisture (Six Samples)		
		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry
T ...	25.1	58.5	59.1	25.1	68.0	68.0	26.7	69.7	69.8	22.9	68.7	69.0	27.2	68.3	68.4	23.6	68.4	68.5	25.1	66.9	67.1
RT ...	18.4	77.6	78.5	23.9	79.1	79.2	21.1	78.2	78.4	18.9	79.1	79.3	22.3	77.0	77.1	20.4	77.5	77.5	20.8	78.1	78.3
IR ...	26.9	73.0	74.8	38.4	74.6	74.8	32.5	74.2	74.6	33.2	74.4	74.5	35.8	72.6	72.7	34.0	71.7	71.7	33.5	73.4	73.8
RW ...	39.6	41.2	56.9	64.8	54.5	54.7	57.8	55.6	55.8	57.8	57.0	57.2	62.8	52.7	52.7	63.7	48.4	48.5	57.7	51.6	54.3
MEAN ...	27.5	62.6	67.3	38.1	69.1	69.2	34.5	69.4	69.6	33.2	69.8	70.0	37.0	67.6	67.7	35.4	66.5	66.5	34.3	67.5	68.4

TABLE XII

Oil and Moisture Gradients in the " Mature Kalati "

SAMPLE	I			II			III			IV			V			VI			Mean %	Mean % Oil (Six Samples)	
REGION	% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		Moisture (Six Samples)		
		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry
T ...	66.5	51.4	57.8	42.3	68.9	70.3	62.4	62.5	64.3	50.4	66.1	67.4	66.4	59.0	59.8	60.9	62.3	63.1	58.2	61.7	63.8
RT ...	56.9	70.5	71.9	33.1	78.6	78.6	49.7	74.4	74.7	37.6	77.0	77.2	56.3	71.3	71.4	49.6	73.3	73.4	47.2	74.2	74.6
IR ...	54.1	70.1	71.7	39.1	76.3	76.8	45.7	74.1	74.8	39.9	74.0	74.7	53.5	71.4	71.9	45.8	73.8	74.2	46.3	73 3	74 0
RW ...	70.1	56.4	58.1	63.1	61.5	62.2	68.3	57.7	58.6	66.4	57.8	59.0	70.6	54.5	55.3	64.7	59.9	60.6	67.2	57.9	59.0
MEAN ...	61.9	62.4	64.9	44.4	71.3	72.0	56.5	67.2	68.1	48.6	68.4	69.6	61.7	64.1	64.6	55.3	67.3	67.8	54.7	66.8	67.8

T — Testa
RT — Region near testa
IR — Intermediate Region
RW — Region near Water Cavity.

TABLE XIII

Oil and Moisture Gradients in the "Kalati"

SAMPLE	I			II			III			IV			V			VI			Mean % Moisture	Mean % Oil	
REGION	% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil				
		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry
T ...	74.9	48.3	51.0	72.0	56.3	56.5	68.9	56.8	56.9	68.4	55.8	56.1	68.7	61.5	61.6	66.2	57.3	57.6	69.9	56.0	56.6
IR ...	67.5	70.5	70.9	66.2	68.2	69.0	62.2	69.9	70.5	57.7	71.1	71.6	61.3	69.0	70.1	52.4	71.4	72.2	61.2	70.0	70.7
RW ...	74.1	56.9	58.3	77.8	53.9	54.0	69.7	62.0	62.1	69.5	62.0	62.9	70.4	59.8	59.7	64.1	62.5	62.8	70.9	59.5	59.9
MEAN ...	72.2	58.5	60.1	72.0	59.5	59.8	66.9	62.9	63.2	65.2	63.0	63.5	66.8	63.4	63.8	60.9	63.7	64.2	67.3	61.8	62.4

TABLE XIV

Oil and Moisture Gradients in the "Tender Kalati"

SAMPLE	I			II			III			IV			V			VI			Mean % Moisture	Mean % Oil	
REGION	% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil		% Moisture	% Oil				
		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry		Wet	Dry
T ...	81.9	36.4	36.7	83.4	40.7	41.1	79.4	49.3	49.3	76.1	51.5	51.7	71.1	60.2	60.4	74.1	54.1	54.2	77.7	48.7	48.9
RW ...	85.1	47.6	47.8	87.0	44.2	44.9	82.7	48.3	48.4	76.5	52.1	52.7	74.2	56.0	56.1	77.2	53.4	53.5	80.5	50.3	50.6
MEAN ...	83.5	42.0	42.3	85.2	42.5	43.0	81.1	48.8	48.8	76.3	51.8	52.2	72.7	58.1	58.2	75.7	53.8	53.9	79.1	49.5	49.7

T — Testa

IR — Intermediate Region

RT — Region near testa

RW — Region near water cavity.

(*b*) Protein and Mineral gradients in the Coconut kernel during the development of the drupe.

Studies on these are in progress and the results will be reported on completion of the work.

IV. POT-CULTURE EXPERIMENT

(*a*) The seventh sand pot-culture experiment on 288 seedlings laid down on 24th December 1966 to establish the pattern of nutrient distribution in the leaves (by rank) for seven treatments, using the " Leaf punch " technique, was concluded during the year.

(*b*) The chemical examination of plant samples prepared from previous sand pot-culture experiments was continued during the year.

V. ARRACK

Twelve palms were tapped for toddy during the year. The toddy collected was used for laboratory studies on fermentation efficiencies and the preparation of experimental samples of arrack (High Wines).

VI. VINEGAR

The vinegar generator installed at the factory at Nainamadama, continued to operate satisfactorily during the year. Arrangements for extending the factory and installing a second generator were under way at the close of the year.

VII. MISCELLANEOUS WORK

(*a*) Analyses and reports were made during the year on samples of copra, poonac and vinegar.

(*b*) There was occasion to examine samples of extracted meal from the kernels of San Ramon and Ceylon (*typica*) coconuts. The following results were obtained in the study.

ANALYSIS OF EXTRACTED MEAL SAMPLES

(Dry basis)

	% *N*	% P_2O_5	% K_2O	% *CaO*	% *MgO*
Ceylon Nuts	3.7	1.6	2.5	0.07	0.51
San Ramon	3.6	1.3	1.6	0.07	0.47

W. R. N. NATHANAEL,
Chemist.

Ceylon Cocon. Quart. (*1968*) **19**, 32–33

REPORT OF THE OFFICER-IN-CHARGE BOTANY DIVISION

1. The Division functioned throughout the year under the Officer-in-Charge.

2. **Pollination Programme.**—Routine pollination work to raise hand pollinated seedlings for distribution to the industry was carried out at five stations. Work on a further 500 palms at Kiniyama and Andigedera Estates commenced in 1967. Details pertaining to pollination work are as follows :—

STATIONS

Month	*Rathmalagara Estate*	*Bandirippuwa Estate*	*Marandawila Estate*	*I.S.G.*	*Achchitotam Estate*	*Kiniyama Estate*
January ...	688	1157	689	814	993	—
February ...	618	1147	519	938	953	—
March ...	548	1354	759	830	1334	—
April ...	592	1280	681	839	1383	—
May ...	667	1034	719	663	1861	—
June ...	1170	1558	828	1048	1728	—
July ...	1313	1279	712	1002	1605	3653
August ...	1108	1513	719	1167	2108	6161
September ...	1092	1290	515	371	2066	5640
October ...	758	698	684	563	1650	4834
November ...	992	740	660	692	1491	4085
December ...	649	822	574	405	1163	3206
	10,195	13,872	8059	9332	18,335	27,579

Total female flowers —87,372

Systematic emasculation of the Dwarf palms at the Isolated Seed Garden for the large scale production of hybrid seedlings was continued. Summary of the seednuts harvested from pollinations done during the year is as follows :—

Station	Tall × Tall	*Open Pollinated*
Bandirippuwa Estate	4783	—
Rathmalagara Estate	2060	1
Marandawila Estate	1822	203
Isolated Seed Garden	2729	—
Achchitotam Estate	4639	219
	16,033	423

Grand Total — 16,456

Apart from the above, 11,340 seednuts (Dwarf × Tall) resulting from the open pollination of emasculated dwarf palms at the Isolated Seed Garden were harvested.

506 tubes of Tall and 359 tubes of Dwarf pollen were supplied to 17 private estates for their own pollination work.

3. The Field Experiments at Bandirippuwa Estate, Rathmalagara Estate, Pothukulama Research Station and the Walpita Progeny Trial were maintained throughout the year. Yield data etc. were recorded as usual from these experiments.

4. A new nursery of about 2 acres was established at Bandirippuwa Estate. 17,612 (Tall × Tall) and (Dwarf × Tall) seedlings and 3,522 open pollinated seedlings were issued to the industry.

5. **Mother Palm Seed Supply :** 1,694,241 seednuts were supplied to the Planting Division nurseries.

6. **Personnel :** Mr. R. W. Senaratne, District Coconut Instructor, was seconded for service in the Botany Division. Mr. V. Dharmadasa was appointed Field Assistant in 1967.

R. B. RODRIGO,
Officer-in-Charge,
Botany Division.

Coconut Research Institute,
26th March, 1968.

Ceylon Cocon. Quart. (*1968*) **19**, 34–52

REPORT OF THE ACTING SOIL CHEMIST

SUMMARY

A. FIELD EXPERIMENTS

The long term experiments at Bandirippuwa, Ratmalagara, Bingiriya, Pothukulama, Walahapitiya, and Mawatte were maintained. New field experiments were begun at Naiwala, Bingiriya and Rathgama. The observation trials on the problems of leaf scorch at Kirimetiya, yellowing at Iranaville, and immature nutfall at Palugaswetiya were continued.

The experiments at Bandirippuwa and Ratmalagara showed responses to N, P, and K, while the experiment at Pothukulama showed no response to P.

On a light sandy loam soil at Bingiriya no significant difference in effect has been shown between organic and inorganic fertilizers nor between annual and biennial manuring. But the annual manuring with inorganic fertilizers is building up faster than the other treatments.

On the coastal marine sandy soil at Iranaville where annual application of fertilizer produced poor yields the quarterly application of fertilizer has increased the yield of nuts ranging from 117 to 204%.

B. LABORATORY INVESTIGATIONS

Pursuant to the long term project of developing a method for making manurial recommendations to individual lands the chemical composition of coconut water and leaf samples from the 4^3 NPK experiment at Bandirippuwa Estate and the 3^3 NPK experiment at Ratmalagara Estate were determined. Both in nut water and leaf samples the content of N, P and K was raised by the supply of the respective fertilizer.

The soil nitrogen studies at Iranaville Estate were continued during the year.

A contract was signed with the International Atomic Energy Agency to conduct studies on the efficiency of fertilizer utilization by coconut palms.

C. SOIL SURVEYS

The major project was the regional soil survey of the coconut growing areas of the Eastern Province. Soil surveys were also conducted for alienation of lands under Government Schemes.

A. FIELD EXPERIMENTS

1. 4 × 4 × 4 NPK Experiment on Adult Palms (Bandirippuwa Estate).

[Details of Treatment and Design appear in the CRI, Annual Report for 1960].

The eighth year of the experiment ended in November 1967 and the annual manuring was carried out in October 1967. The fertilizer was applied on the surface in the entire area within a radius of 6 feet from the palm and the soil turned in.

Leaf samples were taken from the experimental palms in April 1967 for chemical analysis and nut water sampled form the nuts picked at the time of leaf sampling was also analysed (see under " Laboratory Investigations " in Section C).

Potash continues to give a highly significant response and phosphorus, at the rate of 1.5 lbs. P_2O_5, also gave significant response. NP and NK interactions also showed significance. The main effects are shown in Table A1 and the NP, NK, PK, interactions in Table A2.

TABLE A 1

Yield Data for 1967—4^3 NPK Experiment on Adult Palms—Bandirippuwa Estate

66 palms/acre

Copra Yields adjusted by covariance analysis

Treatment (ANNUAL)	*lbs. Copra/Acre*	*%*	*Difference in lbs. Copra/Acre*
N_0 (0.0 lbs. N)	1303	100	—
N_1 (0.5 lbs. N)	1369	105.1	+ 66
N_2 (1.0 lbs. N)	1410	108.2	+107
N_3 (1.5 lbs. N)	1336	102.5	+ 33
P_0 (0.0 lbs. P_2O_5)	1318	100	—
P_1 (0.5 lbs. P_2O_5)	1319	100.1	+ 1
P_2 (1.0 lbs. P_2O_5)	1311	99.5	— 7
P_3 (1.5 lbs. P_2O_5)	1470	111.5	+152*
K_0 (0.0 lbs. K_2O)	999	100	—
K_1 (0.5 lbs. K_2O)	1370	137.1	+371**
K_2 (1.0 lbs. K_2O)	1561	156.3	+562***
K_3 (1.5 lbs. K_2O)	1487	148.8	+488***

Significant difference P 0.05 ≏ 141.0 lbs. copra/acre.

*Significant at P 0.05

**Significant at P 0.01

***Significant at P 0.001

TABLE A 2

Adjusted Interactions—lbs. Copra/Acre

	N_0	N_1	N_2	N_3
K_0	1134	962	1025	876
K_1	1355	1387	1316	1425
K_2	1267	1670	1708	1601
K_3	1458	1456	1596	1441

	P_0	P_1	P_2	P_3
K_0	1019	1052	853	1074
K_1	1378	1237	1314	1552
K_2	1538	1566	1489	1654
K_3	1336	1423	1587	1603

	P_0	P_1	P_2	P_3
N_0	1245	1276	1126	1565
N_1	1280	1424	1370	1400
N_2	1507	1221	1416	1497
N_3	1238	1356	1330	1417

2. Manurial × Cultivation Experiment (Ratmalagara Estate).

(Details of Treatment and Design appear in CRI Annual Reports for 1959 and 1965).

The 24th year of the experiment was completed in July 1967. The annual manuring was carried out in June 1967. The experimental treatments were modified in May 1965 and the effects of the earlier treatments still persist.

3. 3 × 3 × 3 NPK Experiment on Young Palms (Ratmalagara Estate).

[Details of Treatment and Design appear in CRI Annual Reports for 1959 and 1965].

The experiment completed 19 years in December 1967. The annual manuring due in November 1967 had to be postponed, owing to adverse weather conditions.

The main effects of N, P, and K for 1967 are shown in Table A 3 and the NP, NK, and PK interactions in Table A 4. While the effect of phosphorus was highly significant, that of potassium was significant at the 0.05 level. The NK interaction was also significant at the 0.05 level showing that the response to potassium is better with increasing nitrogen.

TABLE A 3

Yield Data for 1967—3×3×3 NPK Experiment on Young Palms

Ratmalagara Estate

55 Palms/acre

Treatment Annual	lbs. Copra per Acre	%	Difference lbs. Copra/ Acre	Copra Outturn Nuts/Candy
N_0 (1½ lbs. Ammonium Sulphate)	1184	100	—	1145
N_1 (3 lbs. Ammonium Sulphate)	1312	111	+128*	1173
N_2 (4½ lbs. Ammonium Sulphate)	1303	110	+119	1221
P_0 (1 lb. Saphos Phosphate)	919	100	—	1115
P_1 (2 lbs. Saphos Phosphate)	1452	158	+533***	1184
P_2 (3 lbs. Saphos Phosphate)	1427	155	+508***	1220
K_0 (1½ lbs. Muriate of Potash)	1165	100	—	1220
K_1 (3 lbs. Muriate of Potash)	1278	110	+113	1162
K_2 (4½ lbs. Muriate of Potash)	1355	116	+190*	1165

Significant difference at P 0.05 = 122.9 lbs./acre.

*Significant at P 0.05
***Significant at P 0.001

TABLE A 4

lbs. Copra/Acre

	N_0	N_1	N_2
K_0	1188	1196	1111
K_1	1174	1336	1324
K_2	1189	1404	1472
	P_0	P_1	P_2
K_0	906	1253	1335
K_1	894	1522	1417
K_2	957	1581	1527
	P_0	P_1	P_2
N_0	941	1312	1298
N_1	903	1538	1496
N_2	914	1507	1486

4. 4×4×4 NPK Experiment on Young Palms—Pothukulama Research Station.

[Details of Design and Treatment given in CRI Annual Reports for 1961 and 1963].

The experiment completed 7 years in 1967. Biannual manuring, practised during the first six years, was abandoned at the end of 1966. The first annual manuring was done in December 1967.

By the end of 1967 over 80% of the palms had come into flower. The yield data, in terms of nuts, are given in Table A 5. Only phosphorus has shown significant response, at 0.05 level. The result may be due to the palms flowering early.

TABLE A 5

Yield of Nuts for 1967—4^3 NPK Experiment on Young Palms. Pothukulama Research Station

72 Palms/Acre

Treatment	*Nuts/acre*	%
N_0	2095	100
N_1	2530	120.76
N_2	2386	113.89
N_3	2168	103.48
P_0	1898	100
P_1	2318	122.12
P_2	2387	125.76
P_3	2574	135.62
K_0	1990	100
K_1	2389	120.05
K_2	2318	116.48
K_3	2480	124.62

5. Manurial Experiment on Organics *vs.* Inorganics and Frequency of Manuring [Co-operative Experiment at Marandawila Estate, Bingiriya].

(Details of Treatment and Design appear in CRI Annual Reports for 1959, 1964, and 1965).

The 9th year of the experiment ended in June 1967 and manuring of the annual plots was done in May 1967.

No significant difference has yet been shown between organic and inorganic fertilizers nor between annual and biennial manuring. However, the plots treated annually with inorganic fertilizers are building up faster than the others.

The yield data for the year is given in Table A 6.

TABLE A 6

Yield Data for the year ending June 1967—Experiment on Organics Vs. Inorganics, Marandawila Estate

Copra Yields adjusted by Covariance Analysis—60 Palms/Acre

	lbs. Copra/Acre	*Difference in lbs. Copra/Acre*	*Copra Outturn Nuts/Candy*
Control	1512	—	1340
Inorganics Annually	2021	+509	1242
Inorganics Biennially	1849	+337	1202
Organics Annually	1896	+384	1185
Organics Biennially	1797	+285	1243
Cattle Manure Supplemented	1906	+984	1201

6. Methods of Placement and Liming Experiment on Adult Palms. (Co-operative Experiment at Walahapitiya Estate, Nattandiya).

(Details of Treatment and Design Appear in CRI Annual Reports for 1961 and 1965).

The sixth year of the experiment ended in December 1967 and the annual manuring was carried out in October 1967. No lime was applied in 1967. To the end of 1966 the limed plots have received a total of 4¾ tons of lime per acre. In July 1967 soil samples were taken from the limed plots and pH determined. The pH values ranged from 7.16 to 11.32 for the top soil (0-9") and 6.05 to 8.08 for the sub-soil (9-18").

All three methods of application gave highly significant results.

TABLE A 7

Yield Data for 1967—Experiment on Fertilizer Placement and Liming—Walahapitiya Estate (Yields Adjusted by Covariance Analysis)

50 Palms/Acre

Treatment	*lbs. Copra/Acre*	*%*	*Difference lbs. Copra/Acre*
O (No fertilizers)	645	100	—
B (Broadcast)	1016	157.5	+371***
C (Surface Application up to 6 ft. from Base)	992	153.8	+347***
S (Spread on surface in circular strips) ...	951	147.4	+306***

Significant difference P 0.05 = 70.2 lbs. Copra/acre.
***Significant at P 0.001.

L_0 (No Lime)	851	100	—
L_1 (Lime)	950	111.6	+ 99
O (No Fertilizer)	645	100	—
F_1 (3½ lbs. NPK Mixture)	783	121.4	+138
F_2 (7 lbs. NPK Mixture)	1189	184.3	+544

TABLE A 8

pH of Soils

Experiment on Fertilizer Placement and Liming—Walahapitiya Estate

Sample	pH	
	Top-Soil 0-9"	Sub-Soil 9-18"
1	11.32	7.94
2	9.44	6.05
3	8.61	6.62
4	10.84	8.08
5	10.56	7.00
6	7.75	6.32
7	8.26	6.05
8	9.86	6.54
9	8.40	6.67
10	7.92	7.78
11	8.31	7.90
12	7.16	6.32

7. Experiment on Quality of Nitrogen and Frequency of Manuring—Mawatte Estate, Dankotuwa (Co-operative Experiment).

[Details of Treatment and Design appear in the CRI Annual Report for 1964].

The experiment completed three years in December 1967. The half yearly and annual manuring were done in June and December 1967, respectively.

8. Experiment on Quality of Nitrogen and Phosphorus and Frequency of Manuring—Pothukulama.

The object of the experiment is to compare the effect of different sources of nitrogen and phosphorus at two frequencies of application—half yearly and yearly—on young coconut seedlings planted on a sandy loam soil in a virgin jungle clearing. The sources of nitrogen are ammonium sulphate, sodium nitrate and urea and of phosphorus saphos phosphate and super phosphate.

The design of the experiment consists of 3 blocks of 13 plots each—one zero fertilizer plot and 12 plots representing the factorial effects of 3 forms of nitrogen, 2 forms of phosphorus and two frequencies. Each plot consists of 15 palms.

The first differential manuring was done in June 1967. All the seedlings were given a basic dose of 1 lb. of muriate of potash (60%). The rates of nitrogen and phosphorus per seedling are :

Sulphate of Ammonia	1 lb. (half yearly)	2 lbs. (yearly)
Sodium nitrate	1.28 lbs. ,,	2.575 lbs. ,,
Urea	0.45 lbs. ,,	0.896 lbs. ,,
Saphos Phosphate	0.75 lbs. ,,	1.50 lbs. ,,
Super Phosphate	0.50 lbs. ,,	1.00 lbs. ,,

9. 5×5×5 NPK Experiment on Adult Palms, Naiwala Estate, Veyangoda (Co-operative Experiment).

The object of the experiment is to determine the yield response curves of adult coconut palms to the application of inorganic N, P and K fertilizers for assessing the optimum levels of fertilizer applications under the soil (lateritic) and climatic (wet zone) conditions prevalent at Naiwala Estate which is typical of coconut lands in the Colombo District.

The experimental design consists of Boxe's central composite rotatable second order design. There are 15 plots, each plot with 18 palms. Each of the factors N (as ammonium sulphate), P (as saphos phosphate), and K (as muriate of potash 60% K_2O), will be tested at the 5 different levels given below.

The rates per palm per annum are :

	lbs. N	*lbs. Ammonium Sulphate (20.6%N)*		*lbs. P_2O_5*	*Saphos phosphate (27.5% P_2O_5)*
N_0	0.0	0.0	P_0	0.0	0.0
N_1	0.5	2.43	P_1	0.5	1.82
N_2	1.0	4.86	P_2	1.0	3.64
N_3	1.5	7.29	P_3	1.5	5.46
N_4	2.0	9.72	P_4	2.0	7.28

	lbs. K_2O	*lbs. Muriate of Potash (60% K_2O)*
K_0	0.0	0.0
K_1	0.6	1.0
K_2	1.2	2.0
K_3	1.8	3.0
K_4	2.4	4.0

Leaf samples were taken from all the plot palms in March 1967 and soil samples in May 1967. The first differential manuring was done in July 1967. The manure was applied on the surface in the entire area within a radius of 6 feet from the base of the palm and turned into the soil.

10. 5×5×5×5 NPK Mg Experiment on Adult Palms, Marandawila Estate, Bingiriya (Co-operative Experiment).

The object of the experiment is to determine the yield response curves of adult coconut palms to the application of inorganic N, P, K and Mg fertilizers in order to assess the optimum levels of fertilizer application under the soil (sandy loam) and climatic (intermediate zone) conditions represented at Marandawila Estate.

The experimental design consists of a central composite rotatable second order design. There are 31 plots, each plot with 18 palms. Each of the factors N (as ammonium sulphate), P (as saphos phosphate), K (as muriate of potash) and Mg (as Kieserite) will be tested at the 5 different levels given below.

The rates per palm per annum are :

	lbs. N	*lbs. Ammonium sulphate (20.6%N)*		*lbs. P_2O_5*	*lbs. Saphos phosphate (27.5% P_2O_5)*
N_0	0.0	0.0	P_0	0.0	0.0
N_1	0.5	2.43	P_1	0.5	1.82
N_2	1.0	4.86	P_2	1.0	3.64
N_3	1.5	7.29	P_3	1.5	5.46
N_4	2.0	9.72	P_4	2.0	7.28
	lbs. K_2O	*lbs. Muriate of Potash (60% K_2O)*		*lbs. MgO*	*lbs. Kieserite (24% MgO)*
K_0	0.0	0.0	Mg_0	0.0	0.0
K_1	0.6	1.0	Mg_1	0.36	1.5
K_2	1.2	2.0	Mg_2	0.72	3.0
K_3	1.8	3.0	Mg_3	1.08	4.5
K_4	2.4	4.0	Mg_4	1.44	6.0

At the completion of an year's premanurial recording of yield, the first differential manuring was done in November 1967. Prior to manuring, leaf samples were taken from all the plot palms in October 1967. Soil samples were also taken about the same time.

11. 5×5×5×5 NPK Mg Experiment on Adult Palms, Monrovia Estate, Rathgama (Co-operative Experiment).

The object of the experiment is to determine the yield response curves of adult coconut palms to the application of inorganic N, P, K and Mg fertilizers in order to assess the optimum levels of fertilizer application under the soil (lateritic) and climatic (wet zone) conditions prevalent at Monrovia Estate which is typical of coconut lands in the Southern Province.

The experimental design consists of a central composite rotatable second order design. There are 31 plots, each plot containing 18 palms, Each of the factors N (as Ammonium sulphate), P (as Saphos phosphate), K (as Muriate of potash, 60% K_2O), and Mg (as Kieserite, 24% MgO) will be tested at the 5 different levels given below.

The rates per palm per annum are :

	lbs. N	*lbs. Ammonium Sulphate (20.6%N)*		*lbs. P_2O_5*	*lbs. Saphos phosphate (27.5% P_2O_5)*
N_0	0.0	0.0	P_0	0.0	0.0
N_1	0.5	2.43	P_1	0.5	1.82
N_2	1.0	4.86	P_2	1.0	3.66
N_3	1.5	7.29	P_3	1.5	5.46
N_4	2.0	9.72	P_4	2.0	7.28
	lbs. K_2O	*lbs. Muriate of Potash (60% K_2O)*		*lbs. MgO*	*lbs. Kieserite (24% MgO)*
K_0	0.0	0.0	Mg_0	0.0	0.0
K_1	0.6	1.0	Mg_1	0.36	1.5
K_2	1.2	2.0	Mg_2	0.72	3.0
K_3	1.8	3.0	Mg_3	1.08	4.5
K_4	2.4	4.0	Mg_4	1.44	6.0

Leaf samples were taken from all the plot palms in October 1967, followed by soil samples.

The first differential manuring was done in November 1967 at the conclusion of an year's premanurial recording of yield data.

12. **5×5×5 B Zn S Experiment on Adult Palms—Monrovia Estate, Rathgama, (Co-operative Experiment).**

Pre-manurial recording of nuts and number of female flowers was continued during the year. Contour drains were opened :

13. **Leaf Scorch Problem, Gonapinuwela Area.** (See also CRI Annual Reports for 1961 to 1964).

The two groups of healthy (220) and affected (220) palms were continued to be treated with the different combinattions of nutrients (see annual report for 1965). The recording of nuts and female flowers was maintained.

During the year 19 more palms showed symptom of scorch, bringing the total of affected palms in the original group of healthy palms to 33 ; from the group of affected palms 9 died making the total to date 27. The effected palms showed no signs of improvement. Since 1965 the yield has been declining. The yield per palm for the 4 years 1964-1967 are as follows :—

	1964	*1965*	*1966*	*1967*
Affected palms	38	43	28	25
Healthy palms	65	84	75	71

14. Observation Trials on Nitrogen Quality (Iranaville Estate, Chilaw).

(See CRI Annual Reports for 1965 and 1966).

To the end of December 1967 six quarterly applications of the different combinations of fertilizers have been made. The following increases over the premanurial figures have been recorded : female flowers 162 to 392 per cent ; nuts 117 to 204 per cent ; and copra 111 to 198 per cent. Table A 10 gives the data on female flowers, nuts, and copra for the premanurial year and the first manurial year.

TABLE A 10

Yield Data of Female Flowers, Nuts, and Copra—Iranaville Estate, Chilaw.

Treatment (40 palms each)	*FEMALE FLOWERS*		*NUTS*		*COPRA (lbs.)*	
	Pre manurial	*1967*	*Pre manurial*	*1967*	*Pre manurial*	*1967*
1	351	1090	293	599	135	267
2	446	1030	382	620	172	265
3	400	975	546	731	253	320
4	490	1429	490	808	222	335
5	435	1085	442	659	203	289
6	578	937	523	612	245	271
7	576	1157	347	599	153	238
8	478	1876	351	513	161	212
9	596	1358	368	687	174	293
10	330	1183	248	425	111	170

15. Observation Trial on Immature Nutfall—Palugaswetiya Estate, Weerapokuna.

The treatments, commenced in October 1966, were continued during the year. The immature nutfall data for the year 1967 together with the figures for the two preceding premanurial years are given in Tables A 11 and A 12.

TABLE A 11

Immature Nutfall (Healthy Palms)—Total of 5 Palms

TREATMENT	*Pre-Treatment year 1*		*Pre-Treatment year 2*		*1967*	
	Fit for Copra	*Unfit for Copra*	*Fit for Copra*	*Unfit for Copra*	*Fit for Copra*	*Unfit for Copra*
CRI " C " Mixture 10 lbs. ...	3	7	2	17	—	21
Barium Nitrate 3 lbs.	1	3	5	1	2	15
Strontium Nitrate 3 lbs. ...	1	4	1	4	2	25
Barium Nitrate 2 lbs.+) ...	20	3	7	4	—	20
Strontium Nitrate 2 lbs.) ...						
Gypsum 20 lbs.	3	7	15	10	—	49

TABLE A 12

Immature Nutfall (Nutfall Palms)—Total of 25 Palms

TREATMENT	Pre-Treatment year 1		Pre-Treatment year 2		1967	
	Fit for Copra	Unfit for Copra	Fit for Copra	Unfit for Copra	Fit for Copra	Unfit for Copra
CRI " C " Mixture 10 lbs. ...	696	968	850	857	496	465
CRI " C " Mixture 10 lbs.+ Muriate of Potash (60%) 10 lbs. ...	777	1864	731	1387	666	801

B. LABORATORY INVESTIGATIONS

1. Leaf and Nut Water Analysis—3×3×3 NPK Experiment on Young Palms, Ratmalagara Estate.

In February 1967 leaf samples were taken from the 3 × 3 × 3 NPK experiment on young palms. From each of the 18 palms in a plot the 14th frond was cut down. From the mid-region of each frond 3 leaflets from either side of the rachis were removed. The mid-rib of each leaflet was taken away and about 2 inches of the lower end of each leaflet was rejected. From the balance a piece about 10 inches long was removed to make the sample. The pieces thus removed from the leaflets formed a composite sample. The samples were dried in a dehydrator, ground to powder and analysed. The results are presented in Table B 1.

Nut water sampled from nuts picked at the same time as the leaf sampling was analysed for N, P, and K. From each plot 100 nuts were split and the water bulked. The sample for analysis was taken from the bulked water. The results are given in Table B 3.

Both in the leaves and nut water the content of N, P, and K has been raised by the supply of the respective fertilizers. This parallels the yield response (Table B 2).

In the leaves the supply of (i) nitrogen depressed the phosphorus, potassium, and magnesium content, (ii) phosphorus decreased the level of potassium and increased that of magnesium (iii) and potassium raised the level of calcium but reduced those of nitrogen, phosphorus and magnesium.

In nut water nitrogen decreased potassium, phosphorus increased nitrogen and decreased potassium content, and potassium reduced both nitrogen and phosphorus levels,

TABLE B I

3×3×3 NPK Experiment on Young Palms at Ratmalagara Estate

Analysis of 14th Leaf Samples—Sampled in February-March 1967

% Element on Oven-Dry Basis

Treatment	*N*	%	*P*	%	*K*	%	*Ca*	%	*Mg*	%
N_0	2.164	100.0	0.133	100.0	1.465	100.0	0.293	100.0	0.260	100.0
N_1	2.199	101.6	0.130	98.2	1.416	97.7	0.291	99.3	0.271	104.0
N_2	2.242	103.6	0.127	95.5	1.346	91.9	0.300	102.4	0.256	98.5
P_0	2.192	100	0.120	100.0	1.581	100.0	0.288	100.0	0.233	100.0
P_1	2.224	101.5	0.131	109.2	1.398	88.4	0.282	97.9	0.275	118.0
P_2	2.188	99.8	0.139	115.6	1.248	78.9	0.314	109.0	0.280	120.0
K_0	2.213	100	0.132	100.0	1.159	100.0	0.285	100.0	0.295	100.0
K_1	2.203	99.6	0.130	98.6	1.470	126.8	0.307	107.7	0.258	87.5
K_2	2.189	98.2	0.128	97.1	1.597	137.8	0.293	102.8	0.235	79.7

TABLE B 2

Copra Yields in lbs./Acre for 1967—3×3×3 NPK Experiment on Young Palms, Ratmalagara Estate

Treatment	*lbs. Copra/Acre*	%
N_0	1184	100
N_1	1312	111
N_2	1303	110
P_0	919	100
P_1	1452	158***
P_2	1427	155***
K_0	1165	100
K_1	1278	110
K_2	1355	116*

*Significant at P 0.05

***Significant at P 0.001

TABLE B 3

Nut Water Analysis

3×3×3 NPK Experiment on Young Palms—Ratmalagara Estate

Date of Sampling : April 1967

Treatment	*N* mg/lit.	%	P_2O_5 mg/lit.	%	K_2O mg/lit.	%
N_0	25	100.0	257	100.0	2.60	100.0
N_1	27	108.0	273	106.1	2.56	98.5
N_2	26	104.0	248	96.4	2.42	93.1
P_0	24	100.0	219	100.0	2.69	100.0
P_1	26	108.3	278	127.3	2.47	91.8
P_2	27	112.5	282	129.2	2.41	89.6
K_0	27	100.0	269	100.0	2.29	100.0
K_1	26	96.3	260	96.8	2.60	113.5
K_2	26	96.3	250	93.1	2.69	117.5

TABLE B 5

Specific Activities (Counts per minute/mg P)

10th day samples taken on 12th September 1967.
20th day samples taken on 22nd September 1967.
30th day samples taken on 2nd October 1967.
40th day samples taken on 12th October 1967.

PALM No.	1st LEAF				6th LEAF			
	10 Days	20 Days	30 Days	40 Days	10 Days	20 Days	30 Days	40 Days
1	21.9	32.1	147.7	119.7	62.8	76.4	114.5	194.4
2	49.8	49.3	108.9	127.0	52.0	65.8	162.4	179.1
3	85.2	117.5	140.5	129.1	207.4	124.7	238.2	238.2
4	22.7	66.3	71.4	141.1	46.3	73.9	154.3	207.1

TABLE B 6

Samples taken 20 days after the application of P 32.
Date of Sampling : 22nd September 1967
Specific Activities (Counts per minute/mg P)

LEAF No.	•SPECIFIC ACTIVITY Counts per minute/mg P				
	PALM 1	PALM 2	PALM 3	PALM 4	Mean of Palms 1, 2 & 4
1	32.1	49.3	117.5	66.3	49.2
3	82.2	53.8	144.8	82.9	73.0
6	76.4	65.8	124.7	73.9	72.0
9	70.0	59.3	103.0	82.1	70.4
12	55.6	55.5	91.7	73.2	61.5
15	72.5	53.9	94.7	68.6	65.0
18	54.8	54.8	99.3	61.6	57.1

2. Soil Nitrogen Studies on Iranaville Soils :

Soil samples were taken from the different groups just before each quarterly application of fertilizers. Total carbon, total nitrogen, ammoniacal and nitrate nitrogen were determined in these samples. Also the pH of the samples were measured.

No consistent trend in the content of total, Ammoniacal and nitrate nitrogen was discernible. No treatment has shown a tendency to increase the content of soil nitrogen. The content of total carbon has increased.

3. Radio Isotope Studies on Efficiency of Fertilizer Utilization by Coconut Palms. (In Co-operation with the International Atomic Energy Agency).

The Institute entered into a contract with the International Atomic Energy Agency in Vienna to conduct radio isotope studies on efficiency of fertilizer utilisation by coconut palms. A preliminary trial was carried out to determine (i) the rank of leaf to be sampled, and (ii) the effect of time on the pattern of uptake of the radioactive isotope.

Four palms of the same age, vegetative growth and yield, planted in a sandy loam soil were selected. The selected palms were separated from each other by an untreated palm. Each palm was treated with 5 mc. of radioactive phosphorus (P 32). The radioactive phosphorus was placed at a depth of 10 cms. in 16 points along a ring of radius 100 cms. from the palm, the points being evenly distributed along the ring.

Leaf samples were taken 10, 20, 30 and 40 days from the day of application of the isotope according to the following schedule :

Time of Sampling	*Rank of Leaf Sampled*
10 days	1 and 6
20 days	1, 3, 6, 9, 12, 15 & 18
30 days	1 and 6
40 days	1 and 6

Samples from untreated palms in the area were also taken on these days.

The leaflet samples were dry ashed and the phosphate precipitated and redissolved to eliminate interfering sources of radioactivity. P 32 was determined by the liquid counting technique, and total phosphate by the colorimetric vanado-molybdate method.

The results are summarised in Tables B 5 and B 6. The results show wide variation in uptake between the palms, although the palms selected were of the same age ; vegetative growth and yield. This illustrates the difficulty in choosing uniform experimental material. From Table B 5 it will be noted that the uptake of P 32 by palm 3 is much greater than the other three palms. Also it will be noted from Table B 6 that the mean values of the specific activities of leaves 3, 6 and 9 from palms 1, 2, and 4 are nearly the same. This suggests that the uptake of phosphorus by leaves 3 to 9 vary over a narrow range. Thus for sampling it would be advantageous to choose a leaf between 3 and 9. The uptake of P 32 increased with time.

C. SOIL SURVEYS

(Report submitted by Mr. K. S. O. Perera, Technical Assistant, Soil Survey Unit).

The major project for this year was the regional soil survey of the Eastern Province, and the Puttalam 1" sheet. Minor surveys were carried out for Government Colonization schemes, and other lands to determine the suitability of soils for coconut cultivation.

In the Eastern province, the soil surveys of the Batticaloa, Kalkudah, Kathiravelli and Kalmunai 1" sheets were carried out.

Climate and Vegetation

The soil climate belongs to the hot lowland dry tropical regime with a temperature of 80°F, precipitation of 50"-75" and an evaporation rate of 60" to 70".

The vegetation belongs to the Monsoon Forest type, and in the saline areas, abundant halomorphs are present.

Physiography and Geology.

The dominant landform in the area surveyed, especially in the Batticaloa and Kalkudah 1" sheets is the coastal sand plain. In the Batticaloa 1" sheet, the lagoon clay plain is also of importance.

The flat outer coastal plain passes into a low gently rolling mantled plain, which is continuous with the great plains of the north central regions.

Geology.

The coastal sand plains, especially of the Kalkudah and Batticaloa 1" sheets is thrown into a system of strand lines similar to the beach ridges of the Puttalam sand plains. Inner to the coastal sand plain which is of Recent origin is the inner mantled plain developed on the Archean platform, predominantly of biotite gneisses.

Soils.

The Kalkudah series : Developed on the old beach ridge sand plain. The soils are deep moist and well drained sands. The best coconut lands are situated in these soils.

Solodized Solenetz.

These are soils of the lagoon clay plain and are very unsuitable for coconut cultivation.

The Kalmunai Series.

These are imperfectly to poorly drained, hard, yellow soils, with gravelly horizons. Most of these soils are hydromorphic and occupied by paddy lands.

The Tamankaduwa Series.

These are deep, well drained soils. Coconut plantations are successful in this series.

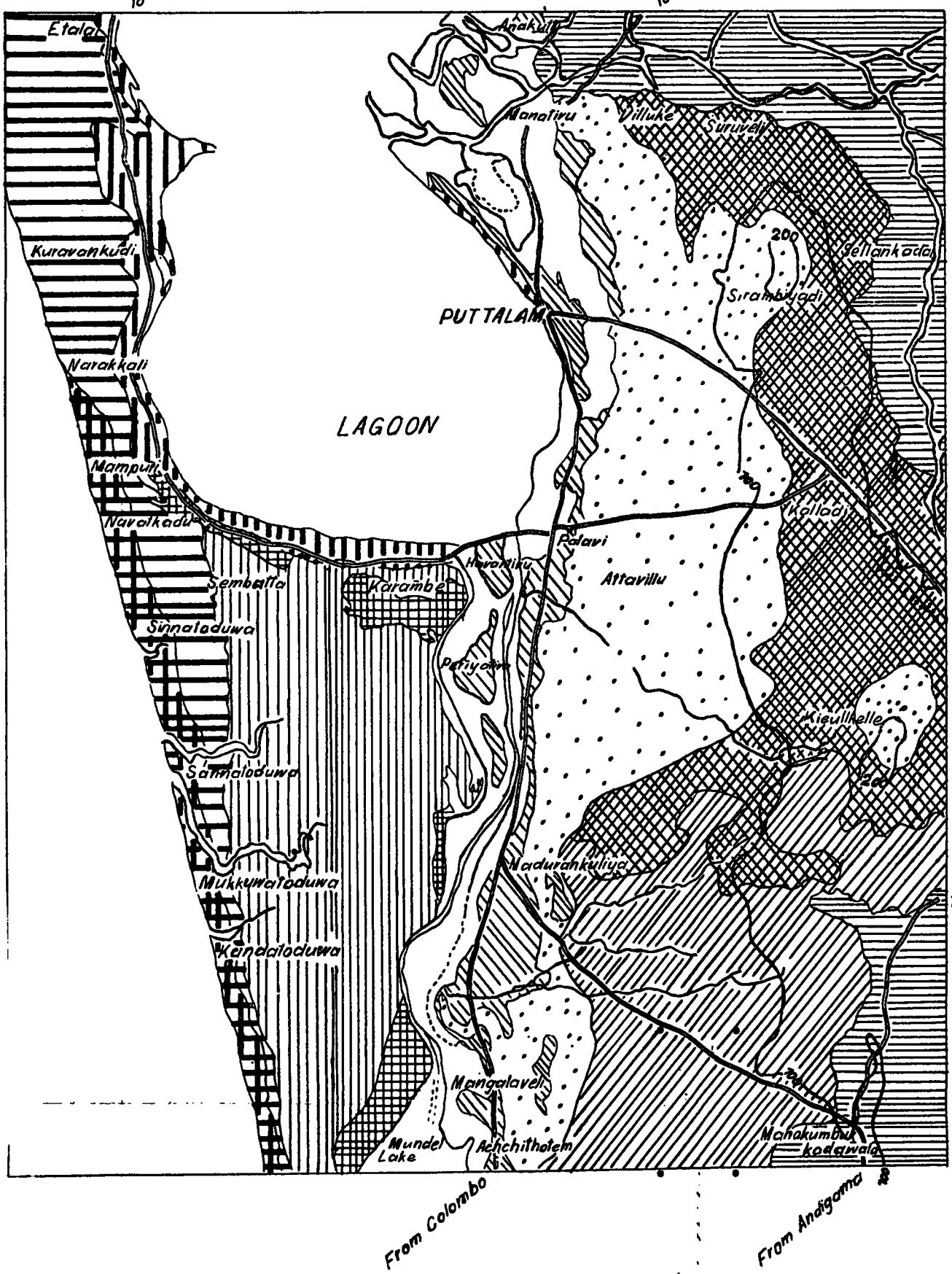
The Welikande series.

These are the imperfectly drained soils of the above group.

The soil survey of the Eastern Province is proceeding.

(MAPS)

SOIL MAP—PUTTALAM



Mapped- K.S.O.Perera

Scale 2 miles to 1 inch

Cartographed; E.N.Fernando

Attavillu Series Deep well drained	Rolling mantled plain	Old river sediments
Kalladi Series Perfectly to imperfectly drained	Rolling mantled plain	
Madurankuli Series Poorly drained gravelly clays		Developed on Vijayan Gneisses
Mukkuwatoduwa Series (Sands with high water table)	Rolling sand plain	Developed on old beach ridges
Yellow Sands	Lagoon Sand plain	probably old beach Sands
Sand dunes Present coast } White sands		Recent Marine deposits
Mi-oya flood plain Lagoon clays Soladized Solanetz } Hydromorphic Soil Marsh (Grass & scrubland)	Lagoon clay plain	Lagoon deposits

The Puttalam 1" sheet.

The red soils were differentiated on the basis of their genesis, the transported Attavillu series being separated from the Kalladi complex developed on gneissic rocks. A great gravelly clay plain, the Madurankuli series, which is highly unsuitable for coconut cultivation was observed.

In the coastal sand plain, a strandline area, the Mokkuwathoduwa series similar to the Kalkudah series was observed.

Soil Surveys for Government Projects.

(1) **Manativu (Puttalam 1" sheet).**—An area in the arid zone, developed as lagoon and estuarine deposits.

(2) **Wigamuwa and Taluna in the Ambalantota 1" sheet.**—Average annual rainfall is 50"- 75". The soils are developed on the rolling ridge-valley of the Ranna series. (c.f. Ranna Series C.C.Q. Vol. 18, Nos. 1/2). The valleys are hydromorphic in this area.

(3) **Palayangoda.**—(Alutgama 1" sheet). Average annual rainfall is between 75"-100", and the soils are developed in the deep, well drained Baddegama Series, situated in the " island landforms ". c.f. Baddegama series, C.C.Q. Vol. 16, Nos. 1/2.

(4) **Ullihitiyawa and Wellipitiya (Giruwapattu North).**—In the Ambalantota 1" Sheet.

Deep, well drained soils of the Ranna series.

Soil Survey of lands in the Moneragala District.—This survey is still proceeding.

Miscellaneous Soil Surveys :

(1) **Ruwanwella Estate (Kegalle District).**—Landforms consist of gentle slopes. The soils are deep, well drained and moderately lateritic. Average annual precipitation 75"-100".

(2) **Kobomella (Morawaka 1" sheet).**—Soils consist of lateritic hardpans on the high, steep landforms, and deep well drained soils in the middle contours and lowlying fields. Average annual precipitation is 125"-150".

(3) **Madampe Estate (Rakwana 1" sheet).**—Steep to moderately steep slopes—Altitude 800"-1000". The soils on the high summit ridges, and steep slopes are eroded, with lateritic hardpans. On the moderately steep and gentle slopes, the soils are deep and well drained. Average annual precipitation is 100"-125".

Seminar on Photo-interpretations—Soil Survey of the Uva Basin.

The above project was carried out in collaboration with Dr. Schmidt-Krapellin, U.N. Expert on Air Photo Interpretation. A reconnaisance survey of the Nuwara Eliya, Haputale, Passara and Buttala 1" sheets was carried out, covering a sharp variation of climatic geomorphic and geological boundaries, which gave a clear indication of the differentiation of soils on a regional basis.

D. Miscellaneous.

1. In March 1967 Mr. K. S. O. Perera, T/A Soil Survey Unit, attended the Seminar on photo-Interpretation under which a reconnaisance Soil Survey of the Uva basin was carried out.

2. Mr. E. N. Fernando, F.A., Soil Survey Unit, followed a course in plan drawing at the Surveyor-General's Department.

E. PERSONNEL

1. In November 1967, Mr. M. A. T. de Silva, Senior Technical Assistant, left for the United Kingdom under a Colombo Plan Scholarship. He is undergoing training in trace element analysis at the Long Ashton Research Station, Bristol.

2. Messrs. K. A. Gunaratne, and K. U. G. Dayananda resigned from their posts of Laboratory and Field Attendant in April 1967. Mr. S. Rajapakse, Laboratory and Field Attendant, resigned from his post in May 1967.

3. Messrs. K. Murugiah and B. E. C. Perera assumed duties as Laboratory and Field Attendants in May 1967.

4. Mr. A. Albert Fernando assumed duties as Field Assistant in October 1967.

T. S. BALAKRISHNAMURTI,
Acting Soil Chemist,
Coconut Research Institute.

Ceylon Cocon. Quart. (*1968*) **19**, 53–67

REPORT OF THE OFFICER-IN-CHARGE, AGROSTOLOGY DIVISION

INTRODUCTION

With the completion of the re-roofing of the new glass house towards the end of the year soil nutrient studies were commenced.

Physiological studies on paddy were continued in the old glass house.

This year the N-E monsoon rains were quite unusual in that the rainy season was rather short—there being no rains recorded after the 7th of December at B/E. Further the N-E monsoon rains were accompanied by strong Cyclonic winds which resulted in the loss of a large number of palms (uprooted) from the experimental plots. Further the very heavy downpours that accompanied the cyclonic winds washed away the majority of the plants in the experiments laid down to study the agronomy of subsidiary food crops under coconuts.

A large quantity of " Cori " grass cuttings were sold to a number of planters for establishment under coconuts.

Milk production during the year was satisfactory.

Soil Nutrient Studies :

With the completion of the re-roofing of the glass house towards the end of the year soil nutrient studies were commenced.

The following experiments were set up with the Hanwella gravel to study the optimum requirements of the nutrients deficient in that soil (1966 Annual Report).

Experiment I.

This was a 4^2 factorial pot experiment of 4 levels of P(0, 1½, 3 and 4½ cwts/acre of NaH_2PO_4) and 4 levels of N(0, 1½, 3 and 4½ cwts/acre of NH_4NO_3) with 2 replicates of all treatments planted to *Paspalum commersonii*.

Experiment II.

This was a 4^2 factorial pot experiment of 4 levels of P(0, 1½, 3 and 4½ cwts/acre of NaH_2PO_4) and 4 levels of K(0, 1½, 3 and 4½ cwts/acre of K_2SO_4) with 2 replicates of all treatments planted to *Paspalum commersonii*.

Experiment III.

This was a 4^2 factorial pot experiment of 4 levels of Mo(0, 1, 2 and 4 lbs./acre of $(NH_4)_6 Mo_7 O_{24}$) and 4 forms of Ca(Ca_{nil}, $Ca(OH)_2$ $CaCO_3$ and $CaSO_4$) with 2 replicates of all treatments planted to *Phaseolus lathyroides*.

Experiment IV.

This was a 4^2 factorial pot experiment of 4 levels of Mo(0, 1, 2 and 4 lb/acre of $(NH_4)_0Mo_7{}^0{}_{24}$) and 4 levels of N(0, 2½, 5 and 7½ cwt/acre of $(NH_4)_2SO_4$) with 2 replicates of all treatments planted to *Phaseolus atropurpurius*.

All these experiments were set up towards the end of the year and are in progress.

INTERCROPPING WITH COCONUTS

Effect of Pasture on the Yield of Coconut

Intensity of grazing and level of manuring on the yield of coconut (P_5.R/E).

This experiment was manured and grazed to schedule. The uncorrected nut yield data and the herbage yield are presented in Table I.

TABLE I

Treatment			No. of Nuts/acre	Herbage yield D.m. gm/M²
Weed Control	FN GO	... ...	4403	101.08
B. brizantha	FN GO	... ...	2168	197.40
„	FN GH	... ...	3172	190.79
„	FH GH	... ...	3416	113.12
„	FN GN	... ...	4187	225.08
„	FH GN	... ...	4336	204.99

F = Fertilizer, G = Grazing, O = Nil
N = Normal, H = Heavy.

Number of Nuts/acre (uncorrected) and dry matter yield of herbage (gm/M²) due to levels of manuring and grazing a Coconut/B. brizantha pasture association.

The normal level of fertilizer in this experiment is a mixture of 2 cwts. of Sulphate of ammonia, 1 cwt. each of saphos phosphate and muriate of potash applied/acre/year. The heavy level of fertilizer is double this quantity. The normal level of grazing is 2 adult Sinhala cows/acre and the heavy level of grazing is 16 adult Sinhala cows to the acre.

Data for four years have been collected from this experiment and the treatment effects are showing up now. The data can now be subjected to rigorous statistical analysis. The indications are that there is a sharp drop in the yield of coconuts due to the establishment of a pasture of *B. brizantha* under coconuts at Ratmalagara but appears to be corrected by grazing. As has been observed in the previous years production of *B. brizantha* does not seem to be enhanced by the addition of the extra fertilizers.

The effect of level of fertilizer (N, P and K) on a coconut cum pasture association (P_{21}.R/E)

The data for the 4th year of this experiment are presented in Table 2. There appears to be an increase in nut yield due to potash and phosphate while nitrogen appears to depress the yield of nuts. The herbage yield does not appear to be influenced by the higher level of fertilizer added.

TABLE 2

Treatments	No. of nuts/acre	Herbage yield D.M. g.m./M²
N_2 P_1 K_1	4186	225.08
N_2 P_1 K_2	4877	232.10
N_4 P_1 K_1	4261	251.81
N_4 P_1 K_2	4226	233.26
N_2 P_2 K_1	4627	166.88
N_2 P_2 K_2	5066	271.97
N_4 P_2 K_1	4440	202.04
N_4 P_2 K_2	4336	204.99

No. of nuts/acre and D.M. yield of pasture (gm/M²) of a Coconut cum—*B. brizantha* pasture association.

Levels of fertilizer × pasture management on the yield of coconut and pasture (P_{22}R/E)

The management treatments imposed in this experiment are grazing a pasture of *B. miliiformis* at an intensity of 2 adult *Sinhala* cows per acre versus mowing the pasture and the aftermath grazed at the same intensity and when no grazing is available to feed the animals with hay made out of the mown pasture and stacked in the plot itself. This experiment has completed its 3rd year. The uncorrected nut yield data and the pasture yield are presented in Table 3. The nut yield does not appear to be influenced by the management of the pasture while the production and persistancy of the *B. miliiformis* pasture appears to be greatly depressed by mowing compared to grazing.

TABLE 3

Treatment	No. of nuts/acre	Herbage yield D.M. gm/M²
Fertilizer ½ mowing	3744	57.1
,, 1 ,, ...	4225	264.3
,, 2 ,, ...	3870	163.1
,, 4 ,, ...	4558	183.8
Fertilizer ½ grazing	3656	136.7
,, 1 ,, ...	3890	233.7
,, 2 ,, ...	4677	198.6
,, 4 ,, ...	4110	265.6

No. of nuts/acre (uncorrected) and the yield of herbage from 2 cuts in gm/M² due to levels of fertilizers and management of a *B. miliiformis* pasture under coconut.

Reduction in the level of manuring to half the normal has depressed the yield of both coconut and pasture.

Rates of nitrogen application to coconut cum pasture association (P_{12} B/E)

This trial was manured and managed to schedule in its 4th year in 1967. The uncorrected nut yield data and the herbage yield are presented in *Table 4*. The pastures in this trial are control (weeds), *B. brizantha*, *B. milliformis* and *P. maximum*. The levels of nitrogen are 1, 2 and 4 cwts/acre of sulphate of ammonia per year applied broadcast in 2 equal split doses with the commencement of each monsoon rain.

TABLE 4

Treatment		*No. of nuts/acre*	*Herbage yield D.M. gm/m²*
Control (Weeds)	N_1	2688	578.0
	N_2	2780	344.3
	N_4	3424	411.3
B. milliformis	N_1	4410	434.8
	N_2	4153	590.1
	N_4	4874	620.2
B. brinzantha	N_1	3893	402.2
	N_2	3787	378.1
	N_4	4373	291.6
P. maximum	N_1	3088	365.3
	N_2	2298	538.8
	N_4	3112	518.8

Yield of coconuts (nuts/acre) and herbage (D.M. gm/M²) due to levels of nitrogen applied.

The data indicates that there is a progressive increase in the dry matter yield of herbage and nut yields with increase in the level of added nitrogen. In the previous years the nut yields appeared to be depressed at the highest level of added nitrogen. A feature of interest in this experiment is the invasion of the B. brizantha plots by B. milliformis from the adjoining plots, This invasion was most severe in the plots getting the highest level of nitrogen. This has resulted in the progressive depression of the yield of B. brinzantha with increase in the level of added nitrogen.

Fertilizer placement to a coconut cum pasture association (P_{38}) B/E.

This experiment studies the effect of 3 methods of fertilizer placement to a coconut cum *B. milliformis* pasture at 2 levels of fertilizer application. The data for the 2nd year of this experiment are presented in *Table 5*. Nut yields appear to be greatly influenced by the method of placement at the lower level of fertilizer application. However at the higher level of application there does not seem to be a prominent effect due to method of placement. At both levels of fertilizer application herbage yields were influenced by the method of fertilizer placement. Highest yields were obtained when the total quantity was broadcast.

TABLE 5

Treatment		*No. of nuts/acre*	*Herbage yield D.M. gm/M²*
Normal 7 lbs.	(Total placed	3701	258.2
	($\frac{1}{2}$placed+$\frac{1}{2}$b.c.	3803	305.3
	(total b.c.	2818	404.0
Twice normal 14 lbs.	(Total placed	3612	301.6
	($\frac{1}{2}$ placed+$\frac{1}{2}$ b.c.	3229	321.9
	(total b.c.	3323	464.2

Yield of coconuts (nuts/acre uncorrected) and the herbage yield (D.M. gm/M² from 2 cuts) due to the type and level of manuring.

Selection, establishment and management of pastures.

(a) Yield and palatability of 10 varieties of pasture grasses.

This experiment which was set up during the latter part of last year has been grazed 4 times during this year. The total dry matter yield for the 4 cycles before and after grazing are presented in *Table 6*. Since at the end of each grazing all the plots in this experiment are mowed down to ground level, the percentage of the grass consumed has been obtained by expressing the differences in the total production before and after grazing as a percentage of the total production. These figures are presented in *Table 7*. These figures should give an indication of the palatability of these grasses at the time of grazing. Since a continuous observation of grazing behaviour of the animals used in grazing this experiment had been done, the analysis of this data should give a reliable indication of the palatability of each grass tested. The leaf stem ratio of the grasses at the time of grazing are also presented in *Table 7*.

TABLE 6

Grass variety	D.M. gm/m² before grazing	D.M. gm/m² after grazing
B. brizantha (Ceylon)	716.2	324.7
B. ,, (Tanganika)	734.0	376.8
B. ,, (Kenya)	504.2	133.7
B. ruzeziensis	355.0	85.8
B. brizantha (F.D.A. 15072)	433.7	158.7
B. distachiya	190.8	55.5
Villugrass	532.5	152.2
B. milliformis	554.0	229.2
Urocloa spp.	435.2	169.5
B. mutica	310.2	109.0

Herbage yield (D.M.) gm/M² before and after grazing of 10 varieties of pasture grasses.

TABLE 7

Grass variety	% of grass consumed	leaf to stem ratio
B. brizantha (Ceylon)	54.7	0.45
B. ,, (Tanganika)	48.7	0.75
B. ,, (Kenya)	73.5	1.23
B. ruzeziensis	75.8	1.12
B. brizantha (F.D.A. 15072)	63.4	1.27
B. distachiya	70.9	0.51
Villu grass	71.4	0.58
B. milliformis	58.6	0.44
Urocloa spp.	61.0	0.64
B. mutica	64.9	0.51

Percentage of grass consumed during grazing and the leaf stem ratios of 10 varieties of pasture grasses at the time of grazing.

Comparison of the response to Nitrogen and palatability of 4 varieties of Guinea grass (P. maximum) (P_{61}) B/E.

This experiment, the establishment of which was reported in the 1966 Annual Report was grazed seven times during 1967. The total dry matter production for the year is given in *Table 8*. Total dry matter of the stubble left behind (6" above ground level) after grazing is given in *Table 9*. Percentage of the grass consumed has been worked out from these data and are presented in *Table 10*. This figure gives a fair indication of the palatability of each variety at the different levels of nitrogen tested.

TABLE 8

VARIETY	N_0	N_1	N_2	N_4	*TOTAL*
Commercial (Ceylon) ...	11,104	15,847	16,218	17,581	60,757
,, (Australia) ...	14,182	19,433	18,334	16,662	68,612
Hamil ... ,, ...	7,252	10,503	10,888	12,470	41,114
Jamaican tall	15,545	12,219	20,109	14,088	61,961

Total dry matter yield (lb/acre) of 4 varieties of *P. maximum* for 7 cuts made during the year under 4 levels of nitrogen.

From the point of view of total dry matter production there does not appear to be a large difference between the Australian commercial and the Ceylon Commercial. However, the response to nitrogen appears to be better in the case of Australian Commercial. The Jamaican tall although productive to the same extent is not a suitable grass since the leaf/stem ratio is comparatively small. The leaf/stem ratio for the 4 varieties are given in Table 11.

TABLE 9

VARIETY	N_0	N_1	N_2	N_4	*TOTAL*
Commercial (Ceylon) ...	3,548.9	5,598.1	6,248.5	6,994.5	22,390.0
,, (Australia) ...	4,106.6	6,366.7	6,031.0	5,181.1	21,685.4
Hamil ,, ...	3,921.9	5,294.2	5,013.8	6,262.3	20,492.2
Jamaican tall	6,552.9	6,706.4	7,246.7	8,212.8	28,718.8

Total dry matter (lb/acre) of the stubble left over (6" above ground level) after grazing of the 4 varieties at the different levels of nitrogen.

TABLE 10

VARIETY	N_0	N_1	N_2	N_4
Commercial (Ceylon)	68	64	61	60
Commercial (Australia)	71	67	67	69
" HAMIL " (Australia)	45	49	53	50
Jamaican tall	57	45	64	42

Percentage consumption of dry matter of the 4 varieties at the different levels of nitrogen.

TABLE 11

VARIETY	N_0	N_1	N_2	N_4	MEAN
Commercial (Ceylon) ...	1.71	1.19	1.29	1.26	1.36
Commercial (Australia) ...	1.53	1.09	1.35	1.61	1.40
" Hamil " (Australia) ...	0.44	0.67	0.52	0.69	0.58
Jamaican tall	0.75	0.81	0.66	0.63	0.71

The leaf/stem ratios (D.M. basis) of the 4 varieties at the time of grazing due to the different levels of nitrogen.

MANAGEMENT STUDIES OF *B. Milliformis.*

The effect of shade, height and frequency of cutting on the growth of *B. milliformis.*

This experiment was planted in raised beds with arrangement for shading at different times of the day. After uniform growth was reached the treatments were imposed. The treatments were no shading, shading from sunrise to 10 a.m. shading from 10 a.m. to 2.00 p.m. and shading from 2.00 p.m. to sunset, cutting height at 2 and 4 inches above ground level, cutting frequencies at 3 and 6 week intervals. The total dry matter yield from the 2 harvests done are presented in Table 12. Data indicate that cutting 4" above ground level and at 6 week intervals produced slightly higher yields than cutting 2" above ground level and at 3 weekly intervals. Shade reduced yields considerably. Greatest reduction was recorded when shaded from 10 a.m. to 2.00 p.m. followed by shading from sunrise to 10.00 a.m. and from 2.00 p.m. to sunset.

TABLE 12

Time of Shading	H_2		H_4	
	F_3	F_6	F_3	F_6
Sunrise to 10.00 a.m.	365.1	386.4	446.0	424.2
10.00 a.m. to 2.00 p.m.	238.1	277.6	246.8	234.8
2.00 p.m. to sunset	331.0	378.3	427.6	464.1
No shading	412.3	674.3	790.6	778.8

Total dry matter from 2 harvests of *B. milliformis* for different shade treatments. (H_2= cutting 2" above ground level, H_4=cutting 4" above ground level, F_3=cutting at 3 weekly intervals, F_6=cutting at 6 weekly intervals).

Effect of frequency of cutting at different levels of nitrogen on *Brachiaria brizantha* (variety Tanganika)

Brachiaria brizantha (variety Tanganika) appears to be a promising pasture grass for the higher rainfall areas. Therefore it was decided to study this grass in more detail. This preliminary experiment was planted in 12" clay pots to study the behaviour of this grass due to defoliation at different frequencies at 3 levels of nitrogen. Total dry matter yield (mean of 4 replicates) from 2 cycles for the different treatments are given in *Table 13*.

TABLE 13

Cutting Frequency	N_0	N_1	N_2
Cutting every 2 weeks	11.23	12.61	14.12
,, ,, 3 ,, ...	13.55	18.37	23.26
,, ,, 6 ,, ...	28.33	40.87	32.29

Total dry matter yield per pot from 2 defoliation cycles of *B. brizantha* (*Tanganika*) for the various treatments.

While significant differences in yield were recorded for the different cutting frequencies, no significant effect was evident for the higher levels of nitrogen.

OTHER CROPS.

Paddy :

An experiment was planted to study the performances of 9 varieties of paddy under coconut under rainfed irrigation during the S-W monsoon rainy season. The 9 varieties were—

1. Hybrid 53-47
2. Hybrid 54-52
3. Bicom II
4. Hybrid 39-29
5. Hybrid 15-1-W
6. Hybrid 7
7. Kottisaram
8. Sudumadel
9. Hybrid 8.

Cultural operations were similar to that recorded for the similar experiment reported last year. (1966 Annual Report). The data obtained are given in Table 14.

TABLE 14

Variety	*Grain*	*Straw*	*Empties*	*Grain/ Straw ratio*
Hybrid 53-47	529	1785	78	0.30
Hybrid 54-52	498	1785	59	0.28
Bicom II	508	2418	54	0.21
Hybrid 39-29	520	1890	75	0.28
Hybrid 15-1-W	486	1950	85	0.25
Hybrid 7	27	654	5	0.04
Kottisaram	38	1245	20	0.03
Sudumadel	22	1695	27	0.01
Hybrid 8	218	1248	99	0.17

Dry wt. in lb/acre of grain, straw and empties of the different varieties grown and harvested at B/E during the S-W monsoon rainy season.

The exceptionally low yields recorded are due to damage by birds. Very low yields were recorded this year from Kottisaram and Sudumadel due to damage caused by head blast. Except Hybrid 8 all the other varieties are 3-3½ month varieties. They were able to successfully complete their life cycle within the rainy season. The very low yields recorded for H_8 was due to the fact that being a 4½ month variety it was not able to complete its life cycle within the rainy season.

The relationship between soil moisture level and the production of empty grains in three varieties of paddy.

It has been observed under field conditions that if during the heading time the soil moisture level drops then the percentage of empty grains in the heads increase. This experiment was designed to study this phenomenon. Three varieties of paddy were grown in 6" plastic pots without drainage holes and maintained at different soil moisture levels ranging from standing water to 70% *Field capacity*. These pots were kept in the glass house and watered twice daily to bring the soils to their correct moisture levels. Soil pH was determined when the plants were about to head. While flooding decreased the soil pH slightly in all other treatments the soil pH was stable at about 7.5. The pH readings are shown in Table 15.

TABLE 15

	Standing water	*100% F.C.*	*95 %*	*90 %*	*85 %*	*80 %*	*75 %*	*70 %*
pH valves	6.55	7.83	7.64	7.64	7.72	7.71	7.89	7.78

pH readings of the soils in the pots when the paddy plants were heading.

The yield of grain and straw per plant and the percentage of empty grains are shown in Table 16. In all three varieties the percentage of empty grains increased with decrease in the soil moisture level. The percentage of empties was lowest when the soil was kept flooded. The percentage of empty grains was less for the highland varieties Sudumadel and Kottiasaram than for the mudland variety Kataktara. This shows that a suitable variety of paddy for cultivation under coconuts can be bred incorporating these advantageous characters.

TABLE 16

	KOTTISARAM			*SUDUMADEL*			*KATAKTARA*		
	Grain (gm)	*Straw (gm)*	*% empty*	*Grain (gm)*	*Straw (gm)*	*% empty*	*Grain (gm)*	*Straw (gm)*	*% empty*
Standing water ...	6.06	9.20	15.2	5.55	8.78	9.0	5.89	8.82	9.2
100% F.C. ...	3.15	9.28	22.7	4.85	8.78	10.6	5.50	10.65	7.1
95% ...	7.1	9.1	15.0	5.6	9.0	16.9	5.3	14.2	47.6
90% ...	8.5	9.2	19.6	7.6	8.5	24.9	4.9	15.9	52.3
85% ...	6.6	10.8	34.2	5.1	10.2	28.2	4.0	12.1	41.6
80% ...	7.0	7.7	31.5	4.8	9.8	42.8	1.7	15.7	68.0
75% ...	4.3	8.0	29.5	3.7	10.9	37.6	1.4	16.6	75.4
70% ...	3.4	9.8	42.3	4.1	8.3	42.9	2.8	10.3	76.5

Yield of grain and straw per plant in gm dry matter (mean of 8 replicates) and the percentage of empty grains (numerical basis) in the 3 varieties of paddy grown at different soil moisture levels.

Germination studies of paddy.

Germination at the time of harvest of the more promising varieties of paddy harvested last year (1966 Annual Report) was studied. The percentage of germinations are recorded in Table 17. After one month of harvest it was found that all the tested varieties gave 90-95% germination.

TABLE 17

Variety	*Germination*	*Variety*	*Germination*
LACRONE	40	RATRAN WEE	90
DHANALA	60	SUDUHETADA WEE	100
DHARIAL	5	PACHCHPEREMAL 2404	60
VELLAIPERUMAL	70	CENTURY PATNA	10
KOTTISARAM	70	TA-POO-CHO-2	55
LO-SHU-NGAN	80	WANNI DHANALA	20
BASMATHIE	45	MARICHBETI	NIL
PALAWAN	15	KAOCHING-TA-LE-CHEN-Yo ...	50
PAK-HUK-CHAI-MEI	10	CO. 30	90
SINHAKABURI	25	SUDUMADEL	75
K.P.F.-6	NIL	SUKWEL 20	60
T (N) 1	60	PANBIRA	20
LOCAL SAMBA	90	RIKUTONORIN-18-65-235 ...	50
HASHIKALMI	50	KATAKTARA	40
ZENITH	70	SENSHO	60
S-67	70	WOO-GEN	35
MEKEO WHITE	15	J.K.M.-6	5

Percentage of germination at time of harvest of the tested paddy varieties.

MANIOC (CASSAVA)

This crop is the most widely cultivated subsidiary food crop under coconut. It is mostly cultivated as a back garden crop in most of the coconut small holdings. The general practice among these cultivators is to grow this crop without any fertilizer except for some kitchen ash which is added to the base of the plants. This experiment was therefore set up to study the effect of additional fertilizers on the yield of this crop when grown under coconuts. An attempt was also made to study the optimum planting distance under coconut and also the manner in which the stumps should be planted. For this purpose 3 planting distances were selected viz. 2 ft., 4 ft., and 6 ft. between rows with 2 ft. constant on the row between planting points. At each planting point two 6 inch stumps were planted in a hole 5 inches deep. In one half of each plot the stumps were planted in the usual slantwise way while the other half was planted with the stumps standing erect. The additional fertilizers used were 2 and 4 cwts./acre of a mixture of equal quantities of Sulphate of ammonia and muriate of potash. Since there is no response to added phosphate at Bandirippuwa Estate, phosphate fertilizers were omitted from the mixture.

Half of the quantity of fertilizer was added broadcast at the time of planting and the other half was broadcast when the plants were 2 months old. The variety planted was " Muh 8 " of the Department of Agriculture. The yield of yams (fresh weight) is given in Table 18. There was no difference in the yield of yams due to the manner in which the stumps were planted. 2 cwt./acre of the fertilizer increased yields by nearly 50 per cent. The higher level of fertilizer did not appreciably increase yields over the lower level. The highest yields were obtained when the rows were 4 ft apart.

TABLE 18

Treatment		*No Fertilizer*	*Fertilizer 2 cwt/ac.*	*Fertilizer 4 cwt/ac.*	*Total*
2 ft.	Slanting	7,150	12,258	14,645	34,047
	erect	8,172	13,620	15,663	37,455
					71,504
4 ft.	Slanting	17,706	20,657	21,339	59,702
	erect	17,479	21,331	23,608	62,418
					121,922
6 ft.	Slanting	8,285	11,910	13,279	33,474
	erect	8,512	12,144	11,577	32,233
					65,707
	Total ...	67,304	91,920	100,107	

Yield of yams (fresh weight lbs/acre) of Manioc for the different treatments.

GROUND NUTS

Two experiments were carried out to study the optimum time of planting and time of lifting of a 120 day and a 100 day variety of ground nuts planted during the October/November rainy season.

Both experiments were 3 × 3 factorials of 3 planting times and 3 lifting times replicated four times. The planting times for both experiments were (1) with the onset of the monsoon rains, (2) 2 weeks later and (3) 4 weeks later. The lifting times for the 120 day variety were after 110, 120 and 130 days. For the 100 day variety the lifting times were after 90, 100 and 110 days. The yield per acre, the percentage of good pods, empty pods, rotten pods, immature and germinated pods are given in Table 19 and 20, for the 120 and 100 day varieties respectively.

TABLE 19

Treatment		Yield lbs/ac.	% good pods	% empty pods	% rotten pods	% immature pods	% germinated pods
Planting	Lifting						
With the rains	110 days after commencement	1264	38.29	10.86	17.44	31.84	1.04
2 weeks later		544	28.00	14.43	14.75	42.47	0.58
4 weeks later		448	9.85	2.46	12.51	24.37	0.00
With the rains	120 days	1200	29.79	9.28	20.36	28.02	3.21
2 weeks later		384	19.86	9.55	21.99	54.45	0.90
4 weeks later		352	11.77	2.69	15.33	52.09	0.00
With the rains	130 days	672	35.18	6.83	21.45	35.18	2.18
2 weeks later		256	14.70	7.30	18.26	59.71	0.00
4 weeks later		256	10.18	2.68	20.23	66.57	0.28

Yield (lb/acre) and the percentage of good, rotten, empty, immature, and germinated in a sub-sample of the harvested pods, of the 120 day variety of groundnuts at the different times of planting and lifting.

TABLE 20

Treatment		Yield lbs/ac.	% good pods	% empty pods	% rotten pods	% immature pods	% germinated pods
Planting	Lifting						
With the rains	90 days after the commencement of expt.	1104	6.04	3.24	7.00	34.28	45.48
2 weeks later		560	5.82	3.84	15.22	65.83	9.26
4 weeks later		224	6.28	3.56	2.00	86.72	1.41
With the rains	100 days	400	6.99	2.18	20.46	37.82	32.52
2 weeks later	do	352	6.80	1.19	7.83	79.88	4.27
4 weeks later		400	12.24	0.84	1.61	84.81	6.48
With the rains	110 days	992	8.19	5.26	27.38	39.31	23.57
2 weeks later	do	592	16.25	1.78	22.80	53.07	6.08
4 weeks later		512	12.10	1.06	23.52	60.76	2.57

Yield (lbs/acre) of pods and the percentage of good, empty, rotten, immature and germinated pods in a sample of the harvested pods of the 100 days variety of ground nuts for the different times of planting and lifting.

These results indicate that for maximum yields the long term variety should be planted with the commencement of the monsoon rains and lifted 110 to 120 days later. The shorter term variety should also be planted early in the season and lifted early-preferably after 100 days.

In addition to these crops a large variety of other crops were also planted under coconut for observational purposes. Of these sweet potatoes appear to be promising. Yields in the range of 9,000 to 10,000 lbs/acre were recorded with the varieties. IB15 and F.A. 17.

CATTLE

Herd Statistics.

Herd Strength on 31.12.67

	B/E	R/E	Total
Bulls	6	3	9
Cows	94	30	124
Heifer calves	90	31	121
Bull calves	72	3	75
Total	262	67	334

During the year 55 animals comprising 2 bulls, 7 cows, 5 heifer calves and 41 bull calves were sold. There were 63 and 29 births at B/E and R/E respectively.

Milk yield

A total of 61,481.5 and 2,725 pints of milk were produced at B/E and R/E respectively. 42,842 pints were offered to the Milk Board and of this 4,127 pints were rejected for poor keeping quality. 19,424.5 pints were sold to the staff and a further 809.5 pints were converted into ghee. The rest of the milk was fed to calves.

Animal Health

During the year there was no serious outbreak of any disease. The 2 Jersey stud bulls obtained from the Department of Agriculture were suffering from ear infections for most part of the year. It appears that they have not yet acclimatised themselves completely to local conditions.

Jersey × Sinhala Crosses

During the year 23 Jersey × Sinhala Crossbred calves were born. Of these 12 were heifer calves. The average birth weight of these calves is higher than that of the pure Sinhala.

Staff

The Agrostologist Dr. K. Santhirasegaram, left the services of the Institute in July to join the University of Queensland, Australia. Mr. A. Albert Fernando, Lab. and Field Attendant was promoted Field Assistant to the Soil Chemist and left the Division in October. Messrs D. E. F. Ferdinandez, R. M. Dayaratne and K. A. D. W. Jinadasa changed their civil status during the year.

D. E. F. FERDINANDEZ,
Officer-in-Charge,
Agrostology Division,

Ceylon Cocon. Quart. (*1968*) **19**, 68–73.

REPORT OF THE OFFICER-IN-CHARGE OF THE CROP PROTECTION DIVISION

PESTS

1. The Red Weevil (*Rhyncophorus ferrugineus* F.) and its control.

Pilot surveys were conducted to gather more information on distribution, development and economic importance of the pest, with a view to find practical and economic methods of control.

Distribution : From the records available, it appears that Red Weevil infestations occur to a lesser extent in the dry zone districts than in the wet zone, but it must be noted that the acreage of coconut is less in the dry zone areas.

As for local distribution, it has been observed that in one locality, 63% of the small holdings had been infested during the last six years ; but during the past twelve months infestations were found only in 27% of the same holdings. In a number of village holdings, at time of inspection, only about 3% were pest infested. In one village, pest infested holdings were in groups indicating the presence of fairly established pest colonies. It is seen that the Red Weevil pest can occur in colonies of variable sizes, the degree of infestation being enhanced through neglect by not attending to or destroying infested palms, whilst a decline sets in when the sources of infestation (that is the infested palms which are breeding the pest), are treated or destroyed.

The host palm : In these surveys, the host palms were in the ages 1-10 years. Mortality of palms was highest in the 2 6 year group. The infested palms were found scattered.

Habitat : In these surveys, the pest was found breeding only on young palms. There were no alternate breeding grounds in the plantations. Elsewhere, a kitual palm, which had been felled was found to be infested.

Infestation levels : In several places it was observed that there were no infestations, at the time of inspection. Infestation levels up to 3%, at time of inspection, were recorded. The percentage of palms infested, though used as an indication of the level of infestation, is not considered very satisfactory on account of the fact that the insect is a strong flier and pest movement is relatively fast.

Palm mortality : The reckoning of loss of palms, during these surveys, was on two counts, (1) the total loss from time of planting, (2) the current loss which would be the number of palms found destroyed at time of inspection. On the average, an accumulated loss of 5%–16% was recorded for the past 6 years. In one holding, a 100% loss was recorded. In one area, mortality rate of palms for a period of 1 year was 2%.

Pest density : The infested palms in the holdings were few. Hence a direct count of the pest material was possible.

Infestations : An artificially induced infestation was developed from 25, 2nd and 3rd instar larvae, in a palm 4 years old. The grubs were introduced through small holes drilled into the stem. No audible signs of infestation were heard for about 1½ months. Sounds were inaudible when the larvae had developed into pupae. During the second generation of red weevil, (i.e. 5 months and 26 days after the grubs were introduced and the palm was about to collapse), the palm was cut open and the pest material collected,

The economics of plant protection in the control of the Red Weevil pest.

It was observed from these surveys that the value of palms destroyed due to Red Weevil damage was variable in different localities, the main considerations being (*a*) age of palms, (*b*) variety of palm, (*c*) size of holding and (*d*) location. The value of palms, the probable loss from pest damage and the cost of labour are the main considerations when adopting plant protection methods which, as known up to now, are the inspections and the wound dressing (tar application).

2. **The Coconut Caterpillar** (*Nephantis serinopa* L.) **and its control**

The biological control project (vide Ann. Repts. 1960-1966) : As the temperature controlling equipment of the Insectary at Lunuwila was out of commission, parasite breeding was hampered to some extent.

(i) **Parasite liberations—**

The parasites and their numbers liberated are given below—

	Lunuwila Sta. (in thousands)	*Bandirippuwa* (in thousands)
(*a*) *Larval parasites*		
Microbracon brevicornis	380	280
Perisierola nephantidis	56	70
(b) *Pupal parasites*		
Tetrastichus israeli	85	233
Trichospilus pupivora	108	—

(ii) **Evaluation of parasite liberations.**

In a few selected estates where infestations were present and parasites were liberated, population records of the pest and the parasites were kept, as in the previous years. The two exotic parasites *Microbracon brevicornis* and *Tetrastichus israeli* were not recovered.

(iii) **The Pest Situation**

The number of estates that reported infestations were as follows :

Station	*1967*	*Av. for the past 3 years*
Batticaloa	23	31
Lunuwila	30	21

The Lunuwila station reports infestations from several Provinces. This year, the infestations were heavier than in the previous two years. A heavy out-break occurred at Nikadalupotha.

(iv) **The present position**

When this project was discussed at the Estates and Experimental Committee meeting of the CRI Board, it was decided to review the project after the return of the Crop Protection Officer from abroad, next year.

Regarding control measures, it has become necessary to repeat the recommendation to watch for the appearance of the pest (particularly in areas where it is known to occur) and cut and burn infested fronds as far as possible. On an estate where this practice was adopted no outbreaks occured.

3. The Coconut Scale pest (*Aspidiotus destructor* Sign.) and its control.

Out-breaks were controlled successfully by spraying kerosene oil emulsion diluted with water 1 : 10. For several years now, this method of control has been found very satisfactory, because this insecticide is non-persistent and does not have much adverse effects on the predators. Managers of plantations in areas where the pest has occurred, have been urged to keep watch for early detection of the pest, and get infestations treated, as such action has been found to prevent the occurrence of further out-breaks and the spread of the pest.

4. Other pests.

(i) **Nettle grub** (*Parasa lepida* L.)—A mild infestation occurred at the Isolated Seed Garden in the same block where this pest occurred previously. A number of predators were observed but there was no opportunity to conduct a study. As natural control was effective, this infestation did not develop into an out-break.

(ii) **Locusts** (*Aularchis miliaris* L.)—Four infestations were reported but only two needed insecticidal spraying. Endrin and Bidrin sprayings had satisfactory results.

Field observations have provided some data on the natural habits of this pest.

(iii) **Bag Worm**—On one estate, an infestation occurred on adult palms and control was effected by spraying DDT.

Reports were received of damage to seedlings from termites, wild boar and porcupines. Suggestions were made to try out "Arbinol" against the two pests mentioned last.

DISEASES

5. Bud Rot disease and its control.

Fungi, associated—*Phytophthora palmivora* Butl.
Phytophthora nicotianae var. *parasitica* Dastur.

(i) Packetted fungicide, leaf axil placement trial.

This trial which commenced in September 1965 was continued up till September this year and was discontinued as the incidence of the disease remained low.

It was seen from the rate of disease prevalence within the treatments that no evaluation between them was possible. The incidence of the disease fell shortly after commencing the trial.

There are probably two reasons for the fall of the incidence viz. (1) four-fifths of the area under the trial was chemically treated : the fungicidal application (on four-fifths of the area) may have lowered the inoculum potential, thus reducing the incidence of the disease and (2) the estate management had removed the old stand of palms rapidly thus causing an ecologically unfavourable condition for the spread of the disease.

In the same plantation a seven-acre block was separately treated with Bordeaux mixture at bimonthly intervals. The incidence of the disease in this block too was lowered by this treatment.

Empirical trial. For the purpose of treating a large area, 1,000 palms were given the packetted axil placement treatment with " Mercury Spray " in one estate where the disease was prevalent ; and the adjacent block with similar conditions was left untreated as control.

Within three months after application the incidence dropped in both areas. Here again it was considered that the inoculum strength had possibly got reduced.

Observations. Although no conclusive evidence was available to prove statistically the value of these fungicidal treatments there were indications that the fungicidal treatments such as those used in these trials were showing good effects.

Four-monthly applications are perhaps as good as bimonthly ones as regards toxicity, but at least every two months the packet has to be replaced in the axil of the newly opened leaf.

The main complaint regarding this method of application has been that palms are damaged as a result of a person climbing on to the crown of the tree and perching on the fronds to place the ' packets '. The fronds remain bent down and tend to displace the fruit bunches which then require propping.

The economics of plant protection in Bud Rot control depend largely on the rate of incidence and the damage caused. It is the young palms that need protection, particularly those that are underplanted in areas where the disease is known to occur. It has been observed that when palms reach about their thirtieth year and in under-plantations when palms in the old stand are removed, the incidence of the disease drops rapidly.

Fungicidal soap. A fungicidal soap application was considered and preliminary tests were conducted to study the phytotoxic effects of soap placement in the axils of leaves.

6. **Leaf Blights and their control.**
Fungi associated—*Helminthosporium incurvatum* Bernard and *Pestalotiopsis palmarum* (Cke) Stey.

Fungicidal vs. Fertilizer trials.
This trial was commenced in 1965 vide Ann. Repts. 1965-1966.

There is no indication that the copper spraying was more beneficial than the fertilizer treatment. The fertilizer application has shown some improvement but has not established control.

7. **Stem bleeding disease and its control.**
Fungus associated—*Ceratocystis paradoxa* (Dade) Moreau.

A few instances of stem bleeding disease were reported and one plantation was considered to be seriously affected. No experimental work was conducted but control measures were adopted, such as, scooping out infected wood, and the application of " Santar " as a wound dressing.

8. **Coconut Leaf Scorch Decline.**
(i) **Survey**—The results of the Annual survey which is conducted in the Gonapinuwela-Baddegama-Dodanduwa area, are as follows :—

Prevalence rate	...	2-3 palms/acre.
Mortality rate	...	1 palm/3 acres.

(ii) **Conference on "Leaf Scorch"**—A meeting of Research Officers from the three Research Institutions, was held in Colombo to discuss the present position and the future research programme on Leaf Scorch Decline of coconut.

The following papers were presented :

Studies on Leaf Scorch disease in the Galle District—O. S. Peries

Surveys on Leaf Scorch—J. K. T. Fernando.

Investigations on Leaf Scorch Decline of coconut palms—J. K. F. Kirthisinghe.

(iii) **Consultant on Leaf Scorch Decline under the Technical Aid Programme of the Government of the Federal Republic of Germany.**

Dr. J. Kranz, Mycologist, Tropen Institut Justus Liebig University, West Germany, conducted an investigation, mainly on the mycological aspects of Coconut Leaf Scorch Decline, following up the work that has already been carried out.

The results of his investigations are embodied in the report mentioned below.

" Report by Dr. Kranz, Mycologist, assigned to the Ceylon Coconut Research Institute, by the Government of the Federal Republic of Germany—Oct. 9th to Dec. 21st, 1967—C.R.I. Circulation Paper 96/67.

We are grateful to Dr. J. Kranz for conducting valuble investigations on coconut leaf Scorch Decline.

(Iv) **Mycological investigations.**

(*a*) **Studies conducted by the Plant Pathologist, RRI.**

Dr. O. S. Peries, Plant Pathologist, Rubber Research Institute (Ceylon), conducted investigations to find the cause of root decay and also conducted studies on the soil micro flora. He has observed that an abundance of Fusaria spp. occur in the roots of affected palms and in the soil near these palms.

Preliminary inoculation tests on roots have been unsuccessful but he has suggested methods for further investigation.

A number of fungi have been isolated from affected leaves, mainly, species of *Botryodiplodia*, *Fusarium*, *Pestalotiopsis*, *Penicillium* and *Aspergillus*. Inoculation tests have been made but it is recorded that no infections were observed. It has been considered that these fungi isolated from necrotic lesions are either weak parasites that invade the leaves following a weakening of the palm or grow saprophytically on necrotic areas.

(*b*) **Studies conducted by the Consultant in Mycology, Dr. J. Kranz.**

Leaf isolations :

Botryodiplodia theobromae Pat. has been found occurring, consistently in the leaves, but its role as an active parasite, or a weak parasite of secondary importance, or its value as a diagnostic feature has to be clarified only after further investigations. Hitherto unrecorded species of *Fusarium*, *Alternaria*, *Periconia* and *Zygosporium* have been isolated but no importance has been attached to them.

Root Isolations :

Hitherto unrecorded fungi isolations from the roots of affected palms have been species of *Trichoderma*, *Botryodiplodia* and *Rhizoctonia*. These fungi are not considered important in the decline.

Fusaria and Cylindrocarpon spp. have been found to the extent of about 45% of the isolations and they probably cause root decay when the affected palms are declining due to other causes.

These observations are being followed up.

9. **Leaf-Break.**

A condition of leaf-break has been recorded, in a young plantation 15 yrs. old, in Gonapinuwela, Galle District. A few palms have died following the decline which accompanies leaf-break.

10. **Fused leaves.**

A considerable number of palms having fronds with fused leaflets have been observed in Wennappuwa-Marawila-Madampe, in the Chilaw Districts.

STAFF

The Crop Protection Officer returned from U.K. in September after post-graduate studies at the University of Oxford, having obtained the D.Phil. degree.

Dr. R. A. P. Malalasekera, was appointed Research Assistant in Crop Protection in December.

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

(Jan.-Sept., 1967).

Ceylon Cocon. Quart. (*1968*) **19**, 74–76

REPORT OF THE BIOMETRICIAN

The Biometrician was out of the island during the period March to November 1967, following a course in Applied Statistics at East Malling Research Station, U.K. During this period Mr. J. K. T. Fernando, Research Assistant looked after the Division.

1. **Statistical Service :**

(*a*) The routine analysis of the experimental data of the Research Divisions were carried out.

(*b*) Statistical summaries of production and exports of coconut products and also charts and diagrams pertaining to same were prepared for the Director.

2. **Biometrical Studies :**

(*a*) Growth and Yield measurements of the Marandawila progeny Trial and the Ratmalagara Calibration Trial were taken to serve as raw material for the Biometrician's proposed studies at East Malling Research Station.

(*b*) The routine recordings of the Calibration Trial at Ratmalagara Estate were carried out as per schedule.

(*c*) The analysis of Botanist's 300-palm block data with a view to determining the efficiency of pre-experimental yield as a calibrating variate for experiments with adult coconut was completed.

3. **Biometrician's work at East Malling Research Station :**

A large volume of data from coconut experiments were examined through the multivariate analytical technique, using the program " Compona " of East Malling Research Station. The analyses were carried out by the " Orion " computer at Rothamsted Experimental Station.

The following are some of the more important studies carried out.

(i) A principal component analysis of seednut, seedling and adult palm characters in coconut.

(ii) A study of vegetative and reproductive characters in adult coconut palms through principal component analysis mainly from the point of view of identifying useful calibrating variates for coconut experiments.

(iii) A revised index of " repeatability " using principal component analysis.

Subsequently, the Biometrician followed a course on " programming " at the International Computers & Tabulators Ltd., London. This course was sponsored by the Ministry of Overseas Development, U.K.

4. **Agri-Meteorology :**

(*a*) **Meteorological Stations—**

Meteorological Stations at Bandirippuwa Estate, Ratmalagara Estate and the Isolated Seed Garden were maintained satisfactorily.

(*b*) **Rainfall 1967 and Crop Prospects 1968—**

TABLE I

Rainfall and its Distribution in Important Coconut Growing Areas of Ceylon

STATION	TOTAL RAINFALL			EFFECTIVE RAINFALL			DISTRIBUTION INDICES		
	1967	1966	Av. (53-56)	1967	1966	Av. (53-56)	1967	1966	Av. (53-66)
LUNUWILA (Bandirippuwa Estate)	92.39	65.68	79.02	78 79	63.16	74.41	(i) 1.7249 (ii) 2.0030	(i) 1.7091 (ii) 2.1781	(i) 1.9059 (ii) 2.8484
MADAMPE (Ratmalagara Estate)	73.84	56.68	63.78	63.40	56.68	61.66	(i) 1.6190 (ii) 2.0400	(i) 1.4866 (ii) 1.8965	(i) 1.6723 (ii) 2.2806
CHILAW	77.89	47.44	62.60	62.60	47.44	59.70	(i) 1.4856 (ii) 1.7801	(i) 1.3111 (ii) 1.6737	(i) 1.5328 (ii) 2.0772
PUTTALAM	44.68	36.35	47.41	45.68	36.35	45.64	(i) 1.1367 (ii) 1.2778	(i) 1.0149 (ii) 1.1257	(i) 1.2673 (ii) 1.5249
KURUNEGALA	94.83	85.50	84.92	92.98	79.58	79.16	(i) 2.5504 (ii) 3.0205	(i) 1.5967 (ii) 2.2335	(i) 1.9683 (ii) 2.8548

The rainfall in 1967 was appreciably higher than in 1966. But most of this rain was concentrated in the last quarter especially so in Lunuwila, Madampe and Chilaw areas. Heavy rain associated with a cyclone occurred in October and this was followed by a Flood in December.

In spite of this concentration of rainfall within the last quarter, the effective rainfall for 1967 was higher than for 1966 or the 5 years' average.

Therefore the crop prospects for 1968 are fairly good. The down-ward trend of coconut production observed during the last three years would be arrested and crops should begin to improve once again. Chilaw district however may not reflect this overall improvement due to the fact that a good number of coconut palms were affected by the recent cyclone. Kurunegala District should show a distinct improvement over the previous year.

5. Production and Exports :

(*a*) Production—

The estimated production of coconuts in Ceylon for the year 1967 is 2,577 million nuts. This is 1.7% below the production of 1966, 18.1% below the peak production in 1964 and 9.9% below the last five years' average.

(*b*) Exports—

The total quantity (in nut equivalent) of the major coconut products exported in 1967 is 951 million nuts—this being 7.6% less than 1966 and 28.9% less than the last 5 years' average.

6. General :

The Biometrician gave a talk entitled " A review of the work of the Biometrics Division " at the quarterly Research Conference of the Institute held on February 1968.

7. Honorary Work :

The Research Officers of the U.N. Soil Fertility Project in Manila and the Post Graduate Students of the Vidyodaya University of Ceylon were helped by the Biometrician in their experimental work.

8. Personnel :

The Research Assistant (Statistics) Mr. J. K. T. Fernando left the services of the Institute on his being appointed Agricultural Engineer in the Department of Agriculture.

V. ABEYWARDENA,
Biometrician.

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REPORT OF THE CHIEF ADVISORY OFFICER

PART I — ADVISORY SERVICE

During the period, under review, the Division advised and guided a large number of owners and persons in charge of coconut plantations, on new-planting, replanting, aftercare of seedlings, manuring, soil and moisture conservation, control of pests and diseases and on other aspects of work in respect to coconut cultivation. This has been done, mainly, by correspondence, by visits and by demonstrations on coconut holdings on how such work should be carried out. In promoting the adoption of improved and scientific methods of cultivation, amongst coconut growers, advice and recommendations made have been based on the results of experiments and findings of the research divisions of the Institute.

As in previous years, the free field advisory service was operated, through the Advisory Field Officers stationed, in predominantly coconut growing areas, in different parts of the country. This year, on an average, only 18 Advisory Field Officers have been effectively engaged in this work. The reason has been due to vacancies in the field cadre two of which have been filled in June and three in December and also because the new recruits after appointment underwent a course of training during the rest of the year. The field staff have, in carrying out this work, made 6,661 visits to coconut holdings irrespective of their size. In most instances, where a coconut land has been inspected, the field staff have advised the owner or the person in charge on more than one aspect of work which necessitated attention. Whenever a person was found to be not quite conversant in carrying out an operation properly, the field staff have trained such persons by giving demonstrations on their lands, how such work should be done.

The nature of work done by the field staff on their visits to coconut holdings is summarised below :—

(1) SOIL CONSERVATION :

(*a*)	No. of holdings	2,078
(*b*)	No. of holdings where demonstrations of tracing were done ...	337
(*c*)	Extent of tracings done at demonstration	8,785 chains.

(2) DRAINING OF WATER LOGGED LANDS :

(*a*)	No. of holdings	583
(*b*)	No. of holdings where demonstrations of tracing were done ...	148
(*c*)	Extent of tracing done on such demonstrations	854 chains.

(3) REPLANTING :

(*a*)	No. of holdings	1,091
(*b*)	No. of holdings where demonstrations of lining were done ...	425
(*c*)	Extent of lining done on such demonstrations	797 acres.

(4) NEW PLANTING :

(*a*)	No. of holdings	362
(*b*)	No. of holdings where demonstrations of lining were done ...	216
(*c*)	Extent of lining done on such demonstrations	329 acres.

(5) **MANURING :**

(*a*) No. of holdings where "On land" recommendations were made... 4,173

(6) **HUSK BURYING :**

(*a*) No. of holdings where "On land" recommendations were made... 2,042

(7) **CULTURAL OPERATIONS :**

(*a*) No. of holdings where "On land" recommendations were made... 1,220

(8) **CONTROL OF WEEDS :**

(*a*) No. of holdings where "On land" recommendations were made... 1,892

(9) **AFTER-CARE OF SEEDLINGS :**

(*a*) No. of holdings where "On land" recommendations were made... 1,103

(10) **PESTS & DISEASES :**

No. of holdings where " On land " demonstrations and/or advice were given on the control of :

(1)	Red weevil	533
(2)	Black beetle	469
(3)	Termites	628
(4)	Caterpillar	49
(5)	Scale Insect	32
(6)	Grey Blight	192
(7)	Stem Bleeding	80
(8)	Bud Rot	41
(9)	Magnesium deficiency	326
(10)	Other pests and diseases	120

In addition, the field staff have delivered 137 talks at 147 meetings which they have attended in their ranges. The Division also participated in two agricultural exhibitions held at Kurunegala and Kuliyapitiya.

Since early December, the entire field staff, except those in charge of Demonstration Centres, have been engaged in an intensive enumeration of coconut lands, conducted by the Biometrician of this Institute. This enumeration was in respect of coconut holdings in Pitigal Korale South and Pitigal Korale North in the Chilaw District that had been affected by the cyclone in October, 1967. These officers worked under difficult and strenuous conditions, daily from morning till late evening, during the period. The enumeration was continued in the following year ; and upto the end of this year, details of damage caused to young and adult palms on approximately 5,632 coconut holdings have been recorded. Crowns of fallen palms constitute a potential source for Red weevil breeding in the early stages, and with decay permit breeding of Black beetle. In view of this, the field staff have, during the course of the enumeration distributed in the affected areas, several hundred advisory pamphlets prepared by this division, indicating precautionary and control measures that should be adopted against these two dangerous pests. Posters emphasising the need to adopt such measures have also been exhibited, in the affected areas for the information of the public.

The Demonstration Centres at Pallai, Mundel, Alampil and Mylambavelly which had been established to serve as visual aids, for the benefit of the coconut growing public, continued to be maintained.

At Pallai, owing to severe drought, the underplanted seedlings have been watered. The uneconomic and senile palms of the adult stand, which nearly 5 years ago had been killed with " Atlas Tree Killer " as an alternative to uprooting, indicated that Black beetle had been breeding in the decayed upper portions of the standing trunks which from time to time have been found to fall off in pieces to the ground. " Atlas Tree Killer " had been used not only to kill the palms, but also to determine whether this poisonous chemical would prevent Black beetle from breeding in the decaying stumps. Owing to the breeding of this pest on the standing trunks, if " Atlas Tree Killer " is used to dispose a senile stand in an underplantation, it will be necessary to uproot the palms once the crowns have fallen off the trees.

At Mundel, in the underplantation 7½ years in age, approximately 81% of the T × T seedlings and 87% of the T × D crosses of the same age were in bearing. Generally, the young plantation here has been doing quite well. The leguminous cover crop, that has been established on the block, effectively kept down Illuk which had been in the past a serious weed on the entire area. As the extent of Mundel Demonstration block was too small, a further extent of 10 acres, 1 rood, 26 perches adjoining the existing area has been acquired this year. At the time of acquisition this area was overgrown with weeds and scrub jungle and contained a neglected coconut plantation of tall and poor senile palms. The scrub and weed growth have been cleared, the land has been ploughed and some of the poor senile palms uprooted.

At Mylambavelly, the balance 15 acres have been planted. The planting had to be delayed until March owing to previous heavy rains which flooded the block and rendered the area water logged for a length of time. Nevertheless, later in the year, the seedlings had to be watered on account of the severe drought that prevailed. In a section of the block, where Illuk and Couch grass is a problem, attempts have been made to establish a leguminous cover crop. The purpose, besides controlling the growth of such weeds, is to ascertain how best this would establish itself and to determine the effect of this cover on the plantation in a sandy soil where the rainfall is poor.

At the Demonstration Centre at Alampil, the entire young plantation of 15 acres was performing well and 79% of the 6 year old plants were in bearing.

Large, black and white posters, indicating the availability of our Free Advisory Service and depicting how low yields could be stepped up, have been exhibited at prominent places in the ranges of the Advisory Field Officers.

The Free Advisory Service, has been effectively promoting an interest among quite a number of coconut growers, judging from the number of inquiries that have been received and the several persons who have been adopting our recommendations. Individual contact has been found to be the best form of approach. Nevertheless, this form of approach is necessarily limited in its application considering the enormous number of holdings and the available staff. With the present staff, each Advisory Field Officer has to operate an area varying from 35,000 to 55,000 acres of coconut. With such a set up it is naturally not possible to give individual attention to a wider coconut growing public. Being mindful of this fact a memorandum, entitled "Objects, Functions and Projected Requirements for the Advisory Division " was submitted for consideration in August 1965, which embodied a request for facilities to provide a more meaningful Advisory and Extension Service through group and mass media forms of education. The criticism, that our services are inadequate, will therefore have to remain owing to the paucity of staff and lack of necessary facilities to provide an intensive publicity and propaganda drive. During the year a committee, appointed by the Hon. Minister of Agriculture and Food, to report

on measures required to improve the productivity of coconut lands, have in their report recognised " That the Advisory Division of the C.R.I. did not adequately cater to the needs of the coconut industry as far as extension was concerned ". The committee in consideration of this fact had recommended the necessity and desirability of having an Extension and Advisory Service to work in closer contact with the Fertilizer Corporation and the Coconut Rehabilitation Department. It is hoped this Division will be provided with necessary facilities and amenities to improve its organization to the best possible levels, and within available resources, to provide a more vigorus and extensive service to the industry.

STAFF

The position of the staff at the end of the year was as follows :—

District Coconut Instructors	2
Advisory Field Officers	24
Clerk/Typists	2
Office Attendant	1

Vacancies in the Field staff have been filled by the appointment of the following :—

Mr. S. Rajapakse, Advisory Field Officer as from 1.6.67.
Mr. D. P. R. N. Edirisinghe, Advisory Field Officer as from 2.12.67.
Mr. N. L. S. Parakrama de Silva, Advisory Field Officer as from 2.12.67.
Mr. D. H. S. W. Thillekeratne, Advisory Field Officer as from 2.12.67.

Messrs M. A. S. Perera, Advisory Field Officer (temporary) and P. A. Hemapala, Field Attendant (temporary) who were attached for work under the scheme for planting coconuts in citronella lands have in their same capacities been appointed to the permanent cadre.

The following transfers were effected in January :—

Mr. V. Venayagam, Advisory Field Officer from Pallai to Batticaloa.
Mr. V. Arunasalam, Advisory Field Officer from Batticaloa to Pallai.
Mr. L. D. Thambugala, Advisory Field Officer from Kurunegala to Kandy/Matale.
Mr. T. D. J. R. D. Peiris, Advisory Field Officer from Gampaha to Kurunegala.
Mr. P. D. Wijesinghe, Advisory Field Officer from Kandy/Matale to Matara.
Mr. P. A. Wijewickrema, Advisory Field Officer from Matara to Gampaha.
In August, Mr. Dunston Fernando, Advisory Field Officer from Negombo to Head Office.

PART II

SUBSIDY SCHEME FOR PLANTING COCONUTS IN CITRONELLA LANDS

Work under the scheme continued to be carried out during the year. As in previous years citronella lands, that had been planted in coconut under the scheme, continued to be visited by the field staff in order to advise and inspect the coconut plantations. The inspections have been, for the purpose of recommending the payment of the annual cash subsidy of -/50 cts. per plant, properly maintained on the lands. In carrying out this work the field staff have visited 6,640 lands and recommended the payment of subsidy for 643,874 seedlings, out of 856,147 seedlings that had been declared, as well maintained by the owners of land.

Free fertilizer has been distributed among applicants, owning 10 acres and under, who had planted coconut seedlings during May/June, 1962. This was done through permits ; 2,197 of which had been issued. A total of 380 tons—6 cwts and 14 lbs. have been distributed. Similarly during October/November, 4,147 permits have been issued and 3,866 applicants took delivery of fertilizer. A total of 1,102 tons—14 cwts and 84 lbs. of fertilizer have been distributed in this manner among those persons, owning upto 10 acres of land, who had planted up their lands during May/June, 1960 and October/November, 1962.

STAFF

The position of the staff at the end of the year was as follows :—

District Coconut Instructor	1
Advisory Field Officers	2
Field Attendants	16
Clerk/Typists	5
Office Attendants	2

Two Field Attendants who had been seconded for service from the Planting Division of this Institute continued to work under the scheme.

Vacancies in the Field Attendants grade have been filled by the appointments of the following in December :—

Mr. N. A. D. W. Cyril,
Mr. H. M. Muthubanda,
Mr. S. B. Dharmadasa,
Mr. J. D. M. Wilfred,
Mr. M. H. E. S. de Silva.

Messrs V. Dharmadasa, Field Attendant and S. Liyanage, Clerk/Typist resigned to take up appointment elsewhere.

Messrs H. D. Wijeratne, Field Attendant, Vitharandeniya and H. M. Karunaratne, Field Attendant attached to Head Office have been transferred in July to Kakmana and in August to Walasmulla respectively.

C. A. WICKRAMASURIYA,
Chief Advisory Officer.

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REPORT OF THE PLANTING OFFICER

1. NURSERIES : (SEEDNUTS)

Twelve nurseries were maintained during the year and 2,066,354 seednuts were planted for issue of seedlings during the two seasons—May/June and October/November, 1967, the distributions of seednuts in the nurseries being as follows :—

DISTRIBUTION :

Nursery :	*May/June 1967*	*Oct/November 1967*	*TOTAL*
Ratmalagara	110,200	256,010	366,210
Hettipola	35,000	40,000	75,000
Wilpotha	95,820	245,005	340,825
Walpita	105,950	98,280	204,230
Eraminigolla	40,000	40,000	80,000
Karawaddana	41,110	192,244	233,354
Koggala	27,290	60,825	88,115
Kalawewa	—	150,300	150,300
Mylambavely	—	100,680	100,680
Kilinochchi	—	101,020	101,020
Alampil	—	151,075	151,075
Handapangala	—	175,545	175,545
	455,370	1,610,984	2,066,354

SEEDLINGS :

Orders were accepted during the calendar year—1st January to 31st December, 1967 for 1,415,747 seedlings for delivery in May/June and October/November seasons of 1967 :

DISTRIBUTION BY NURSERIES :

Nursery	*May/June 1967*	*Oct/November 1967*	*TOTAL*
Ratmalagara	76,051	149,612	225,663
Hettipola	41,420	28,710	70,130
Wilpotha	65,551	175,915	241,466
Karawaddana	40,265	135,650	175,915
Walpita	76,380	65,809	142,189
Eraminigolla	31,192	29,195	60,387
Koggala	21,733	42,834	64,567
Kalawewa	—	107,710	107,710
Alampil	—	81,755	81,755
Kilinochchi	—	70,340	70,340
Handapangala	—	121,170	121,170
Mylambavely	—	54,455	54,455
	352,592	1,063,155	1,415,747

SUMMARY :

	May/June 1967	Oct/November 1967	TOTAL
Seedlings booked by :			
Small holders	130,288	243,776	374,064
Estate Owners	191,981	339,739	531,720
Government Departments ...	30,323	91,640	121,963
Land Commissioner	—	388,000	388,000
	352,592	1,063,155	1,415,747

Distribution of Orders by Revenue Districts

May/June—1967 :

Revenue District	Small Holders	Estate Owners	Govt. Depts.	Govt. Agents	TOTAL
Colombo/Negombo ...	35,214	28,351	—	—	63,565
Kalutara	1,110	400	—	—	1,510
Puttalam/Chilaw ...	36,937	68,150	—	—	105,087
Kurunegala	37,395	81,505	5	—	118,905
Anuradhapura	—	—	—	—	—
Polonnaruwa	250	—	—	—	250
Jaffna	—	—	—	—	—
Vavuniya	—	—	—	—	—
Mannar	—	—	—	—	—
Batticaloa	—	—	—	—	—
Trincomalee	—	—	—	—	—
Amparai	—	—	—	—	—
Galle	5,039	2,000	—	—	7,039
Matara	3,456	2,740	168	—	6,364
Hambantota	1,800	4,300	—	—	6,100
Kandy	2,575	650	20,000	—	23,225
Nuwara Eliya	—	—	650	—	650
Matale	1,700	1,950	5,000	—	8,650
Badulla	—	—	—	—	—
Monaragala	—	—	—	—	—
Kegalle	4,547	1,310	4,500	—	10,357
Ratnapura	265	625	—	—	890
	130,288	191,981	30,323	—	352,592

October/November—1967 :

Colombo/Negombo	...	15,469	19,474	250	1,100	36,293
Kalutara ...	...	1,575	2,300	—	3,500	7,375
Puttalam/Chilaw	...	86,715	139,310	125	85,000	311,150
Kurunegala ...	...	37,277	60,185	10	—	97,472
Anuradhapura ...	...	11,625	1,700	—	70,000	83,325
Polonnaruwa ...	...	7,085	2,800	—	—	9,885
Jaffna ...	...	19,420	14,050	50	23,000	56,520
Vavuniya ...	...	22,150	43,170	7,155	34,000	106,475
Mannar ...	...	150	2,000	—	—	2,150
Batticaloa ...	...	5,905	8,000	4,550	2,000	20,455
Trincomalee ...	...	1,350	1,800	—	25,000	28,150
Amparai ...	...	500	—	2,500	5,000	8,000
Galle ...	...	1,780	7,150	—	10,000	18,930
Matara ...	...	1,610	1,950	150	2,900	6,610
Hambantota ...	...	4,350	12,250	250	2,500	19,350
Kandy ...	...	3,720	3,700	25,050	23,500	55,970
Nuwara Eliya ...	...	—	—	7,800	—	7,800
Matale ...	...	4,200	7,950	—	7,500	19,650
Badulla ...	...	3,250	—	8,750	39,000	51,000
Monaragala ...	...	8,580	4,100	35,000	30,000	77,680
Kegalle ...	...	1,550	1,000	—	4,000	6,550
Ratnapura ...	...	5,515	6,850	—	20,000	32,365
		243,776	339,739	91,640	388,000	1,063,155

2. DELIVERY OF SEEDLINGS :

Details of seedlings actually delivered during the year. 1st January to 31st December, 1967 are as follows :—

NURSERY	*Balance seedlings of Oct/Nov. 1966 season*	*Seedlings raised for May/June 1967 season*	*Seedlings raised for Oct/November 1967 season*	*TOTAL*
Ratmalagara	45,773	73,181	115,582	234,536
Hettipola	1,300	26,725	25,420	53,445
Wilpotha	28,663	72,986	133,005	234,654
Koggala	5,850	20,556	26,751	53,157
Walpita	39,779	72,450	39,551	151,780
Eraminigolla	8,227	27,628	12,945	48,800
Karawaddana	59,702	28,160	75,955	163,817
Kalawewa	7,870	—	96,975	104,845
Mylambavely	9,823	—	52,548	62,371
Handapangala	8,984	—	83,900	92,884
Alampil	6,058	—	61,105	67,163
Kilinochchi	—	—	63,170	63,170
	222,029	321,686	786,907	1,330,622

No. of seedlings issued during the 1st quarter of 1967	...	...	...	170,809
No. of seedlings issued during the 2nd quarter of 1967	...	...	...	232,171
No. of seedlings issued during the 3rd quarter of 1967	...	...	...	128,907
No. of seedlings issued during the 4th quarter of 1967	...	...	...	798,735
				1,330,622

3. PERSONNEL

Recruitments	...	nil.
Promotions	...	nil.
Transfers	...	Mr. S. D. Mullevitane was transferred to Handapangala nursery.
Resignations	...	Mr. J. K. D. W. Siriwardane, nursery attendant left the services of the Institute.

P. D. L. FERNANDO,
Planting Officer.

Ceylon Cocon. Quart. (1968) **19, 86–91**

REPORT OF THE PUBLICATIONS OFFICER

Ceylon Coconut Quarterly

Three issues of Ceylon Coconut Quarterly (Vol. XVII No. 2, XVII Nos. 3/4, Vol. XVIII Nos. 1/2) were released during the year.

Ceylon Coconut Planters' Review

Two issues of Ceylon Coconut Planters' Review (Vol. IV No. 4, Vol. V No. 1) were released. Vol. V No. 1 was the last of the free copies of Planters' Review issued for the purpose of popularising the journal. Readers have now been requested to subscribe to the subsequent issues of the Journal. As a result of this move an increase in circulation is expected in 1968.

With the free issues despatched, we sent an appeal to readers to send in their comments and suggestions regarding possible improvements of the publication. Those who responded agreed that the journal is extremely useful and good. Some of the important suggestions among several received are given below—

(*a*) The magazine may be printed on low quality paper (news print) and sold at a lower price.

(*b*) Cover should be of thicker paper material.

(*c*) The journal be made available in leading book stalls.

(*d*) Articles in some issues at times tend to be too technical, and this should be avoided as far as possible.

(*e*) More articles from coconut planters should be included.

(*f*) Regarding subject matter to be included different aspects of coconut cultivation and production were emphasised by the respondents and it was difficult to discern any special area of interest. Desire for information on international market situations and price trends has been expressed.

All above suggestions and any more to be received in future would be carefully considered and possible improvements would be effected as early as possible.

Pol Pawath

Vol. IV No. 1 of our Sinhala journal Pol Pawath was published. Vol. IV No. 2 was sent to the press but could not be released before the end of the year. It appears that the journal is becoming increasingly popular. We have noted a sharp increase in the demand for the magazine. Circulation increased from 5,000 to 6,000.

Advisory Leaflets

Post testing :—In order to improve the readability of Advisory Leaflets, some leaflets were subjected to post testing. For a start some Sinhala leaflets were presented to a few persons, representative of the target audience for perusal, and their difficulties in comprehension were noted. These tests have given us some useful hints and changes are being gradually incorporated into the leaflets when these are reprinted.

Even though literacy in Ceylon is high when compared to other Asian Countries, we have to take note of the fact that literacy of a vast majority of peasantry is limited to two or three years of schooling. We have selected a few persons with such an educational background for comprehension testing. One difficulty we have experienced is that they do not often respond to questionnaires sent by post, and this means that we have to resort to interviewing in our post-testing or pre-testing work. This entails time consuming work for which sufficient facilities are not available, but interviewing, even if other modes of testing happen to be less difficult, is perhaps the best method of comprehension testing. We have resorted to another method, and that is to consult the opinion of the village elite—the village priest, Ayurvedic Physician and the School-master—on the language, typography and illustrations of leaflets. They move in very close contact with the villagers and have a clear understanding of the villagers' frame of reference. They also respond to our requests in writing and interviewing is not so essential. This method of testing, though less dependable, appears to be nevertheless satisfactory.

Spoken idiom introduced in some Sinhala leaflets on a trial basis is still being continued. The comprehension tests referred to above, show that we may continue to use spoken idiom, but more precise testing has to be done before we adopt this method as a matter of policy.

The demand for leaflets has increased after the commencement of our regular radio programmes.

The first Edition of following leaflets were released during the year :—

English Leaflets—

No. 44 — Hand-Pollinated coconut seedlings (August 1966).

No. 47 — Controlled pollination of coconut palm (October 1966).

No. 48 — Toddy Tapping (August 1967).

Sinhala Leaflets—

No. 40 — Nettle Grub, Locust, Bag worm-pests of the coconut palm (May 1967).

No. 41 — Bud Rot (July 1966).

No. 45 — Pasture under Coconuts (July 1966).

No. 46 — Planting Coconut in Home Gardens (September 1967).

No. 47 — Controlled Pollination of coconut palm (May 1967).

Tamil Leaflets—

No. 40 — Nettle Grub, Locust, Bag worm-pests of the coconut palm (July 1966).

No. 42 — Bud Rot (July 1966).

No. 44 — Hand-Pollinated coconut seedlings (July 1966).

Following leaflets were revised and reprinted during the year. Some of these were revised in the latter part of 1966, but were released from the press in 1967—

English Leaflets—

No. 4 — Transplanting Coconut Seedlings (March 1966).

No. 8 — Manuring of young palms (January 1967).

No. 9 — The Use of Locally available organic materials for manuring coconuts (March 1967).

No. 21 — Planting coconuts on old rubber lands (October 1966).

No. 24 — Cattle under coconuts—Farmyard manure (August 1967).

No. 36 — The Manuring of Adult coconut palms (August 1967).

No. 46 — Planting Coconut in Home Gardens (August 1967).

Sinhala Leaflets—

No. 4 — Transplanting coconut seedlings (March 1967).

No. 8 — Manuring of young palms (January 1967).

No. 9 — The Use of locally available organic materials for manuring coconuts (January 1967).

No. 17 — Cover crops under coconuts (September 1967).

No. 19 — Free Advisory Service (July 1966).

No. 21 — Planting coconuts on old rubber lands (October 1966).

No. 24 — Cattle under coconuts (August 1967).

No. 28 — Control of illuk (October 1966).

No. 29 — Rats, bats, bandicoots and porcupines-pests on coconut (July 1966).

No. 33 — Stem Bleeding in coconut palms (July 1966).

No. 36 — The Manuring of Adult coconut palms (January 1967).

Tamil Leaflets—

No. 4 — Transplanting coconut seedlings (March 1966).

No. 8 — Manuring of young palms (January 1967).

No. 19 — Free Advisory service (July 1966).

No. 37 — Red Weevil and its control (February 1967).

No. 38 — The Coconut scale insect and its control (September 1965).

No. 42 — Leaf Blight (July 1966).

Following Leaflets were reprinted during the year—

English Leaflets—

No. 6 — Coconut Shell charcoal (October 1967).

No. 22 — The Manufacture of coconut toddy vinegar by the ' Generator ' Process (February 1967).

No. 45 — Pasture under coconuts (July 1966).

Sinhala Leaflets—

No. 15 — The Ceylon Copra kiln (January 1967).

No. 25 — Ceylon copra kiln. Analysis of causes of deterioration or spoilage of copra (December 1966).

Following leaflets were in the press at the end of the year—

Tamil Leaflets—

No. 43 — Magnesium deficiency in coconut palm (Revised Edition—October 1965).

No. 46 — Planting coconut in Home Gardens (First Edition—August 1967).

Radio Talks

After an interruption at the beginning of the year our regular radio programmes in *Sinhala* commenced once again in July, 1967. We now broadcast approximately two 15 minutes programmes for a month. The bulk of our programmes for the year were devoted to Crop Protection. There was a special programme on the ' Changes in fertilizer recommendations ' because it was felt that changes made in our recommendations have to be given additional publicity. Announcements on closing date for seedling applications, services rendered by CRI, etc. were made from time to time.

Regular broadcasts in *Tamil* commenced in July 1967. One talk of 15 minutes duration per month was broadcast in Tamil over the Tamil National Service. Bulk of the programmes was devoted for Seed Selection and planting. There was a special programme on fertilizer recommendations and time was allocated for special announcements wherever necessary.

Apart from our regular series of programmes in Sinhala and Tamil broadcast over the National Service of respective transmissions, arrangements were made to broadcast four talks over the ' Sastriya Sangrahaya '—the counterpart of the third programme of BBC in Sinhala. The talks were presented by the Staff of the Ceylon Broadcasting Corporation and were based on the following articles :

1. Seasonal variation of Coconut Crops—By V. Abeywardena & J. K. T. Fernando (C.C.Q. Vol. XIV Nos. 3/4 P. 74).

2. Methods of under planting in Senile Coconut Plantations—By Dr. D. V. Liyanage (C.C.Q. Vol. XIV Nos. 3/4 P. 89).

3. Moisture and other quality factors of Copra—By Dr. W. R. N. Nathanael (C.C.Q. Vol. XVII No. 1 P. 1).

4. Application of isotopes in fertilizer Research on the Coconut palm—Dr. D. A. Nethsinghe. (C.C.Q. Vol. XVII No. 2 P. 61).

These programmes were designed for an audience with a higher level of education and understanding when compared to the audience for ' rural services '. Apart from the rural peasantry we have to think in terms of a ' Sinhala or Tamil educated intelligentsia ' and this sector of the public has perhaps significantly enlarged as a result of the changes that have taken place in the educational system during last twenty years.

Two talks were broadcast over Sinhala Commercial Service on (1) Need for replanting and Manuring, and (2) Services rendered by Coconut Research Institute. We have also made use of the time set apart for " Agricultural News " by the Broadcasting Corporation for announcements.

Mode of Presentation :—Programmes were presented either in the form of straight talks or discussions. Several programmes took the form of discussions with research officers who were responsible for the findings referred to in the talks. This mode of presentation gives a good deal of authenticity to the programmes. The need for field recording had been felt, but the work has been hampered due to the non-availability of a tape recorder. One voice recordings, presented in the form of straight talks should not however be looked upon as inferior to other forms of rendering programmes. This form has its own merits.

Though in a different context, Mr. Jean Tardieu of Radiodiffusion-Television Francaise, France, states as follows : " . . . our producers, today have rediscovered the one voice reading of dramatic or literary masterpieces and with it have recorded, for several years notable and quite exceptional successes . . . Perhaps the threat of television has prompted radio to return to the eternal magic of human voice, to assert its power as ' bard ' and story teller . . . the work of programme producer and engineers has become so perfect, that big effects are no longer necessary, nuances can do all the work ". *

Our thanks are due to the authorities of the Ceylon Broadcasting Corporation for allocating time for our broadcasts and the co-operation they have extended in the production of our programmes.

Film

Arrangements were made in 1966 for the production of a documentary on coconut by the Government Film Unit. We have failed to produce this film in 1967 due to the fact that Government Film Unit was busy with other work. We now have definite information to the effect that this project would materialize in 1968.

Library

During the year 78 journals were received on subscriptions. Number of journals received on exchange is increasing annually and now 150 journals are received on this basis. We have also purchased 83 books during the year. Purchase of journals and books have been curtailed due to limited foreign exchange available. Due to the expansion of work in Crop Protection Division the necessity for an increase in purchase of books and periodicals on Entomology, Mycology and Plant Pathology has been felt. These requirements would be met as far as present facilities would permit, during 1968.

It has been possible to meet most of the requirements of the Staff by borrowing books and periodicals for reference from other libraries. In this connection our thanks are due specially to the libraries of the Department of Agriculture, University of Ceylon, and University of Ceylon (Colombo).

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* Unesco. *Cultural Radio Broadcasts-Some experiences.* Reports and Papers on Mass Communication, No. 23. Paris, 1956.

Index maintained in the library on coconut is kept up to date and every effort is being made to collect literature available on coconut from all possible sources to build up a comprehensive collection on the subject.

A new feature introduced during the year is the extension service to the Staff by the issue of a Quarterly Bulletin which presents information collected from other sources on subjects relevant to the work done in the Institute. Material available in this bulletin will be incorporated in our periodicals in due course for the benefit of others interested in such information.

Mr. M. J. C. Perera, Library Assistant returned in October 1967, after one year of Internship in Liverpool Central Library. He has acquired further professional qualifications in passing to Intermediate Examination in Librarianship (Part I) conducted by the British Library Association.

GUNAPALA ADIMALI,
Publications Officer,
Coconut Research Institute.

Ceylon Cocon. Quart. (*1968*) **19**, 92–94

REPORT OF THE WELFARE OFFICER

The strength of the staff was as follows :—

	Senior	*Intermediate*	*Asst.*	*Minor*	*Total*
At the end of 1966	6	7	121	103	236
Not accounted in 1966	—	—	—	—	1
New appointments in 1967	—	—	9	13	22
Retirements in 1967	—	—	—	—	—
Resignations in 1967	1	—	4	3	8
Deaths	—	—	1	—	1
Promotions	—	—	—	4	4
Staff position as at 31.12.67	5	7	125	109	246

The cadre of the staff at the end of 1967 was 246 as against 236 in 1966. There were 9 new appointments to the Assistant Staff Grade and 13 to the Minor Staff. 5 out of the 9 appointments to the Assistant Staff Grade were made internally and 8 out of the 13 appointments to the Minor Staff were also from the Institute's labour force. The report of the Salaries and Cadre Committee was implemented and the salaries of those officers who accepted the new scales were revised.

The permanent labour force of the Institute as at 31.12.67 was as follows :—

On Monthly Pay	... ...	19
On Daily Pay	... ...	331

This excludes temporary gangs on daily pay and contract employed for casual work. All monthly paid employees categorised as Non-Staff employees are now eligible for recruitment to the Minor Staff on completion of 12 years continuous service and thus be entitled to all privileges enjoyed by the Minor Staff. Daily paid employees are getting enhanced rates of wages above the respective trades of the Wages Board Ordinance they are classified in addition to the increase of pay given following the devaluation of the rupee. A service allowance of -/15 cents on completion of first 5 years continuous service and another -/15 cents on completion of the second 5 years continuous service are payable in addition to all other benefits. The prospect of placing some categories of daily paid labourers on monthly pay is under consideration.

Workmen's Compensation :—There were 26 accidents during the year as against 24 in 1966. There was one fatal accident—R. K. Babasingho, Buildings Labourer who was electrocuted while on duty. An year's basic salary as a death gratuity was paid to the wife of the deceased and arrangements have been made to obtain compensation for the legal heirs of the deceased under the Workmen's Compensation Ordinance. As a special privilege the workers are covered for the first seven " waiting days " on payment of an additional premium. An year's basic salary was also paid to the wife of the late Mr. C. S. Fernando, Watcher, who died while in service of the Institute.

Housing :—A sum of Rs. 19,050/- has been spent in the construction of buildings during the year and two meetings of the Housing Committee were held during the year to consider allocation of quarters and other matters relating to the allocation of quarters. Canteen, bath-room and rest room facilities were maintained as in previous years.

Financial Aid :—(*a*) Festival Advance of Rs. 100/- per head were paid to the staff and non-staff monthly paid employees drawing a basic salary of Rs. 300/- and less and Rs. 50/- to the daily paid employees. (*b*) The Provident Fund contributions from the staff was Rs. 93,779.69 to which the Board contributed a sum of Rs. 95,083.40. The interest accrued was Rs. 72, 837.88 as at 31.12.67.

The following payments have been made from the Provident Fund during the year :

Loans for purchase of building sites and construction of houses	Rs.	156,835.00
Insurance Premia	Rs.	25,462.87

(*c*) The staff contribution to the Medical Aid Fund during the year was Rs. 19,945.81 while the Board contributed a sum of Rs. 19,945.61 during the same period. 13 meetings were held during this period and the following payments have been made : One of these meetings was held to elect a new representative of the Senior and Intermediate Staff.

Payments in respect of claims	Rs.	32,422.00
Payments in respect of loans	Rs.	1,685.00

The panel of doctors has continued to extend credit facilities and special concession to members.

General :—Liaison between the Institute and its Social and Welfare organisations was maintained and the necessary assistance was given to the Administration in carrying out the establishment work of the Institute and in particular applications and complaints regarding Provident Fund, Festival Advance, Loans, Insurance, Medical Aid, Employment and training have been dealt with.

Thrift, Savings and Stores :—The C.R.I. Co-operative Welfare Society catered to the needs of its members in the supply of controlled articles. With a view to making it a Multi-purpose Society the members contributed on easy terms to a fixed Deposit Account.

Recreational and Cultural activities :—This was the year when the club actually moved into the Club House. The Coconut Research Board gave an additional grant of Rs. 3,000/- to lay out courts and purchase furniture.

With this vote the following were laid under the supervision of the Committee :—

Tennis Court, Volley-ball Court, Badminton Court, Practice Cricket pitch. A few items of furniture were also provided and the balance of approximately Rs. 800/- is expected to be utilised for purchase of more furniture.

Socials and Club Nights were held quarterly culminating in the Annual Christmas Party where members' children were given gifts. An Inter-Club Tournament was organised this year. Participation of members' children in the activities of the club is encouraging. The membership is rapidly increasing and now stands at 132. The Club participated in the "D" Division Government Service Cricket Tournament and was eliminated in the secnod round having won the first match played against the C.T.B. The team also participated in a few friendly Cricket matches during the year.

A fully furnished Rest Room including a radio has been provided at the Headquarters and Rest rooms for labourers at Headquarters and in outstations have also been maintained at Institute's expense.

The C.R.I. Art Circle participated in several excursions and also organised the Sinhalese New Year celebrations during the year. The Institute has spent a sum of Rs. 128/90 on newspapers and magazines during the year.

Industrial Relations :—There were no industrial disputes and the atmosphere remained to be rather quiet during the year. There appeared to be a better understanding among employer-employees and the participation of members in the activities of the respective Unions was high and encouraging.

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

Ceylon Cocon. Quart. (*1968*) **19**, 95–98

REPORT ON ESTATES

(i) BANDIRIPPUWA ESTATE

Acreage Statement :—

	A.	R.	P.
Extent used for Experiments by Research Divisions ...	175	0	04
Extent maintained under Estate Conditions	169	0	13
Buildings, Streams and Roads	17	0	00
Waste Land and Paddy		3	14
Playground	5	0	00
Total Acreage ...	365	3	31

Census End 1967.

Particulars	*1*	*2*	*3*	*4*	*5*	*6*	BB	GA	GB	A	B	C	*Total*
Full Bearing ...	1362	424	828	1777	662	117	58	296	225	4928	2642	1981	14500
Partial Bearing ...	326	214	238	390	128	16	10	28	42	850	735	771	3748
Duds ...	102	153	106	124	64	35	6	3	10	138	125	104	970
In Flower ...	2	5	2	95	18	—	—	82	—	512	—	1	256
With stem ...	3	104	1	44	77	—	—	88	—	1555	1	1	1874
Established Plants...	—	8	—	36	156	—	—	89	—	251	2	2	544
Supplies ...	146	—	246	19	10	—	—	—	—	19	—	—	440
Vacancies ...	55	2	32	100	65	6	—	9	6	665	244	239	1423
Total ...	1996	910	1453	2585	1180	174	74	595	283	8457	3749	3099	23755

Cyclone on the 20th and 21st October 1967—uprooted 904 bearing palms.

Rainfall :—Comparative Rainfall 1966/1967 with respective wet days.

Month	1966		1967		Total Rain Fall	Average Rain Fall
	Inches	Wet Days	Inches	Wet Days	1961/65	1961/65
January	2.15	4	0.88	3	14.18	2.38
February	3.68	4	3.47	4	15.77	3.15
March	2.72	5	1.85	7	31.24	6.25
April	10.20	20	4.22	6	32.03	6.41
May	1.18	8	9.49	19	74.72	14.94
June	2.52	10	6.90	21	39.29	7.46
July	2.32	6	4.07	10	21.74	4.35
August	0.29	2	2.99	12	28.55	5.71
September ...	19.09	15	11.10	11	27.31	7.46
October	9.51	15	25.37	17	70.84	14.17
November ...	6.07	13	13.88	19	39.84	9.97
December ...	4.51	12	4.64	8	17.64	3.53
Total ...	64.24	114	88.56	137	423.15	84.53

Crops :—Total Crop from 1963 to 1967 with the respective Averages.

Pick	1963	1964	1965	1966	1967	Average
1st Crop	136,099	155,216	142,741	89,966	120,536	128,911
2nd Crop	245,978	210,927	218,317	134,782	215,545	205,109
3rd Crop	302,346	274,377	268,827	247,774	235,398	265,744
4th Crop	258,931	239,159	254,697	239,604	161,286	230,735
5th Crop	152,098	167,098	182,795	132,914	178,888	162,758
6th Crop	129,715	130,820	120,655	92,468	191,825	133,096
Total ...	1,225,167	1,177,597	1,188,032	937,508	1,103,478	1,126,353

Disposal of Crops (6 Crops 1967)

	Nuts	
Sold on Contract	401,000	
Sold to Research	504	
Sold to Staff	4,768	
Nursery	3,695	
Converted into Copra	647,638	
Nut Allowance to Staff	27,128	
Empties	18,745	1.69%
	1,103,478	

647,638 nuts were turned into copra weighing 360 candies—529 lbs. with an out-turn of 1,794 nuts per candy. The percentage of nuts per candy was high due to the fact that nuts converted into copra were the left overs from nuts sold to contractors and to the Planting Officer. The percentage of No. 1 quality Copra was 89.1.

FIELD NOTES

The following field works have been carried out during this year.—

Weeding :

Weeds have been effectively controlled on the Estate.

Drains :

1,042 fathoms of new drains have been cut in No. 4 Field and all old drains have been maintained in good order.

Roads :

All Estate roads have been maintained in good order.

Streams :

1,039 fathoms streams running across the estate have been deepened.

Pests and Diseases :

There were a few cases of black beetle attack on palms, but the pest was kept under control by adopting required preventive and control measures.

Disc harrowing by Tractor was done on the whole estate thereby keeping weed growth under control.

A cyclone swept over the estate on the 21st and 22nd October 1967 bringing down 904 bearing palms.

Manuring :

All the palms on the estate section were manured with a mixture containing equal proportions of sulphate of ammonia, saphos phosphate and muriate of potash (60%), at the rate of 7 lbs. per palm. The manure was applied in half circles and forked in. The palms in the Research Sections were manured as per experimental requirements.

HENRY A. RANASINGHE,
Superintendent,
Bandirippuwa Estate.

Ceylon Cocon. Quart. (*1968*) **19**, 99-100

(ii) RATMALAGARA ESTATE

ANNUAL REPORT FOR THE YEAR ENDING 1967

Superintendent :—S. T. Braine. Assumed duties on 1st October, 1967.

Staff :—Mr. W. H. R. A. Fernando, F/A Estate. Four watchers and one Tractor Driver.

Acreage Statement :—This research station is approximately 272 acres in extent and is comprised of the following Research Divisions which have their own officers in charge of the experiments; Division of Botany, Division of Soil Chemistry, Division of Agrostology, Planting Division and the Estate Division. The Biometrician too has an experiment at Ratmalagara but no resident officer has been stationed here. There is also a three acre block of Clonal Rubber the tapping of which was stopped in December. The rubber trees are to be uprooted and Oil palms are to be planted instead.

Rainfall :—Comparative rainfall by months during the last five years.

	1963	*1964*	*1965*	*1966*	*1967*
January ...	3.15	2.50	—	1.20	0.89
February ...	0.15	1.44	1.78	1.30	—
March ...	5.05	8.00	0.36	5.64	2.24
April ...	3.06	1.93	3.39	9.49	7.23
May ...	7.21	9.18	5.32	0.77	6.03
June ...	3.14	3.18	1.46	2.30	5.34
July ...	7.80	2.97	0.09	1.50	4.13
August ...	0.99	1.22	1.69	—	4.42
September ...	4.65	9.47	0.78	10.17	2.11
October ...	10.11	7.27	16.81	10.57	24.44
November ...	10.90	16.79	6.30	6.38	9.95
December ...	4.67	—	6.77	5.76	6.96
	60.88	63.95	46.75	55.08	73.74

Crops :	1963	1964	1965	1966	1967
1st crop ...	88,806	93,857	98,290	65,484	88,477
2nd crop ...	154,890	128,764	162,689	122,472	132,262
3rd crop ...	208,134	181,855	162,985	161,622	97,159
4th crop ...	175,252	137,397	175,467	158,336	88,310
5th crop ...	93,738	116,424	132,521	69,589	102,736
6th crop ...	72,627	77,865	62,039	59,963	117,873
	793,447	736,162	793,991	637,466	626,817

Disposal of Nuts Estate Section :

Cured into copra	242,439 nuts
Sold on contract	29,950 ,,
Sold to Planting Division	83,450 ,,
Allowance staff, labour	11,512 ,,
Rejections	6,441 ,,
	373,792 nuts

Copra :—From 242,439 nuts cured, 156 candies and 208 lbs. of copra of all grades were turned out. The percentages being No: 1—81.41%, No : 2—17.94% and No : 3—0.63% (1,554 nuts per candy).

Field work :—All palms in the estate section were manured during the year, and the palms in the Research Sections were manured as per experimental requirements.

The fence all round the Research Station have been repaired and well maintained.

The effect of the Cyclone in October was negligible and only about 10 palms were destroyed.

Buildings :—The buildings within the Research Station have been well maintained.

S. T. BRAINE,
Superintendent,
Rathmalagara Estate.

COCONUT RESEARCH INSTITUTE OF CEYLON

Staff as at 1st January, 1968.

Director

W. R. N. Nathaneal, M.Sc., Ph.D. (Lond.), F.R.I.C.

CHEMISTRY DIVISION

Officer-in-Charge & Senior Technical Assistant	... M. Jeganathan, B.Sc., (Lond.)
Technical Assistants ...	... M. P. Tissera G. A. S. Nanayakkara P. A. D. G. Appuhamy B. J. A. F. Mendis

BOTANY DIVISION

Research Assistant ...	... M. A. P. P. Manthriratne, B.Sc. (Lond.) (On Overseas Study Leave)
Officer-in-Charge ...	... R. B. Rodrigo
Field Officer	... R. W. Senaratne
Technical Assistant ...	... W. P. Bertie Fernando
Officer-in-Charge I.S.G. ...	... T. M. T. S. P. F. Goonawardena
Senior Field Assistant ...	... T. H. S. Perera
Field Assistants ...	... D. L. G. Lokebalasuriya M. H. Karunadasa G. A. Wijesoma V. Dharmadasa
Conductor, P.R.S. ...	... S. Edirisinghe
Clerk/Typist	... K. A. Ariyadasa

SOIL CHEMISTRY DIVISION

Soil Chemist	... D. A. Nethsinghe, B.Sc. (Cey.), D.Phil. (Oxon.), A.R.I.C. (On Overseas Assignment)
Acting Soil Chemist & Research Assistant ...	... T. S. Balakrishnamurthi, B.Sc. (Lond.) M.Sc. (Aberdeen)
Senior Technical Assistant	... M. A. T. de Silva, B.Sc. (Lond.) (On Overseas Study Leave)
Technical Assistants ...	... V. Nalliah K. S. O. Perera D. M. Selvanayagam K. D. Ancletus

Officer-in-Charge P.R.S.	...	R. M. de Silva
Senior Field Assistants ...	...	G. Rajapakse A. B. A. Jayamaha
Field and Lab Assistants	...	Jim Weerakoon E. N. J. B. Fernando P. M. Harischandra M. R. S. Fernando K. V. Walter de Silva D. M. Pathirage A. Albert Fernando

AGROSTOLOGY DIVISION

Research Assistant ...	...	N. Rajaratnam, B.Sc. Hons. (Ceylon), (On Overseas study Leave)
Officer-in-Charge & Senior Technical Assistant	...	D. E. F. Ferdinandez, B.Sc. (Lond.)
Technical Assistant ...	...	M. Bastian
Senior Field Assistant ...	...	D. C. Ellawala
Field Assistant ...	...	K. C. Muththuchamy
Field and Lab Assistants	...	W. S. C. Perera A. G. K. de Silva

CROP PROTECTION DIVISION

Crop Protection Officer	...	U. B. M. Ekanayake, B.Sc. Hons. (Cey.), D.Phil. (Oxon.)
Senior Technical Assistants	...	S. M. P. Subasinghe, B.Sc. Agric. (Madras) P. A. C. R. Perera, B.Sc. (Lond.)
Technical Assistants ...	...	J. K. F. Kirthisinghe C. P. Wickramaratne
Field and Lab Assistants	...	M. S. Velu J. G. Pinto A. M. Chandrasena

BIOMETRICS UNIT

Biometrician	...	V. Abeywardena
Field and Lab Assistants	...	G. Karunasena E. Ranjit Fernando

ADVISORY DIVISION

Chief Advisory Officer ...	...	C. A. Wickramasuriya, B.Sc. (Cey.)
Research Assistant ...	...	H. D. M. S. C. Samaranayake, B.Sc. (Poona)

District Coconut Instructors	...	T. Ganarajah W. B. Dunstan Fernando
Advisory Field Officers ...	...	K. M. Francis C. Iddawela L. S. Karunagoda W. L. H. M. Wijegunaratne S. Mahesan L. D. Thambugala P. A. H. Gomes T. D. J. R. D. Pieris P. D. Wijesinghe S. B. Karunaratne W. J. P. M. Lowe W. Weeraratne P. A. Wijewickrama C. A. Fernando V. Arunasalam R. M. A. P. Ratnayake E. N. Ratnam V. Venayagam S. Rajapaksa M. A. S. Perera N. L.S. Parakkrama D. H. S. W. Tillekeratne D. P. R. N. Edirisinghe
Clerk/Typists	...	D. C. B. Dissanayake T. G. Ratnapala

Citronella Subsidy Scheme

District Coconut Instructor	...	W. V. Fernando
Advisory Field Officers ...	...	S. C. M. Eric Silva S. Jayanetti
Clerk/Typists	...	Mrs. P. C. S. Fernando M. W. F. W. Fernando Mrs. M. J. Ariyadasa T. Gunadasa A. F. Silva

PLANTING DIVISION

Planting Officer ...	...	P. D. L. Fernando
Assistant Planting Officer	...	C. W. S. de Silva
Senior Field Assistants ...	...	J. A. Cadelis Ernest de Silva
Field Assistants ...	...	H. W. Fernando D. P. Jayamanne C. H. de Alwis J. L. D. Fernando W. A. Sivapragasam S. Nanthagobal Y. V. Sirisena

Clerk/Typists	W. A. Wijesuriya A. E. M. Samaraweera H. W. Molligoda

ADMINISTRATION DIVISION

Chief Administrative Officer ...	S. C. Kahawita, B.Com. (Lond.) F.R.Econ. S.
Assistant Secretary	T. T. A. J. C. Samarasinghe, L.L.B. (Cey.)
Accounting Assistant	G. W. M. Wijetunga
Clerk of Works	K. E. Abeysinghe
Publications Officer	Gunapala Adimali, B.A. (Cey.)
Personal Assistant to Director ...	O. D. J. Wanasinghe
Welfare Officer	F. H. B. Felix Silva
Technical Assistant (Photography)	D. B. Hettiarachchi
Superintendent, Bandirippuwa Estate	H. A. Ranasinghe
Superintendent, Ratmalagara Estate	S. T. Braine
Book-keeper	M. B. S. Kurera
Addl. Book-keeper	G. Richard
Library Assistant	M. J. C. Perera
Stenographer	G. D. Abeywardena
Store-keeper	M. A. Somadasa
Clerk/Typists	J. E. A. Dalpathado I. F. Fernando G. Jayawardena P. R. Fernandopulle F. Milton Silva W. S. A. Tissera Miss H. Jayasinghe Mrs. M. Ganarajah D. G. M. Weerasinghe P. G. F. Fernando W. S. C. Tissera J. D. Ratnasekera
Accounts Clerks	R. H. Bennet Silva S. I. Abraham P. A. Nonis Mrs. K. M. A. Nonis
Senior Mechanic	W. P. Perera